FCC RF TEST REPORT

ISSUED BY
Shenzhen BALUN Technology Co., Ltd.

FOR

LoRaWAN communication node

ISSUED TO
Ruixing Hengfang Network (Shenzhen) CO., LTD.

Room 601, Building 10, Software Park, Keji Mid 2nd Road NanShan District, Shenzhen, 518057 China

Tested by: Ye Hongji
Ye Hongji
Date Nov. 25, 2020

Approved by:
Wei Yanquan
(Chief Engineer)
Date Nov. 25, 2020

Report No.:	BL-SZ2080372-602
EUT Name:	LoRaWAN communication node
Model Name:	RHF0M0E5-HF22
Brand Name:	RisingHF
Test Standard:	47 CFR Part 15 Subpart C
FCC ID:	2AJUZ0M0E5
Test Conclusion:	Pass
Test Date:	Aug. 17, 2020 ~ Nov. 25, 2020
Date of Issue:	Nov. 25, 2020

Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong, P. R. China 518055
TEL: +86-755-66850100, FAX: +86-755-61824271
Email: qc@baluntek.com
www.baluntek.com

Revision History

Version	Issue Date	Revisions Content
Rev. 01	Nov. 25, 2020	Initial Issue

TABLE OF CONTENTS

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	The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are 11524A-1. The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196. 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. 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.
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℃ to 25℃
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.

(7) The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Ruixing Hengfang Network (Shenzhen) CO., LTD.
Address	Room 601, Building 10, Software Park, Keji Mid 2nd Road NanShan District, Shenzhen, 518057 China

2.2 Manufacturer Information

Manufacturer	Ruixing Hengfang Network (Shenzhen) CO., LTD.
Address	Room 601, Building 10, Software Park, Keji Mid 2nd Road NanShan District, Shenzhen, 518057 China

2.3 Factory Information

Factory	N/A
Address	N/A

2.4 General Description for Equipment under Test (EUT)

EUT Name	LoRaWAN communication node
Model Name Under Test	RHF0M0E5-HF22
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	RHF0M0E5V2.0
Software Version	4.0.10
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.5 Technical Information

Network and Wireless connectivity	Lora Spread Spectrum, LoraWAN

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

Modulation Technology	Frequency hopping system
Modulation Type	LoRa
Product Type	☒ Mobile ☐ Portable ☐ Fix Location
Frequency Range	The frequency range used is 902 MHz to 928 MHz.
Number of channel	64
Tested Channel	0 (902.3 MHz), 31 (908.5 MHz), 63 (914.9 MHz)
Antenna Type	Dipole Antenna
Antenna Gain	2 dBi (In test items related to antenna gain, the final results reflect this figure. This value is provided by the applicant.)
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)
0	**902.3**	16	905.5	32	908.7	48	911.9
1	902.5	17	905.7	33	908.9	49	912.1
2	902.7	18	905.9	34	909.1	50	912.3
3	902.9	19	906.1	35	909.3	51	912.5
4	903.1	20	906.3	36	909.5	52	912.7
5	903.3	21	906.5	37	909.7	53	912.9
6	903.5	22	906.7	38	909.9	54	913.1
7	903.7	23	906.9	39	910.1	55	913.3
8	903.9	24	907.1	40	910.3	56	913.5
9	904.1	25	907.3	41	910.5	57	913.7
10	904.3	26	907.5	42	910.7	58	913.9
11	904.5	27	907.7	43	910.9	59	914.1
12	904.7	28	907.9	44	911.1	60	914.3
13	904.9	29	908.1	45	911.3	61	914.5
14	905.1	30	908.3	46	911.5	62	914.7
15	905.3	31	**908.5**	47	911.7	63	**914.9**

2.6 Additional Instructions

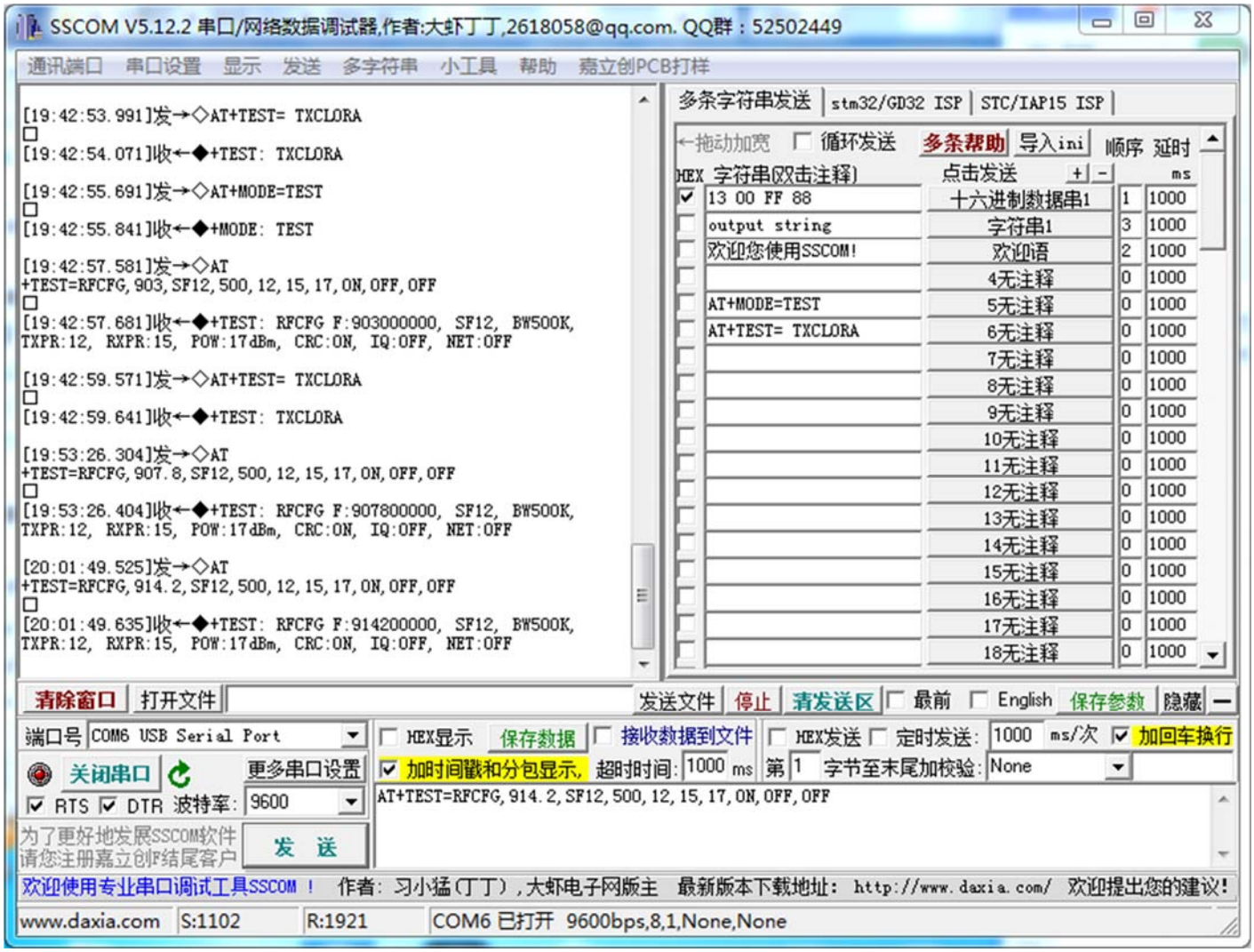
EUT Software Settings:

Mode	☒ Special software is used. The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Power level setup in software			
Test Software Version	SSCOM V5.12.2		
Support Units (Software installation media)	Description	Manufacturer	Model
	Notebook	Lenovo	X220
Mode	Channel	Soft Set	
LoRa	ALL	17	

Run Software



3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 15, Subpart C	Miscellaneous Wireless Communications Services
2	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices
3	KDB Publication 558074 D01v05r02	GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES

3.2 Verdict

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

Note [1]: Please refer to section 5.1

Note [2]: The EUT is powered by battery, so the Conducted Emission is not applicable.

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℃ to +25℃
Working Voltage of the EUT	NV (Normal Voltage)	3.3 V

4.2 Test Equipment List

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	ROHDE&SCHWARZ	FSV-30	103118	2020.06.08	2021.06.07
Switch Unit with OSP-B157	ROHDE&SCHWARZ	OSP120	101270	2020.06.08	2021.06.07
EMI Receiver	KEYSIGHT	N9038A	MY53220118	2020.06.09	2021.06.08
EMI Receiver	ROHDE&SCHWARZ	ESRP	101036	2020.06.09	2021.06.08
LISN	SCHWARZBECK	NSLK 8127	8127-687	2020.06.09	2021.06.08
Bluetooth Tester	ROHDE&SCHWARZ	CBT	101005	2020.06.08	2021.06.07
DC Power Supply	ROHDE&SCHWARZ	HMP2020	018141664	2020.06.08	2021.06.07
Power Splitter	KMW	DCPD-LDC	1305003215	--	--
Power Sensor	ROHDE&SCHWARZ	NRP-Z21	103971	2020.06.08	2021.06.07
Attenuator (20 dB)	KMW	ZA-S1-201	110617091	--	--
Attenuator (6 dB)	KMW	ZA-S1-61	1305003189	--	--
Temperature Chamber	AHK	SP20	1412	2020.06.10	2021.06.09
Test Antenna-Loop(9 kHz-30 MHz)	SCHWARZBECK	FMZB 1519	1519-037	2019.10.29	2021.10.28
Test Antenna-Bi-Log(30 MHz-3 GHz)	SCHWARZBECK	VULB 9163	9163-624	2019.07.02	2021.07.01
Test Antenna-Horn(1-18 GHz)	SCHWARZBECK	BBHA 9120D	9120D-1917	2019.07.02	2021.07.01
Test Antenna-Horn (18-40 GHz)	A-INFO	LB-180400KF	J211060273	2019.01.06	2021.01.05
Anechoic Chamber	RAINFORD	9m*6m*6m	N/A	2017.02.21	2022.02.20
Anechoic Chamber	EMC Electronic Co., Ltd	20.10*11.60*7.35m	N/A	2018.08.08	2021.08.07
Shielded Enclosure	ChangNing	CN-130701	130703	--	--
Signal Generator	ROHDE&SCHWARZ	SMB100A	177746	2020.06.08	2021.06.07
Power Amplifier	OPHIR RF	5225F	1037	2020.02.19	2021.02.18
Power Amplifier	OPHIR RF	5273F	1016	2020.02.19	2021.02.18
Directional Coupler	Werlantone	C5982-10	109275	N/A	N/A
Directional Coupler	Werlantone	CHP-273E	S00801z-01	N/A	N/A
Sound Level Meter	B&K	NL-20	00844023	2020.10.23	2021.10.22
Ear Simulator	B&K	4192-L-001	3038758	2020.02.19	2021.02.18
Audio analyzer	B&K	UPL 16	100129	2020.02.28	2021.02.27

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.

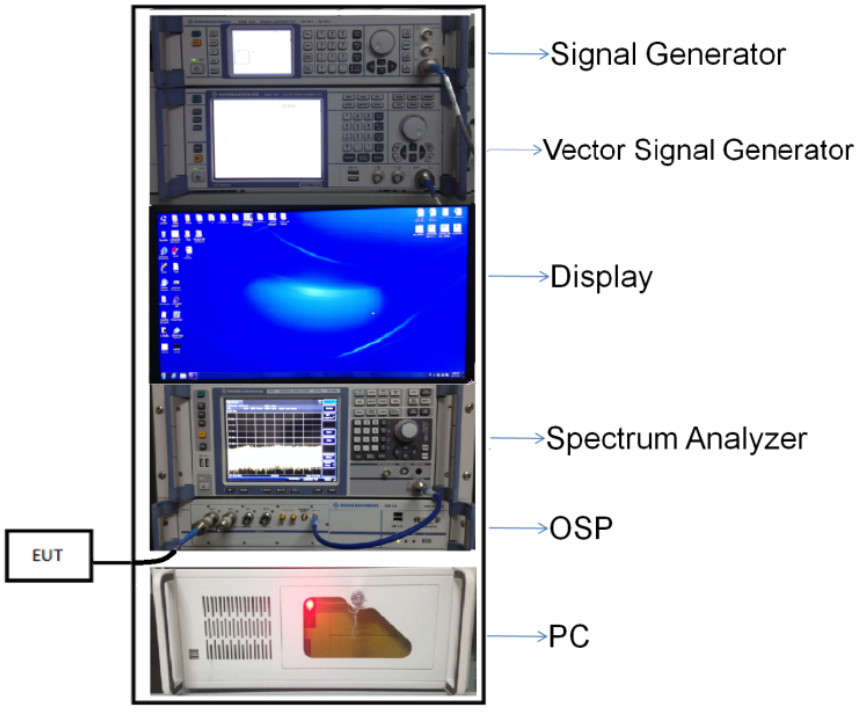
Measurement	Value
Occupied Channel Bandwidth	±4%
RF output power, conducted	±1.4 dB
Power Spectral Density, conducted	±2.5 dB
Unwanted Emissions, conducted	±2.8 dB
All emissions, radiated	±5.4 dB
Temperature	±1°C
Humidity	±4%

4.4 Description of Test Setup

4.4.1 For Antenna Port Test

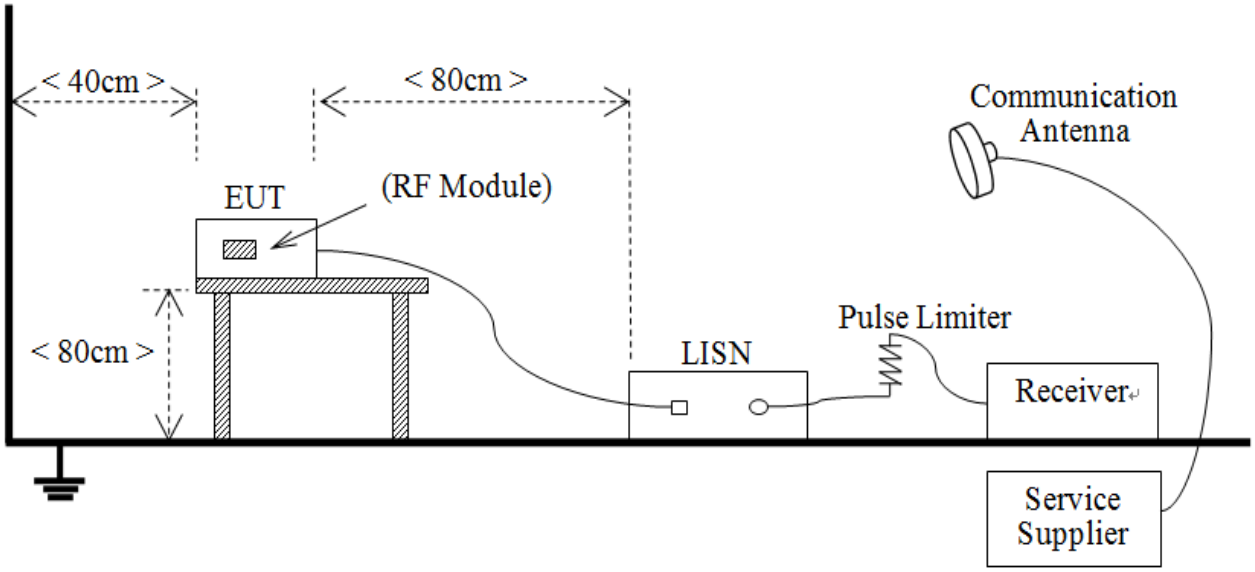
Conducted value (dBm) = Measurement value (dBm) + cable loss (dB)

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



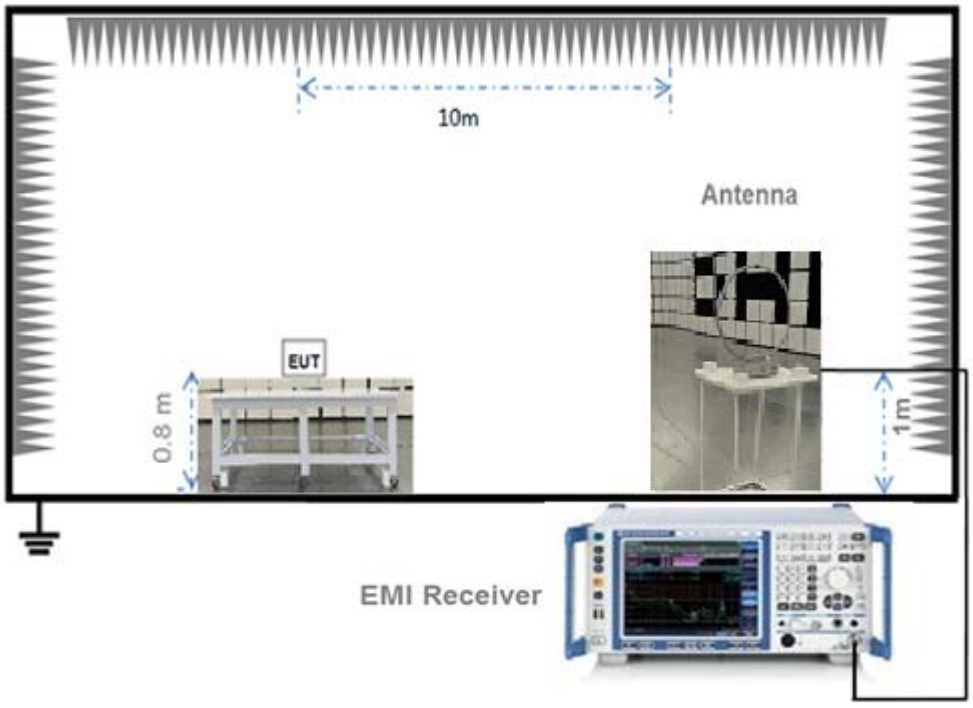
(Diagram 1)

4.4.2 For AC Power Supply Port Test



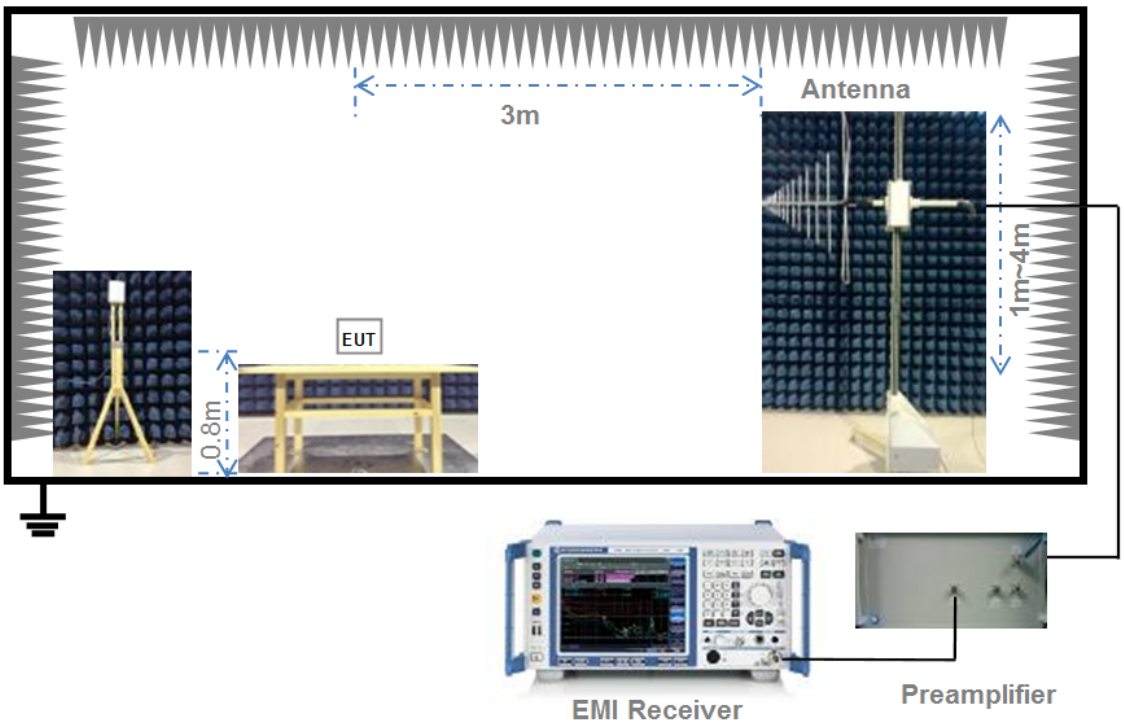
(Diagram 2)

4.4.3 For Radiated Test (Below 30 MHz)



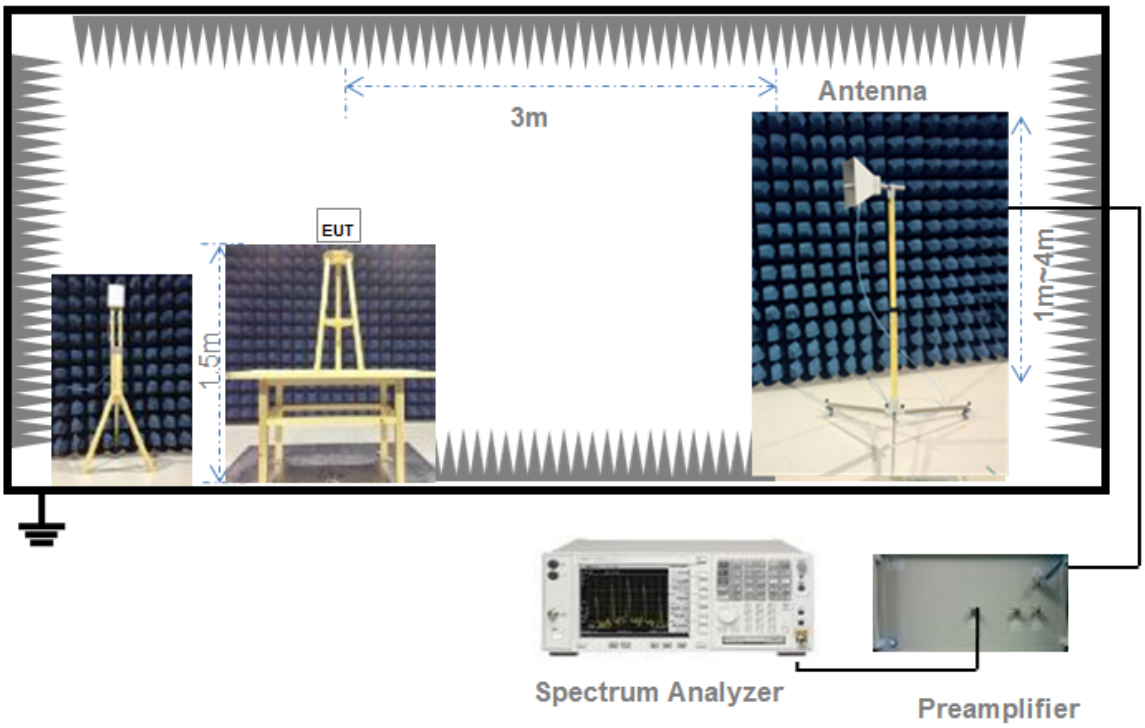
(Diagram 3)

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.

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
The antenna is embedded in the product	An embedded-in antenna design is used

Reference Documents	Item
Photo	Please refer to the EUT Photo documents.

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 ≥ 1% of the span

VBW ≥ 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)(2)

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 75 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 75 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); RSS-247, 5.1 (2)

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. 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 ≥ 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)

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

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) ≥ 1% of the span

Video (or Average) Bandwidth (VBW) ≥ 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 ≥ 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 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	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*log[Field Strength (μV/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 ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ 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 ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ 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

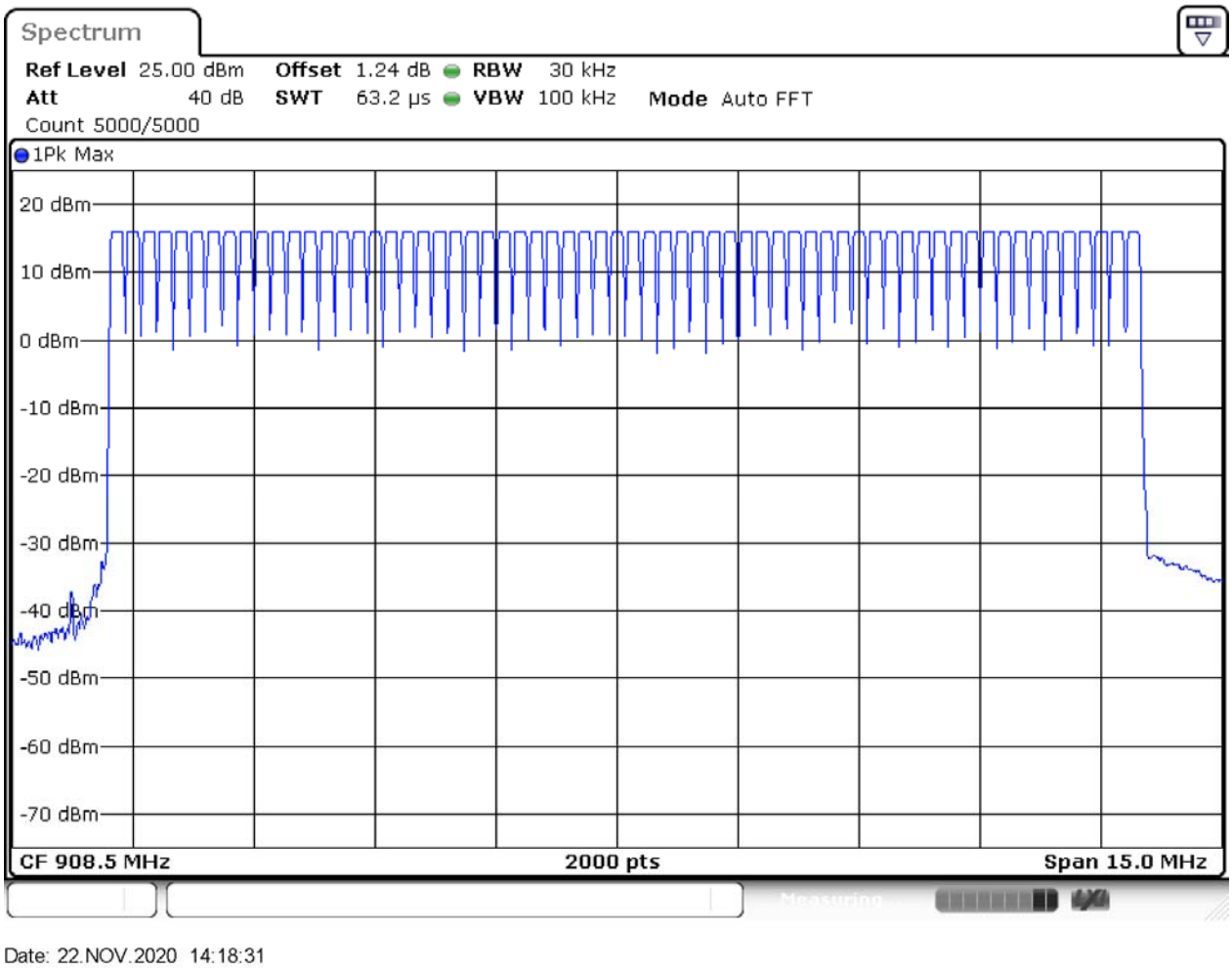
A.1 Number of Hopping Frequency

Test Data

Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Verdict
LoRa	902-928	64	50	Pass

Test plots

LoRa



Date: 22.NOV.2020 14:18:31

A.2 Peak Output Power

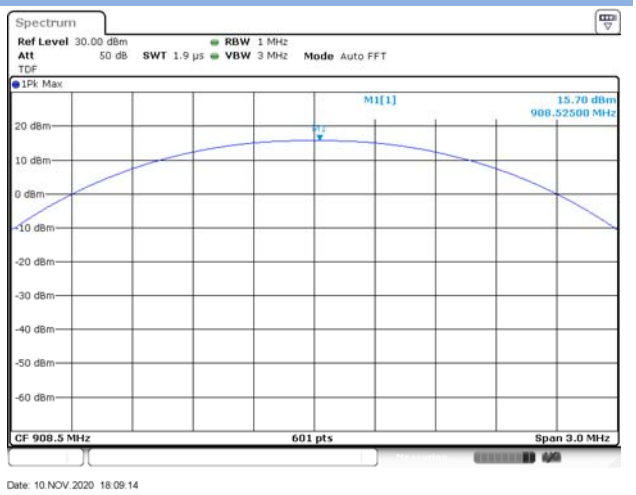
Peak Power Test Data

Channel	Measured Output Peak Power		Limit		Verdict
	LoRa		dBm	mW	
	dBm	mW			
Low	15.72	37.33	30	1000	Pass
Middle	15.70	37.15			Pass
High	15.64	36.64			Pass

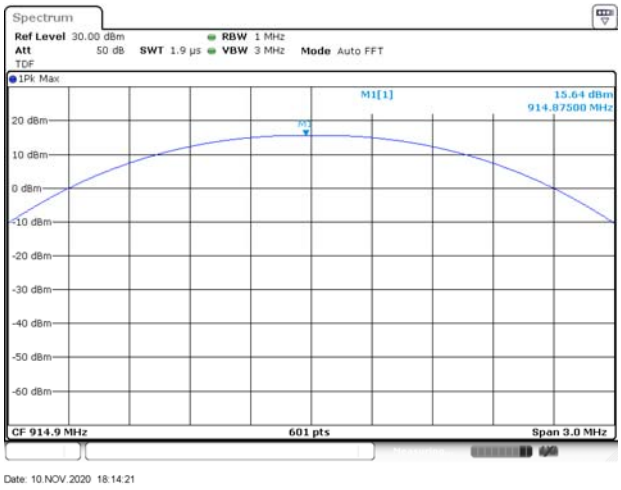
Test plots

LOW CHANNEL

MIDDLE CHANNEL



HIGH CHANNEL



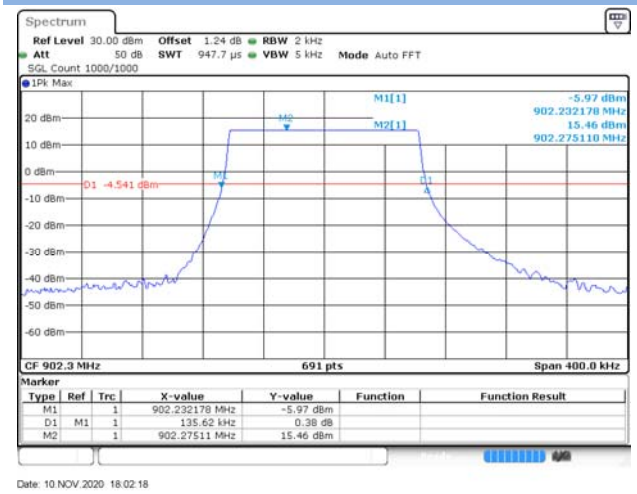
A.3 20 dB and 99% bandwidth

Test Data

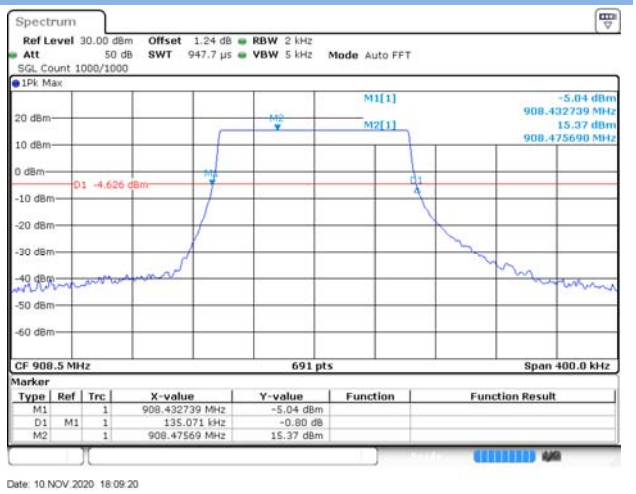
LoRa			
Channel	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)	Verdict
Low	0.135620	0.125200	Pass
Middle	0.135071	0.125200	Pass
High	0.136230	0.125200	Pass

Test plots (20 dB Bandwidth)

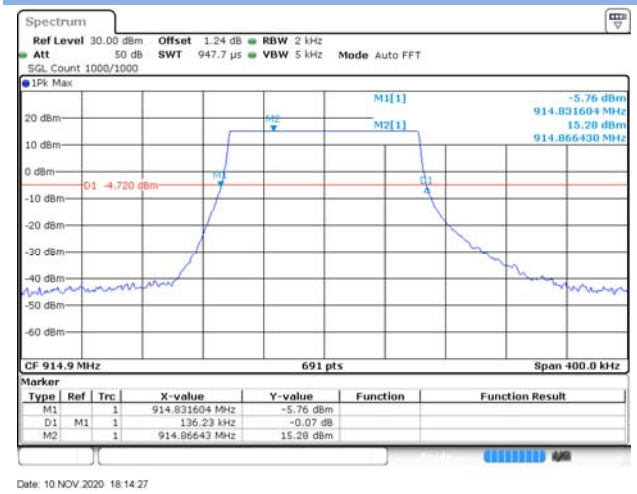
LOW CHANNEL



MIDDLE CHANNEL

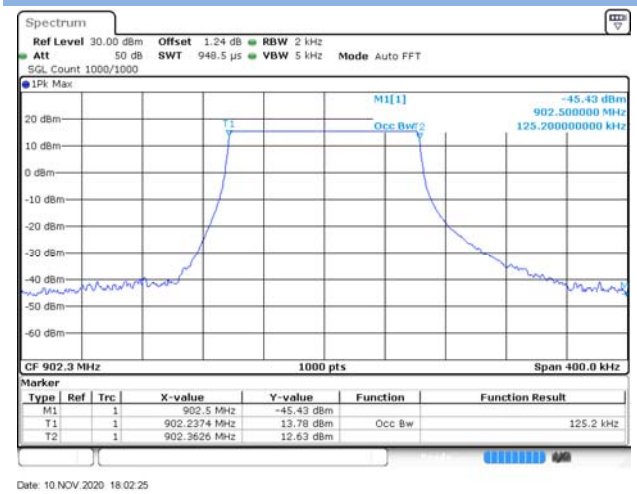


HIGH CHANNEL

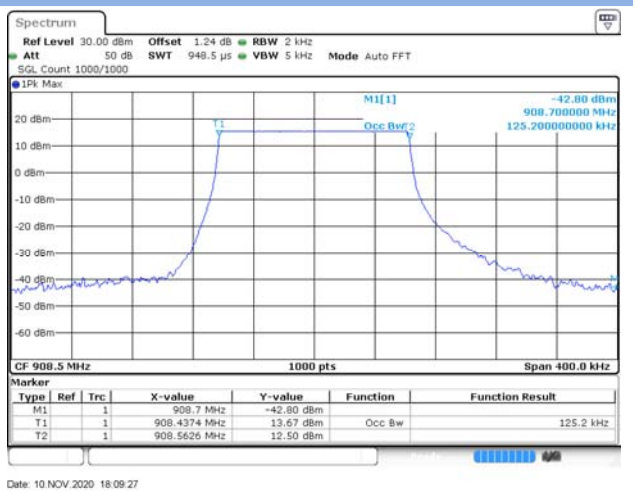


Test plots (99% Bandwidth)

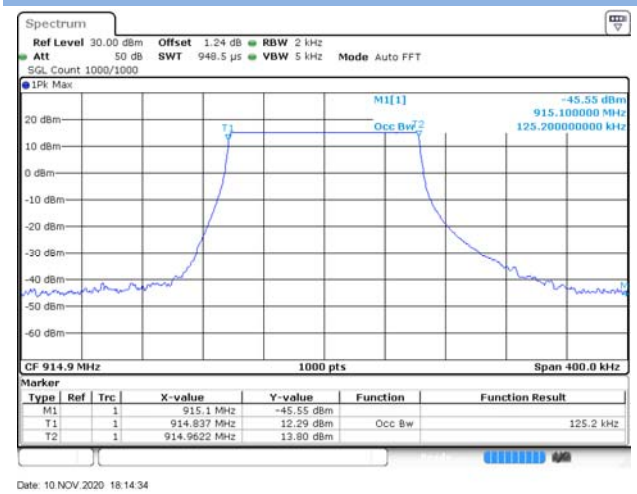
LOW CHANNEL



MIDDLE CHANNEL



HIGH CHANNEL



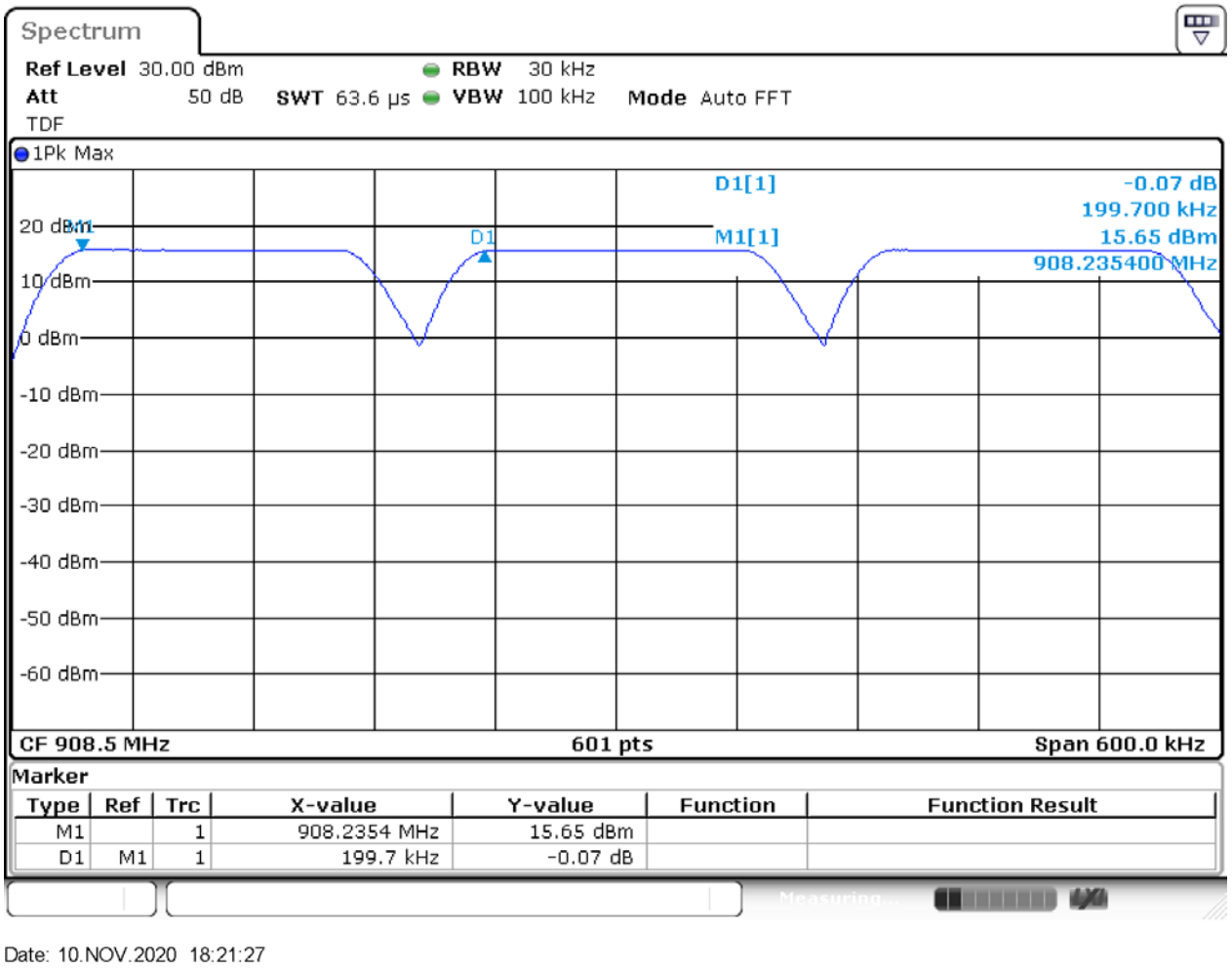
A.4 Hopping Frequency Separation

Test Data

Mode	Frequency separation (MHz)	Max 20 dB Bandwidth (MHz)	Verdict
LoRa	0.1997	0.136230	Pass

Test Plots

LoRa

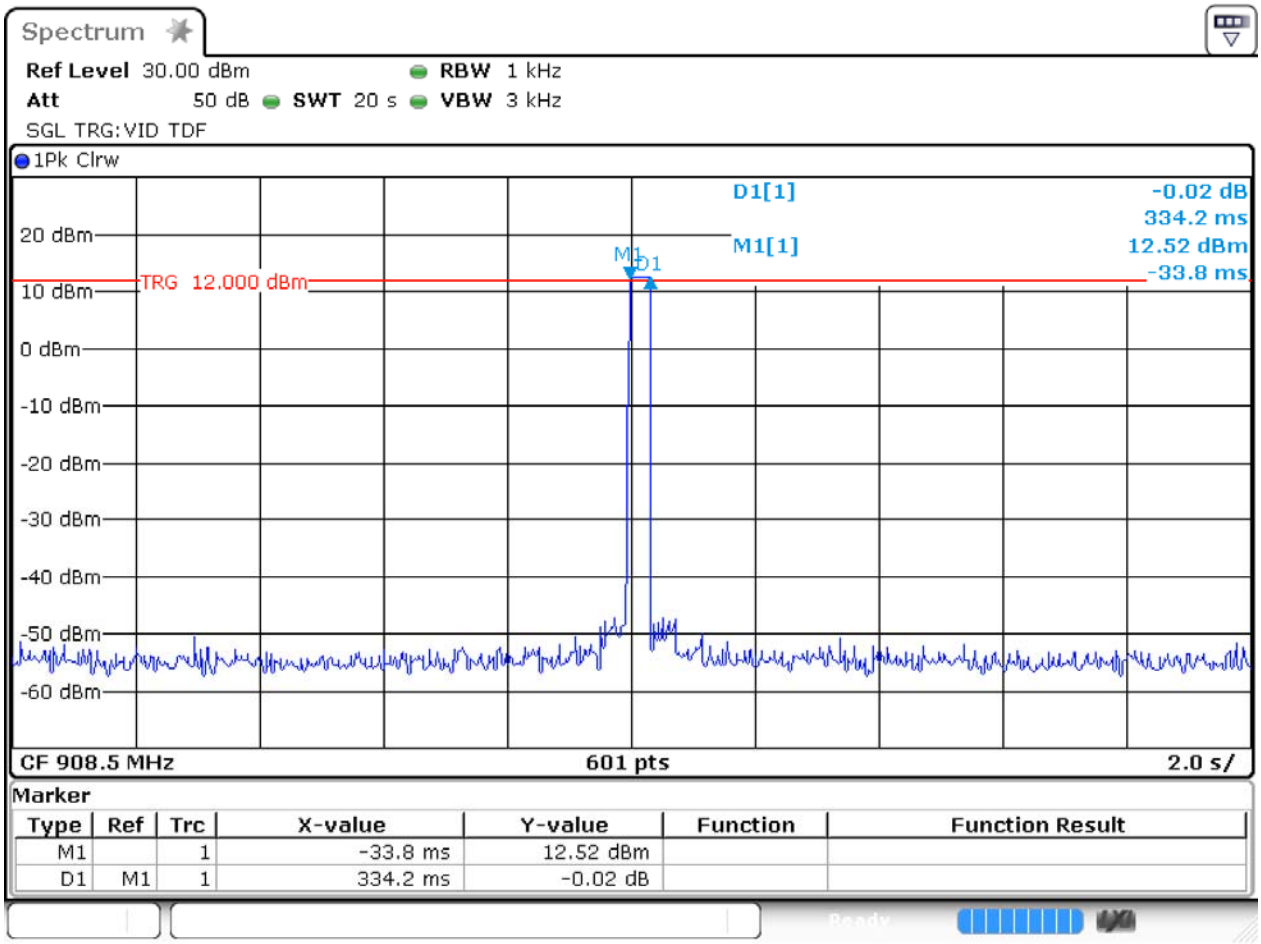


A.5 Average Time of Occupancy

Test Data

Total of Dwell(ms)	Limit (sec)	Verdict
334.200	0.4	Pass

LoRa



Date: 22.NOV.2020 14:53:14

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

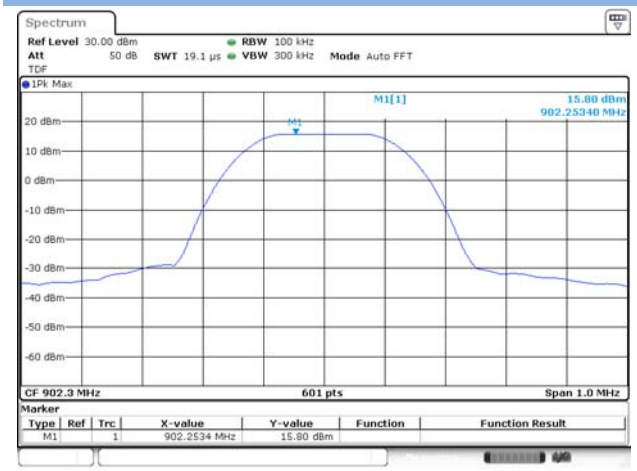
Test Data

LoRa				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-25.38	15.80	-4.20	Pass
Middle	-27.18	15.68	-4.32	Pass
High	-25.44	15.60	-4.40	Pass

LoRa				
Mode	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Hopping	-26.07	15.60	-4.40	Pass

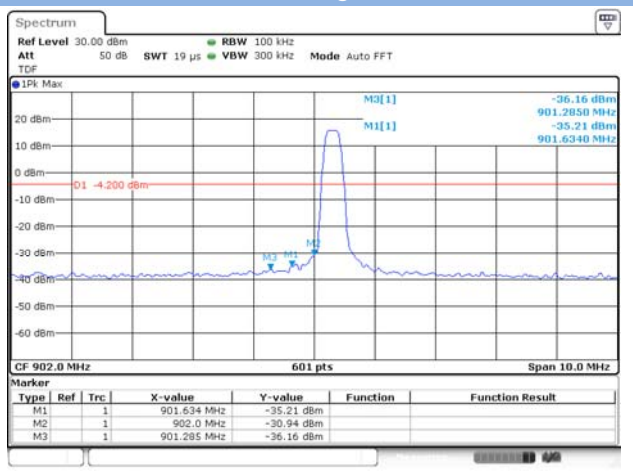
Test Plots

LOW CHANNEL, CARRIER LEVEL



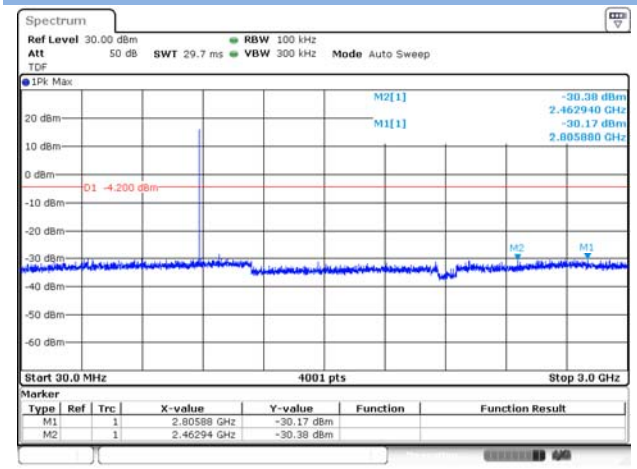
Date: 10.NOV.2020 18:05:06

LOW CHANNEL, Band Edge



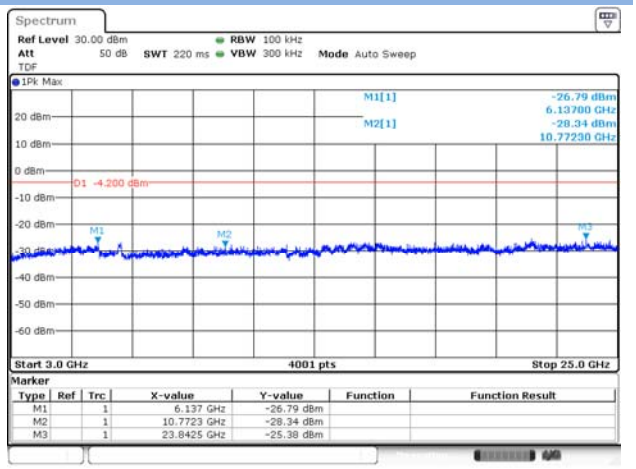
Date: 10.NOV.2020 18:06:53

LOW CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



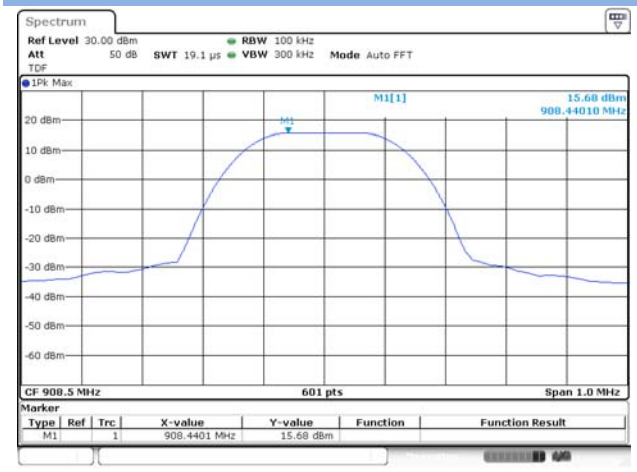
Date: 10.NOV.2020 18:06:09

LOW CHANNEL, SPURIOUS 3 GHz ~ 25 GHz



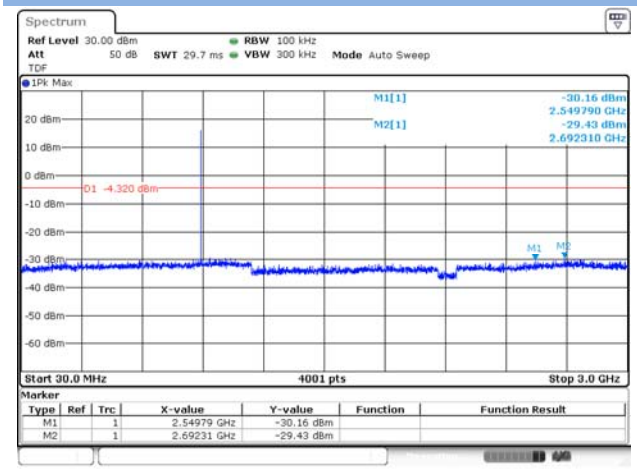
Date: 10.NOV.2020 18:06:25

MIDDLE CHANNEL, CARRIER LEVEL



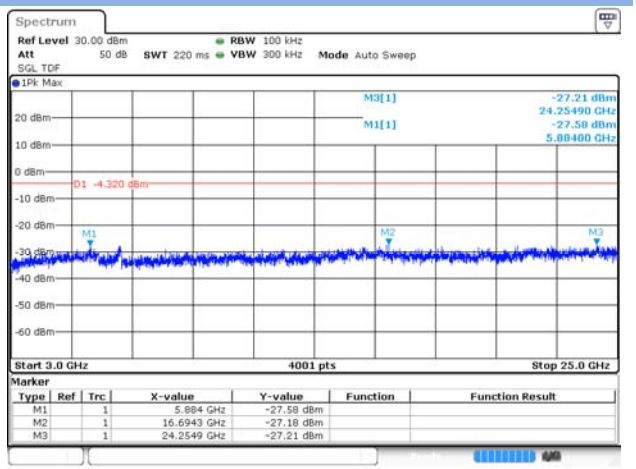
Date: 10.NOV.2020 18:10:10

MIDDLE CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



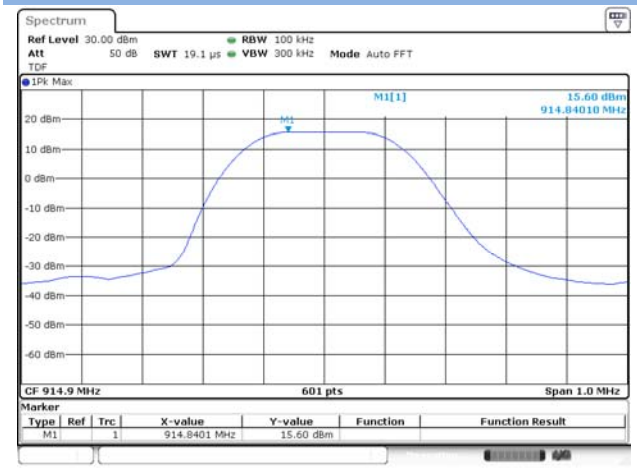
Date: 10.NOV.2020 18:10:51

MIDDLE CHANNEL, SPURIOUS 3 GHz ~ 25 GHz



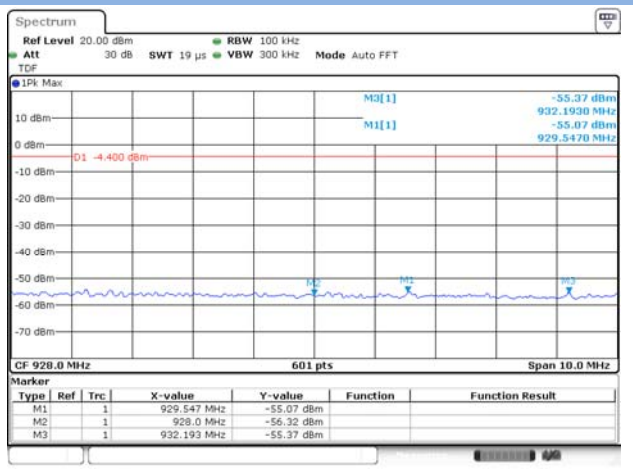
Date: 10.NOV.2020 18:11:25

HIGH CHANNEL, CARRIER LEVEL



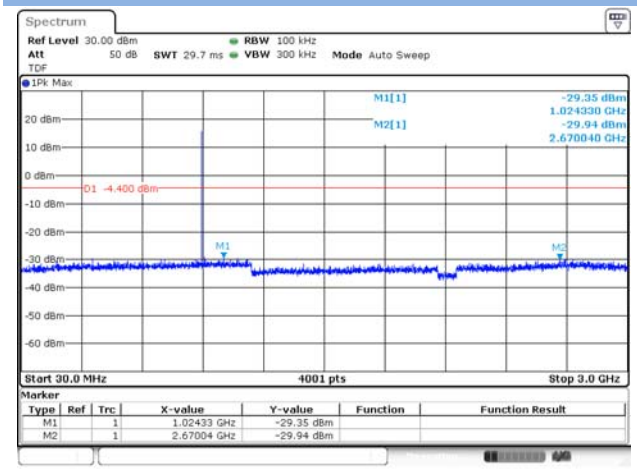
Date: 10.NOV.2020 18:14:55

HIGH CHANNEL, BAND EDGE



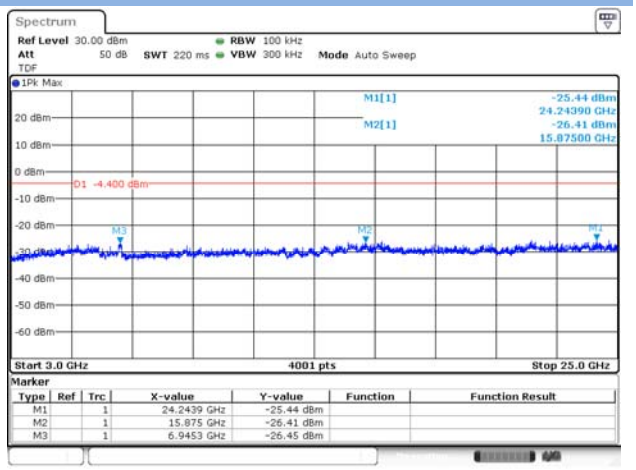
Date: 10.NOV.2020 18:17:14

HIGH CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



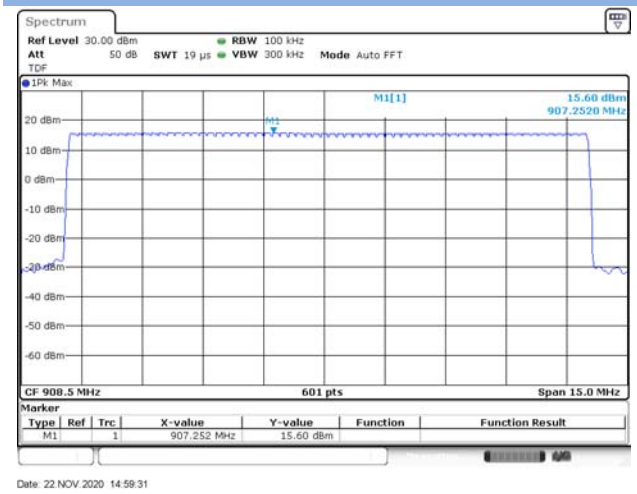
Date: 10.NOV.2020 18:15:34

HIGH CHANNEL, SPURIOUS 3 GHz ~ 25 GHz

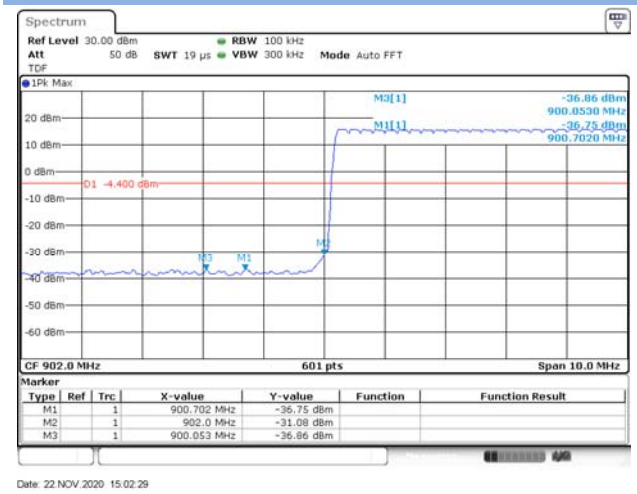


Date: 10.NOV.2020 18:15:58

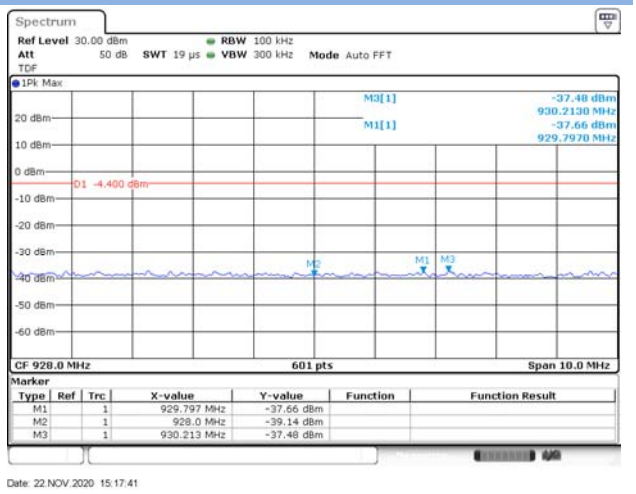
HOPPING, CARRIER LEVEL



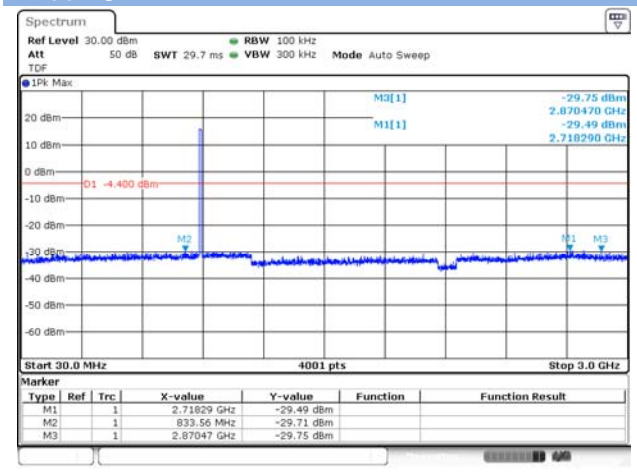
Hopping BAND EDGE (LOW)



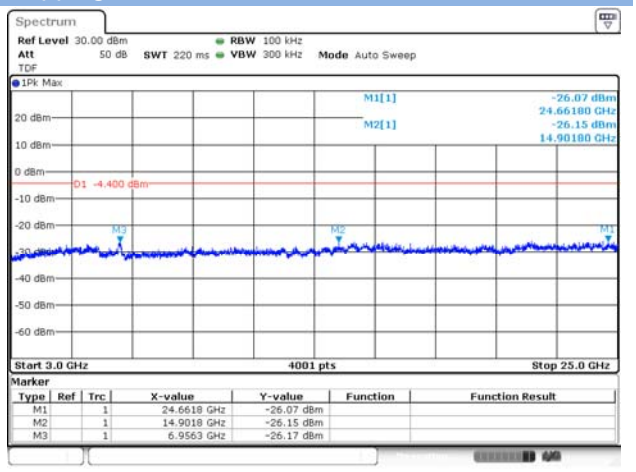
Hopping BAND EDGE (HIGH)



Hopping Mode, SPURIOUS 30 MHz ~ 3 GHz



Hopping Mode, SPURIOUS 3 GHz ~ 25 GHz

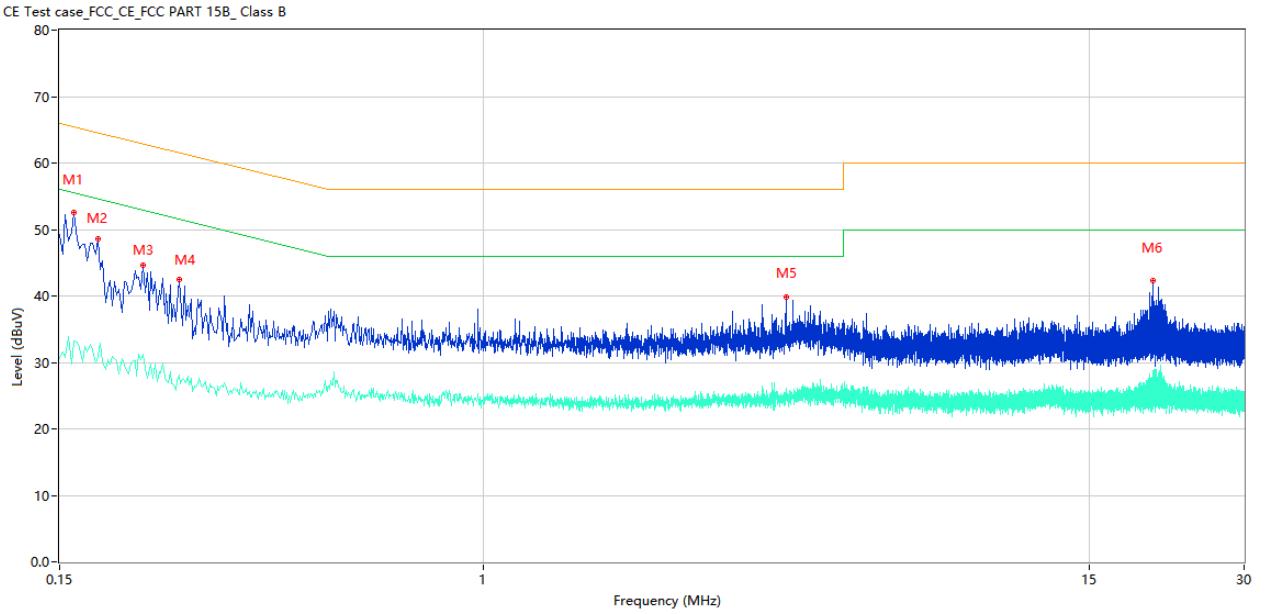


A.7 Conducted Emissions

Note [1]: The EUT is working in the Normal link mode. All modes have been tested and normal link mode is worst.
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.
Note [3]: Results (dBuV) = Original reading level of Spectrum Analyzer (dBuV) + Factor (dB)

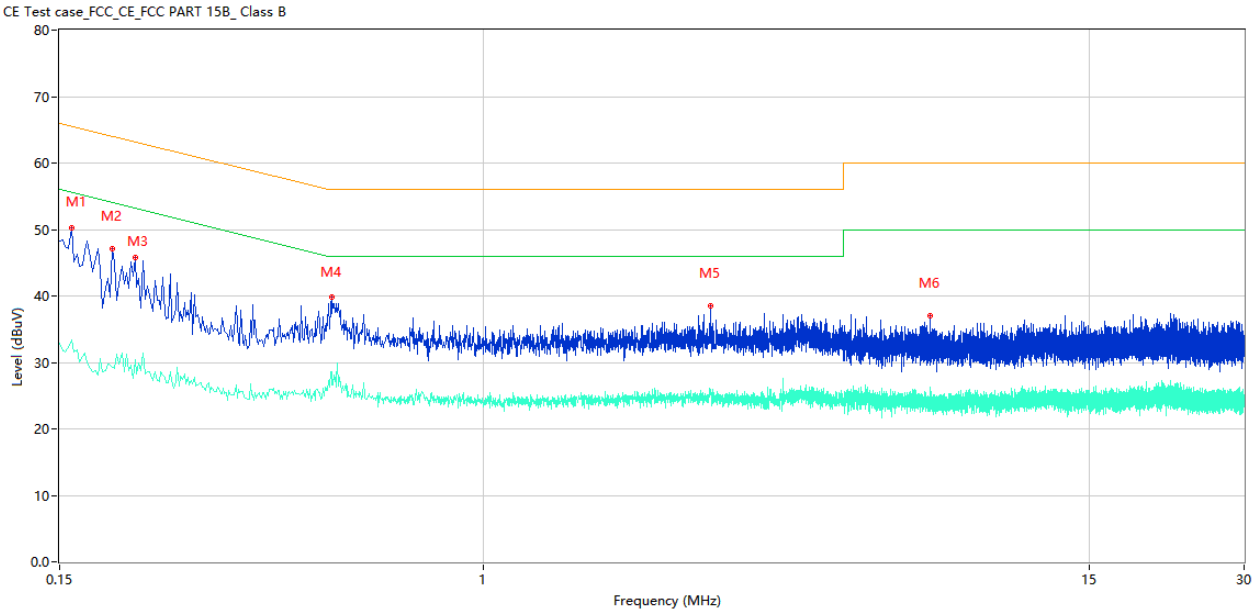
Test Data and Plots

PHASE L



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.160	52.64	10.40	65.46	-12.82	Peak	L	Pass
1**	0.160	33.19	10.40	55.46	-22.27	AV	L	Pass
2	0.178	48.59	10.39	64.58	-15.99	Peak	L	Pass
2**	0.178	30.91	10.39	54.58	-23.67	AV	L	Pass
3	0.218	44.58	10.37	62.89	-18.31	Peak	L	Pass
3**	0.218	31.25	10.37	52.89	-21.64	AV	L	Pass
4	0.256	42.54	10.34	61.56	-19.02	Peak	L	Pass
4**	0.256	28.02	10.34	51.56	-23.54	AV	L	Pass
5	3.862	39.80	10.30	56.00	-16.20	Peak	L	Pass
5**	3.862	26.08	10.30	46.00	-19.92	AV	L	Pass
6	20.002	42.34	10.55	60.00	-17.66	Peak	L	Pass
6**	20.002	27.23	10.55	50.00	-22.77	AV	L	Pass

PHASE N



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.158	50.18	10.40	65.57	-15.39	Peak	N	Pass
1**	0.158	33.32	10.40	55.57	-22.25	AV	N	Pass
2	0.190	47.08	10.38	64.04	-16.96	Peak	N	Pass
2**	0.190	29.31	10.38	54.04	-24.73	AV	N	Pass
3	0.210	45.77	10.38	63.21	-17.44	Peak	N	Pass
3**	0.210	30.47	10.38	53.21	-22.74	AV	N	Pass
4	0.506	39.87	10.30	56.00	-16.13	Peak	N	Pass
4**	0.506	26.67	10.30	46.00	-19.33	AV	N	Pass
5	2.752	38.49	10.28	56.00	-17.51	Peak	N	Pass
5**	2.752	25.68	10.28	46.00	-20.32	AV	N	Pass
6	7.380	36.96	10.35	60.00	-23.04	Peak	N	Pass
6**	7.380	24.34	10.35	50.00	-25.66	AV	N	Pass

A.9 Radiated Spurious Emission

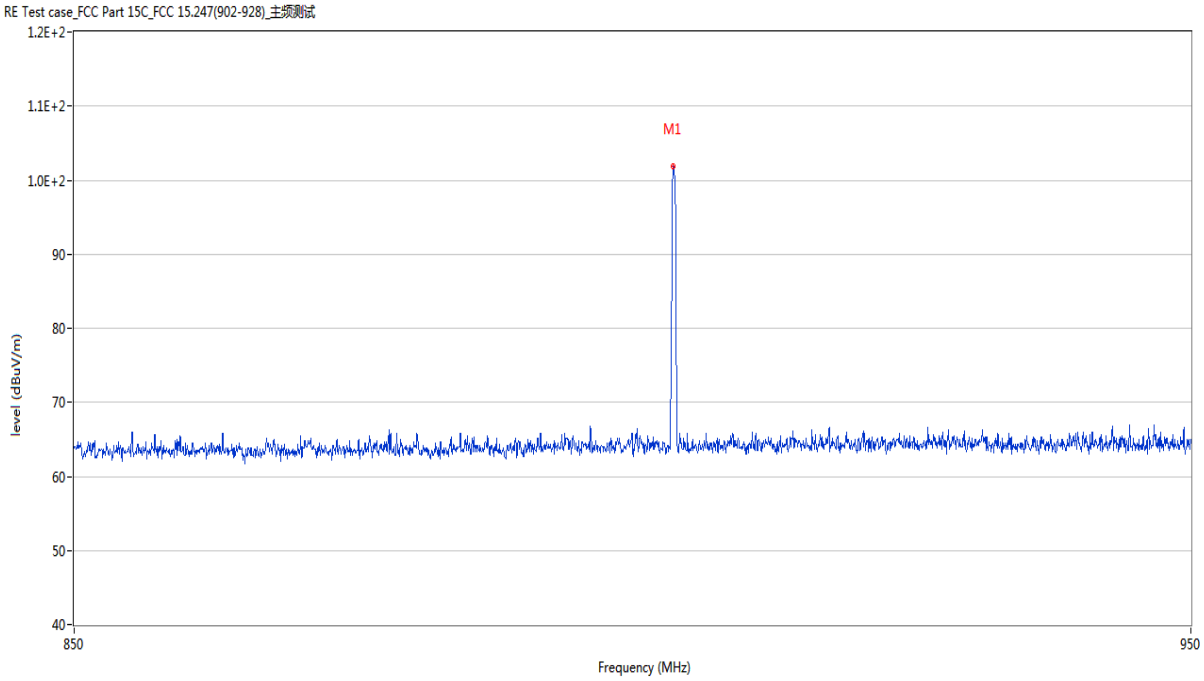
Note [1]: The symbol of "--" in the table which means not application.

Note [2]: 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 [3]: 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.

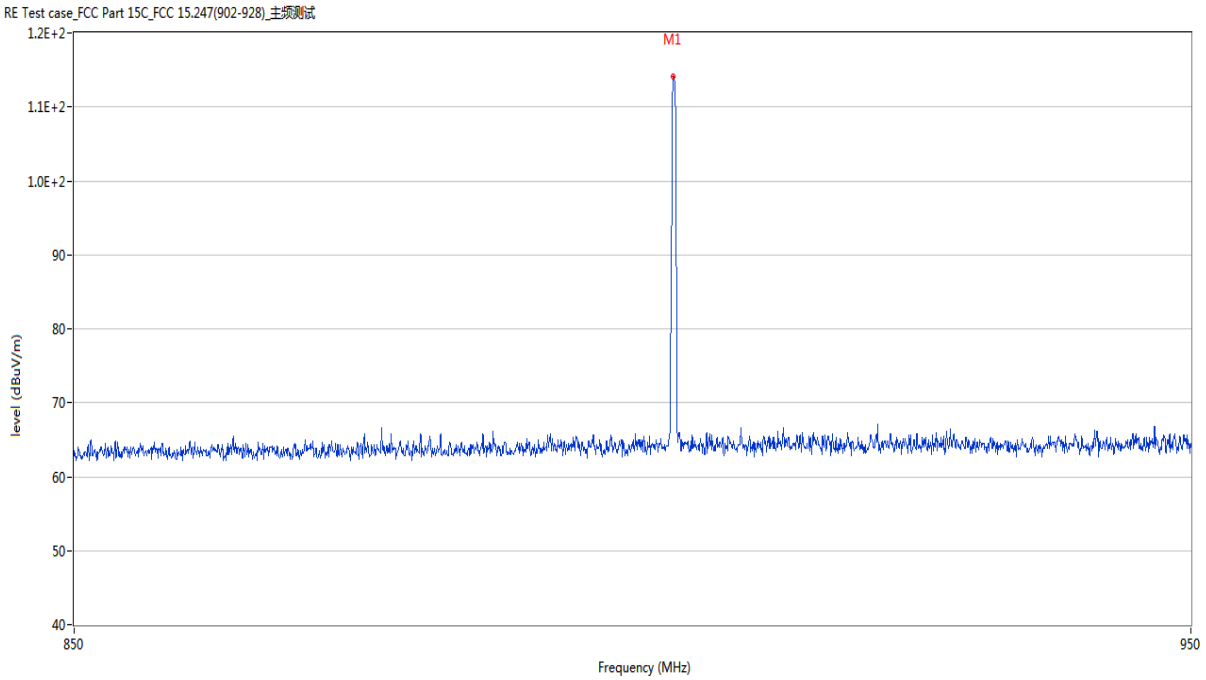
Test Data and Plots

LOW CHANNEL, 850 MHz to 950 MHz, ANT H



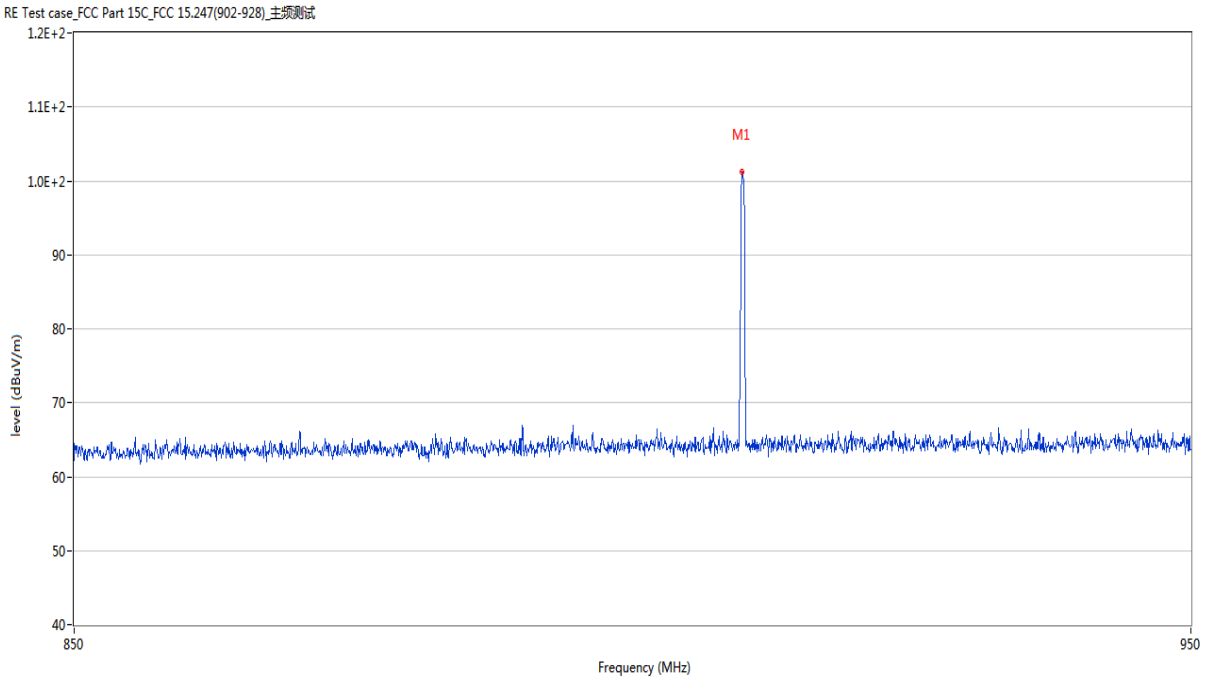
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	902.273	101.88	30.01	--	23.88	Peak	78.00	200	Horizontal	N/A

LOW CHANNEL, 850 MHz to 950 MHz, ANT V



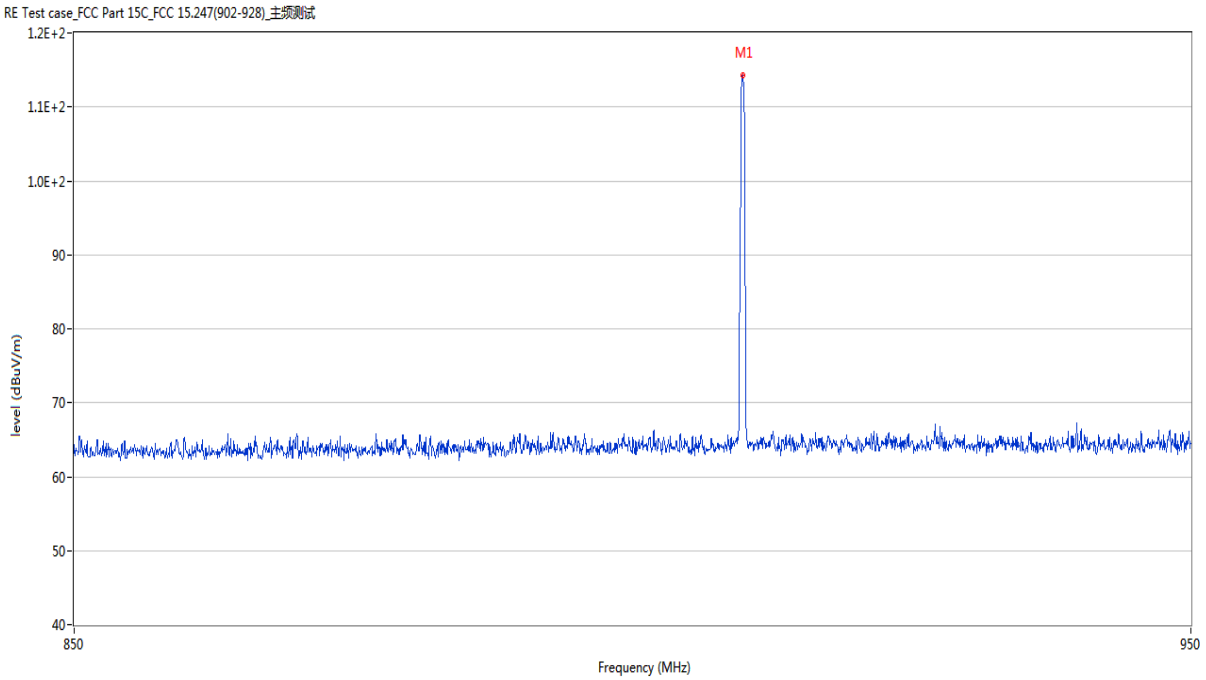
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	902.273	114.14	30.01	--	-2.86	Peak	117.00	200	Vertical	Pass

MIDDLE CHANNEL, 850 MHz to 950 MHz, ANT H



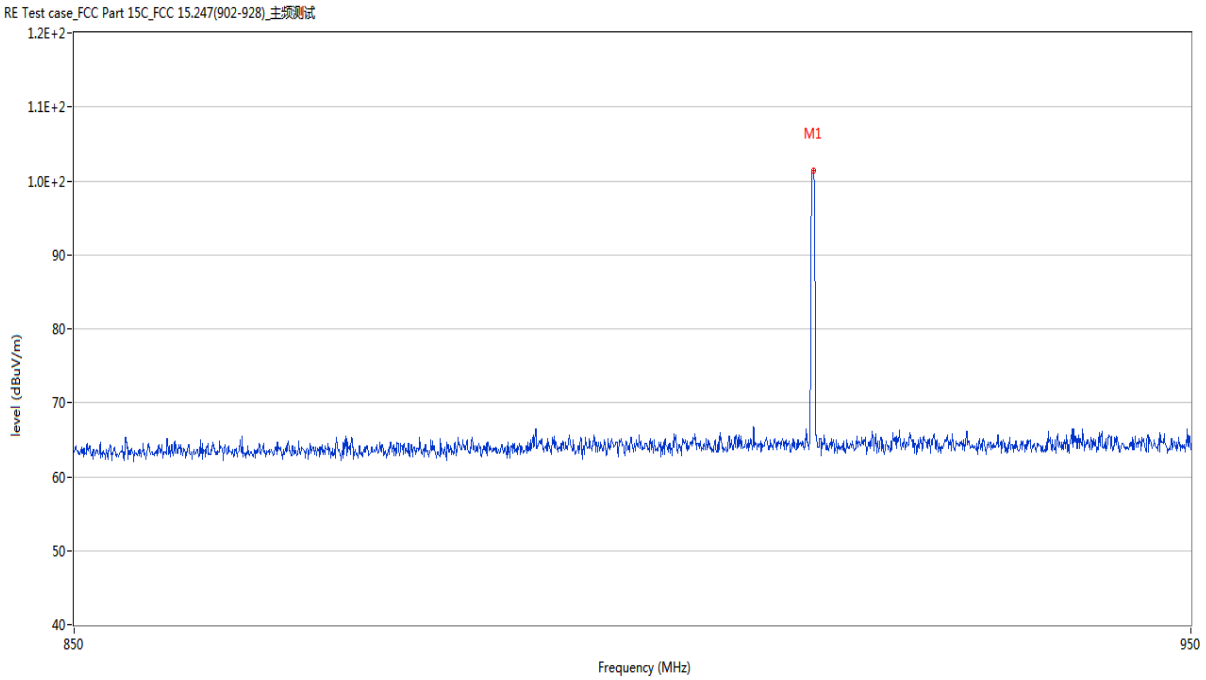
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	908.481	101.28	30.22	--	19.28	Peak	82.00	200	Horizontal	N/A

MIDDLE CHANNEL, 850 MHz to 950 MHz, ANT V



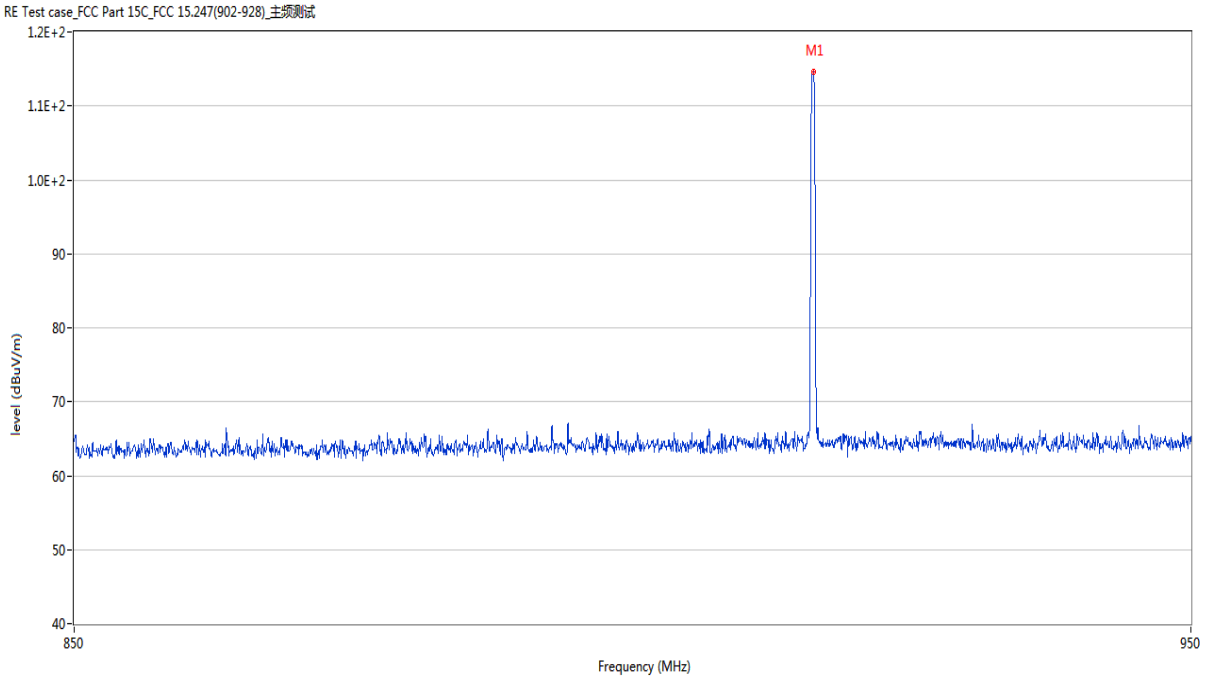
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	908.529	114.27	30.22	--	-8.73	Peak	123.00	200	Vertical	Pass

HIGH CHANNEL, 850 MHz to 950 MHz, ANT H



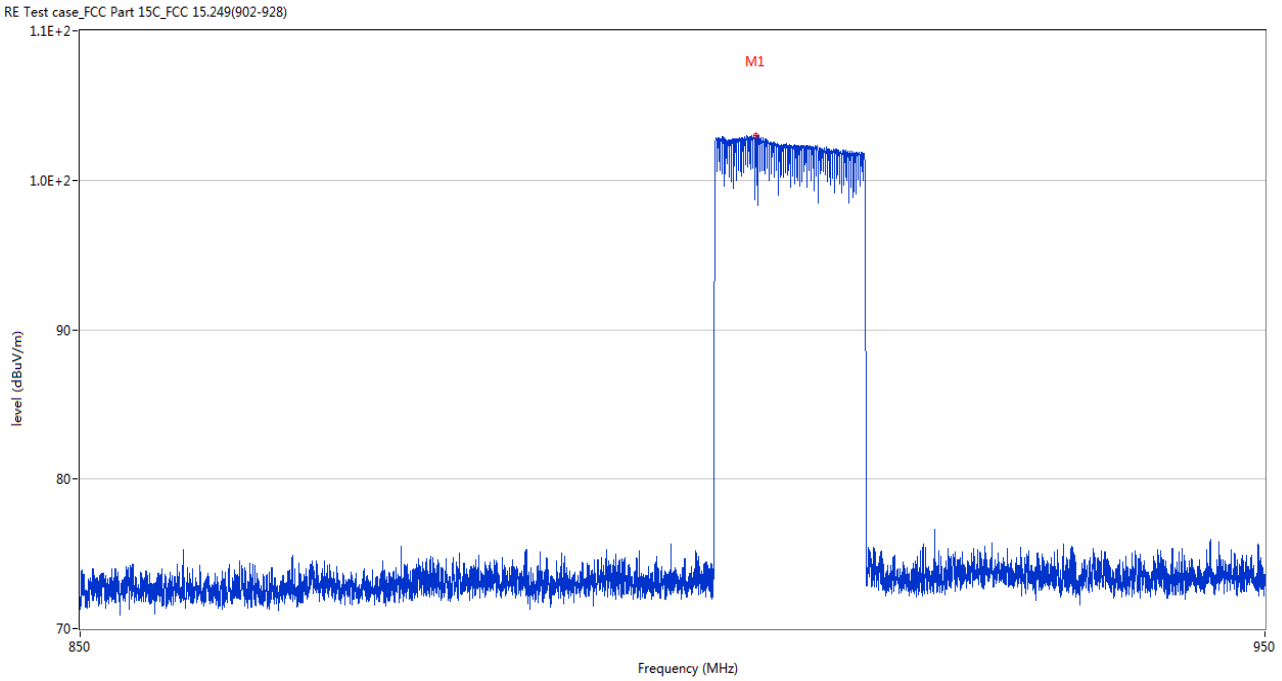
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	914.931	101.34	30.39	--	20.34	Peak	81.00	200	Horizontal	N/A

HIGH CHANNEL, 850 MHz to 950 MHz, ANT V



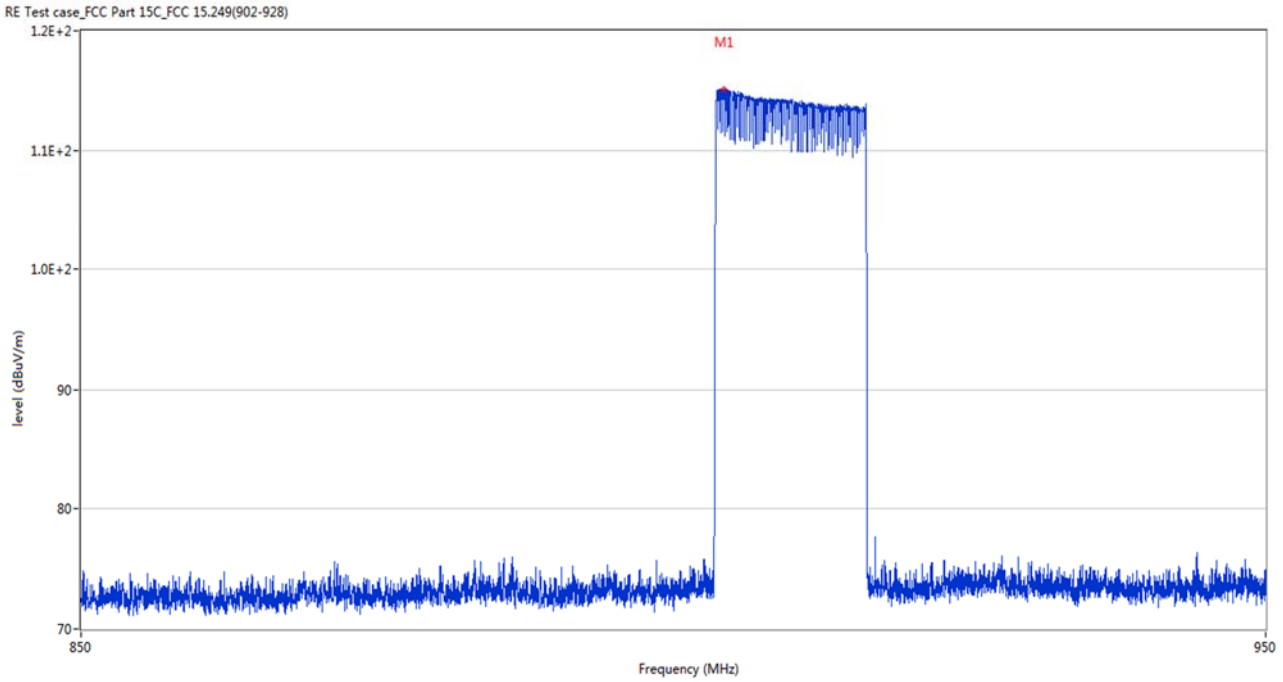
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	914.931	114.62	30.39	--	-5.38	Peak	120.00	200	Vertical	Pass

HOPPING CHANNEL, 850 MHz to 950 MHz, ANT H



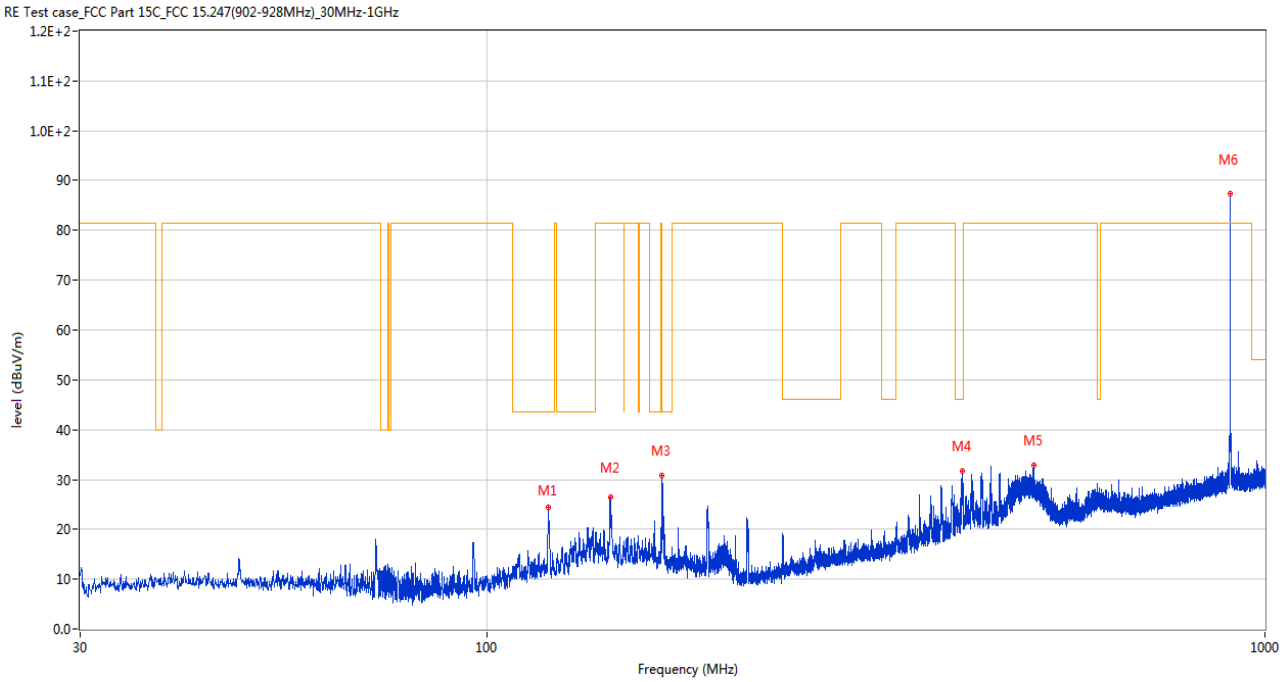
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	905.675	102.98	29.21	--	--	Peak	12.00	150	Horizontal	N/A

HOPPING CHANNEL, 850 MHz to 950 MHz, ANT V



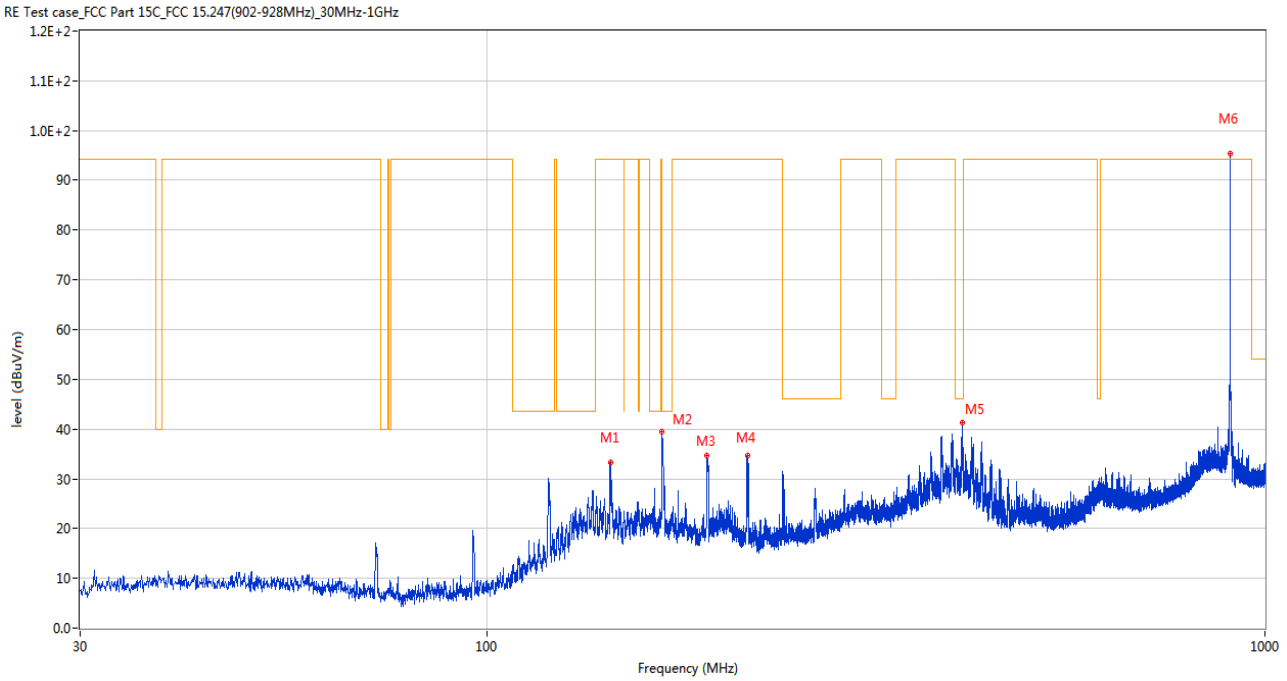
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	902.850	115.12	28.88	--	--	Peak	113.00	150	Vertical	N/A

LOW CHANNEL ANT H



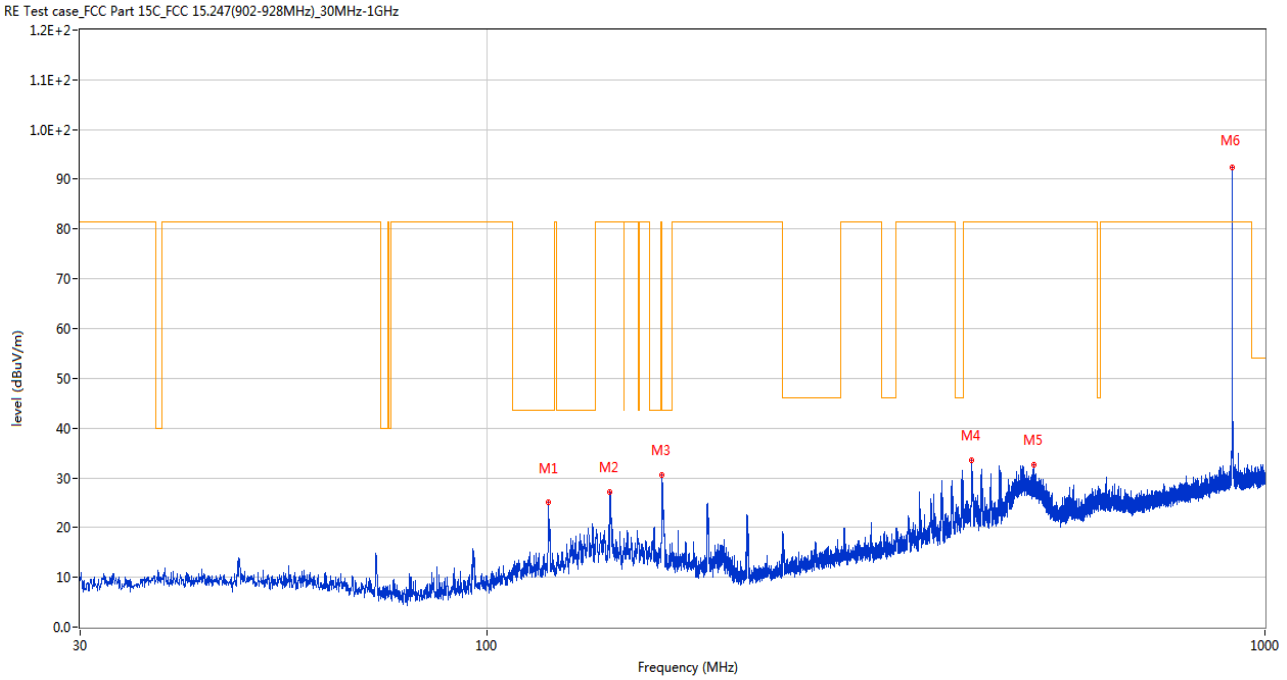
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	119.967	24.34	-26.05	43.5	-19.16	Peak	217.00	100	Horizontal	Pass
2	144.024	26.40	-24.34	81.9	-55.50	Peak	273.00	200	Horizontal	Pass
3	167.982	30.88	-24.11	43.5	-12.62	Peak	86.00	100	Horizontal	Pass
4	408.009	31.66	-19.00	46.0	-14.34	Peak	141.00	100	Horizontal	Pass
5	503.990	32.93	-16.14	81.9	-48.97	Peak	322.00	200	Horizontal	Pass
6	902.224	87.45	-7.47	81.9	5.55	Peak	267.00	100	Horizontal	N/A

LOW CHANNEL, ANT V



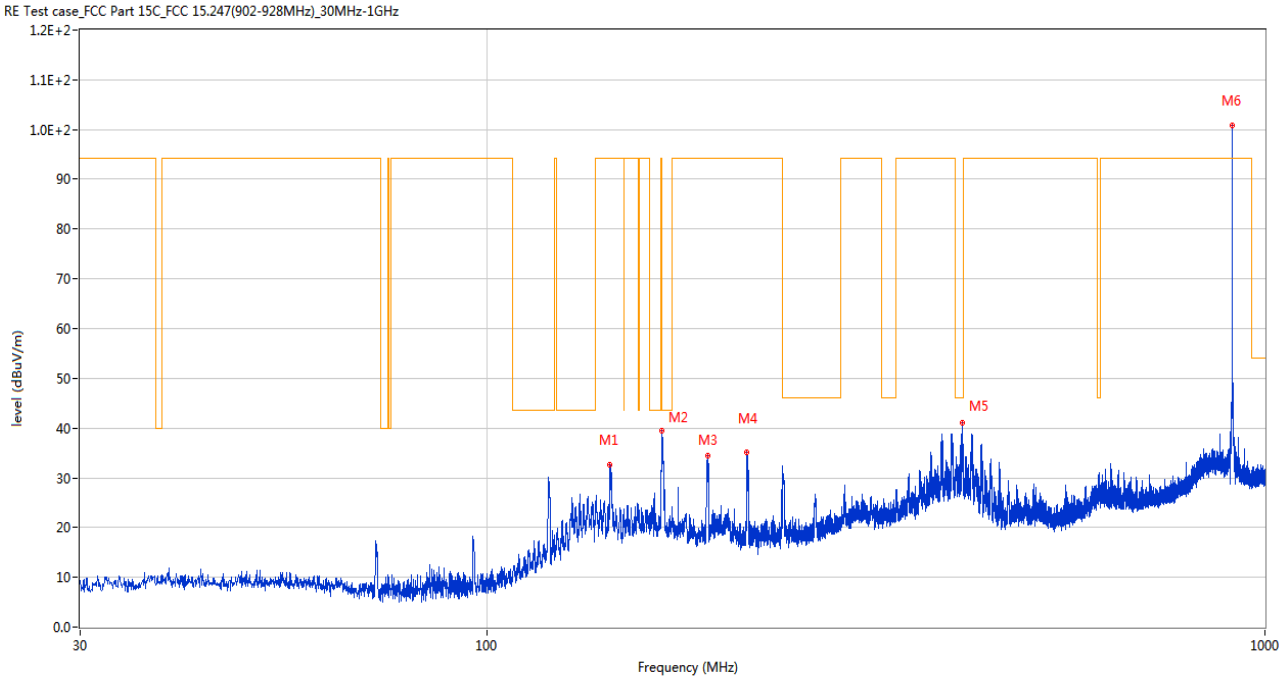
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	144.024	33.41	-24.34	94.1	-60.69	Peak	190.00	200	Vertical	Pass
2	167.982	39.44	-24.11	43.5	-4.06	Peak	293.00	200	Vertical	Pass
3	191.942	34.72	-26.83	94.1	-59.38	Peak	322.00	100	Vertical	Pass
4	216.046	34.60	-26.21	94.1	-59.50	Peak	314.00	100	Vertical	Pass
5	408.009	41.37	-19.00	46.0	-4.63	Peak	343.00	100	Vertical	Pass
6	902.224	95.45	-7.47	94.1	1.35	Peak	336.00	100	Vertical	N/A

MIDDLE CHANNEL, ANT H



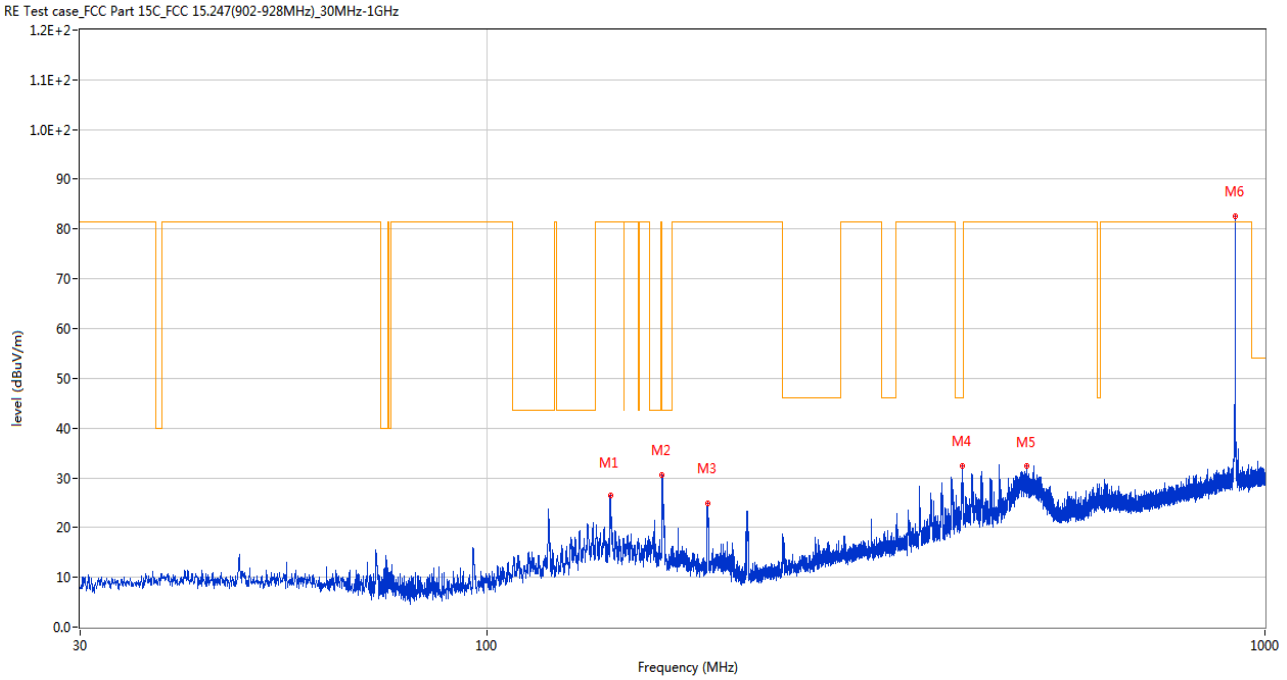
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	120.016	25.17	-26.04	43.5	-18.33	Peak	167.00	200	Horizontal	Pass
2	143.975	27.20	-24.35	81.3	-54.10	Peak	266.00	100	Horizontal	Pass
3	167.982	30.64	-24.11	43.5	-12.86	Peak	238.00	200	Horizontal	Pass
4	419.988	33.61	-18.53	81.3	47.69	Peak	105.00	100	Horizontal	Pass
5	503.990	32.52	-16.14	81.3	-48.78	Peak	301.00	100	Horizontal	Pass
6	908.432	92.45	-7.58	81.3	11.15	Peak	251.00	100	Horizontal	N/A

MIDDLE CHANNEL, ANT V



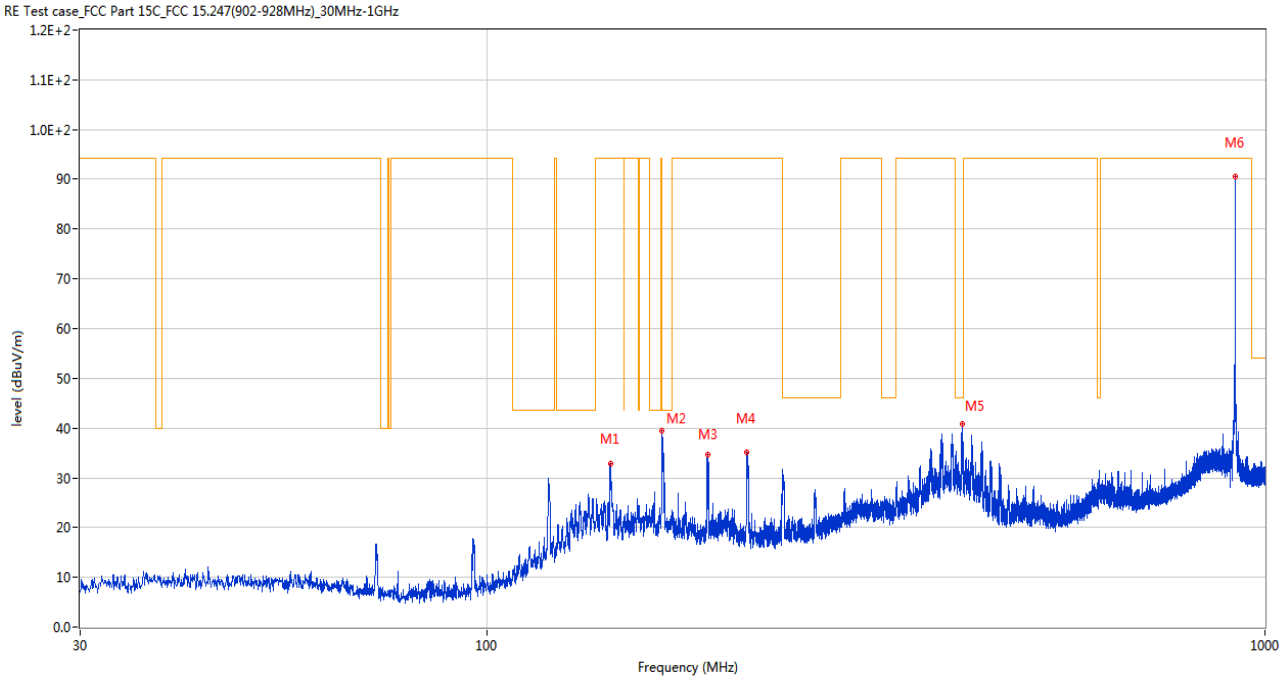
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	143.975	32.55	-24.35	94.3	-61.75	Peak	201.00	100	Vertical	Pass
2	168.031	39.50	-24.12	43.5	-4.00	Peak	326.00	200	Vertical	Pass
3	192.184	34.55	-26.89	94.3	-59.75	Peak	333.00	100	Vertical	Pass
4	215.998	35.11	-26.21	94.3	-59.19	Peak	340.00	100	Vertical	Pass
5	407.912	40.98	-18.98	46.0	-5.02	Peak	360.00	200	Vertical	Pass
6	908.432	100.77	-7.58	94.3	6.47	Peak	333.00	100	Vertical	N/A

HIGH CHANNEL, ANT H



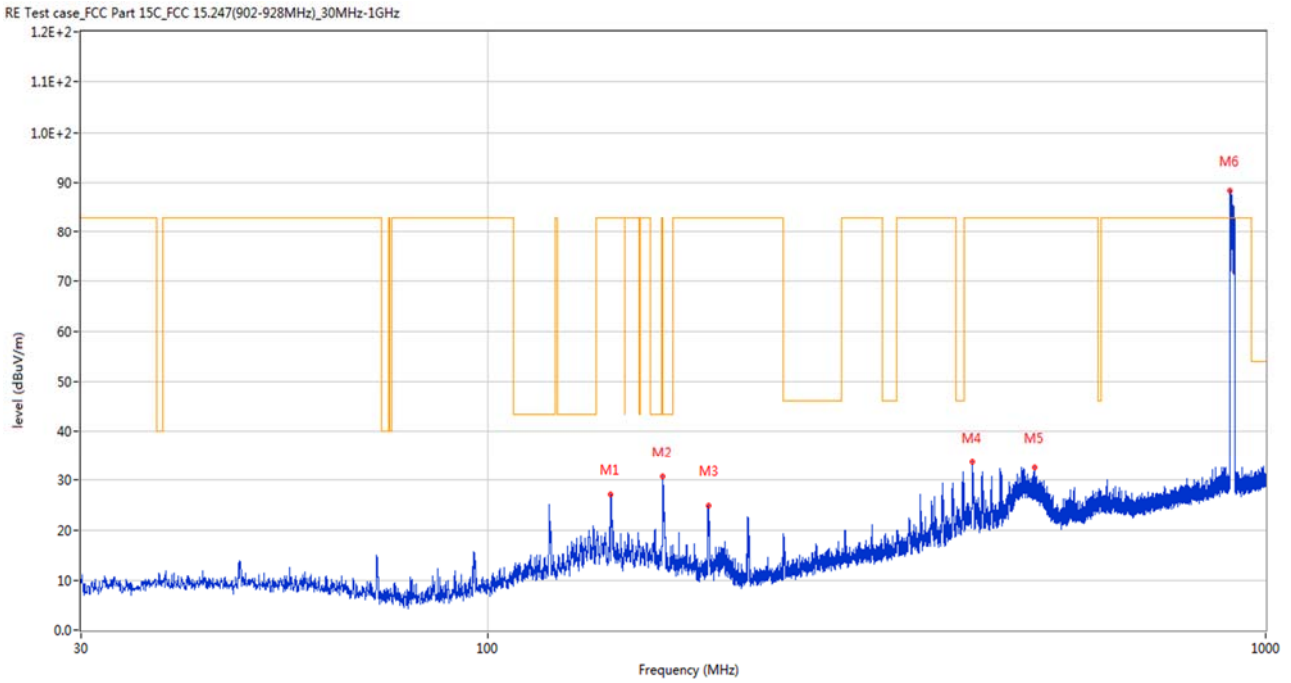
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	144.024	26.40	-24.34	81.3	-54.90	Peak	298.00	100	Horizontal	Pass
2	168.031	30.53	-24.12	43.5	-12.97	Peak	256.00	200	Horizontal	Pass
3	191.990	24.95	-26.85	81.3	-56.35	Peak	115.00	100	Horizontal	Pass
4	408.009	32.30	-19.00	46.0	-13.70	Peak	194.00	200	Horizontal	Pass
5	493.709	32.46	-16.41	81.3	-48.84	Peak	327.00	100	Horizontal	Pass
6	914.980	82.55	-7.17	81.3	1.25	Peak	242.00	100	Horizontal	N/A

HIGH CHANNEL, ANT V



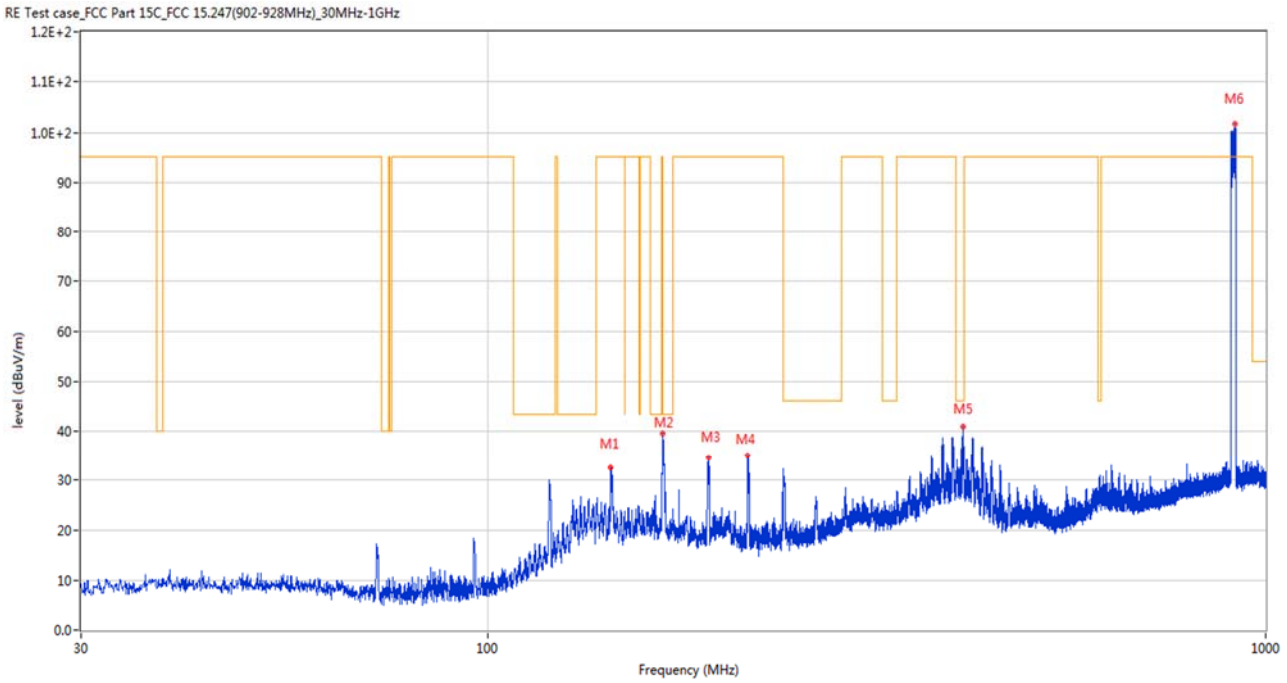
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	144.024	32.91	-24.34	94.6	-61.69	Peak	189.00	100	Vertical	Pass
2	168.031	39.55	-24.12	43.5	-3.95	Peak	302.00	100	Vertical	Pass
3	191.990	34.60	-26.85	94.6	-60.00	Peak	322.00	200	Vertical	Pass
4	215.998	35.06	-26.21	94.6	-59.54	Peak	329.00	200	Vertical	Pass
5	408.009	40.81	-19.00	46.0	-5.19	Peak	336.00	100	Vertical	Pass
6	914.931	90.68	-7.18	94.6	-3.74	Peak	302.00	100	Vertical	N/A

HOPPING CHANNEL, ANT H



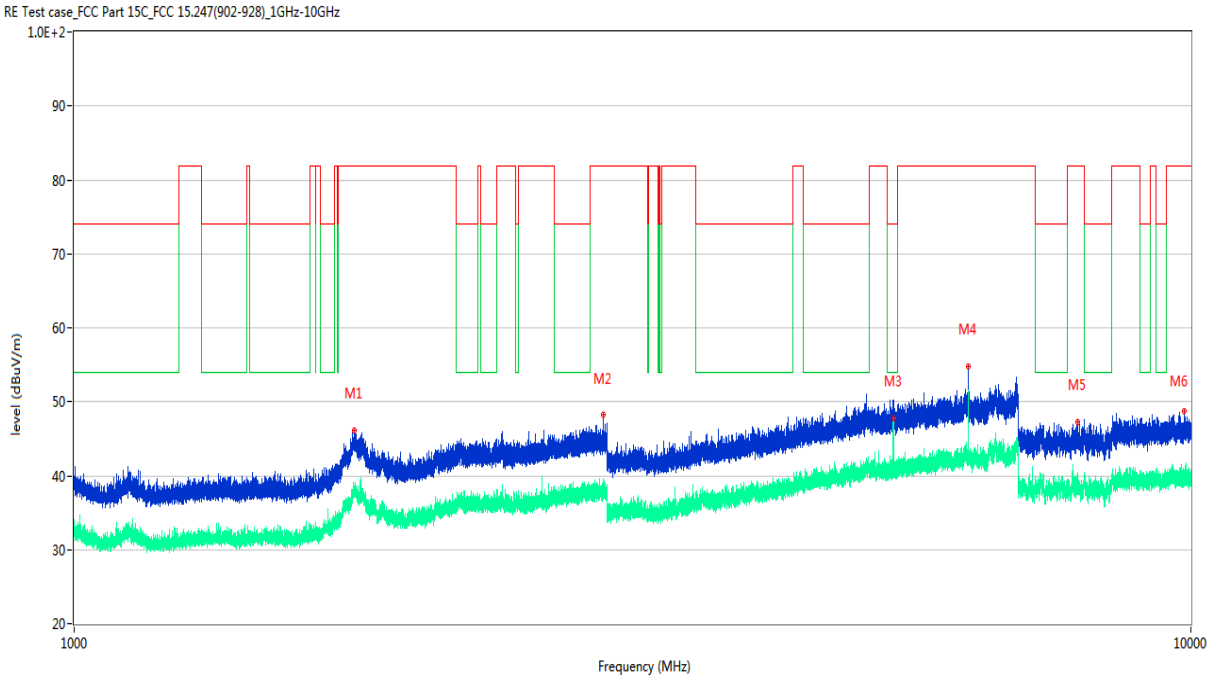
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	143.975	27.20	-24.35	83.0	-55.80	Peak	266.00	100	Horizontal	Pass
2	167.982	30.64	-24.11	43.5	-12.86	Peak	238.00	200	Horizontal	Pass
3	191.990	24.86	-26.85	83.0	-58.14	Peak	98.00	100	Horizontal	Pass
4	419.988	33.61	-18.53	83.0	-49.39	Peak	105.00	200	Horizontal	Pass
5	503.990	32.52	-16.14	83.0	-50.48	Peak	301.00	100	Horizontal	Pass
6	903.049	88.43	-11.52	83.0	5.43	Peak	172.00	100	Horizontal	N/A

HOPPING CHANNEL, ANT V



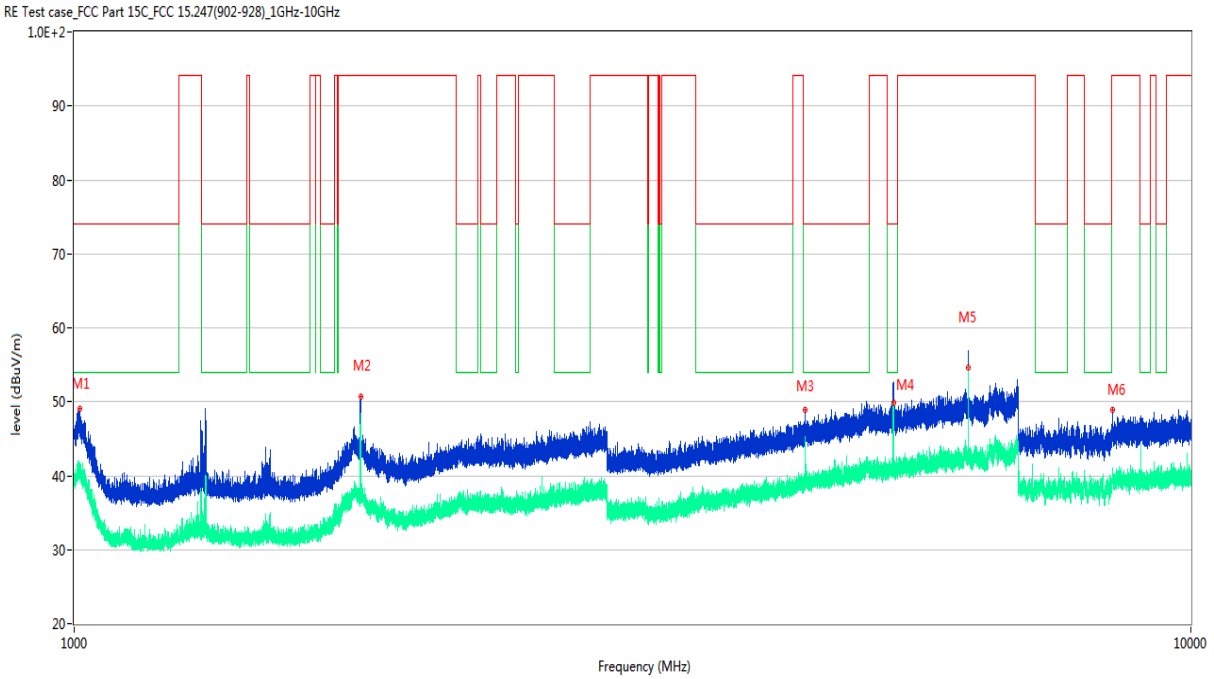
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	143.975	32.55	-24.35	95.1	-62.65	Peak	201.00	200	Vertical	Pass
2	168.031	39.50	-24.12	43.5	-4.00	Peak	326.00	100	Vertical	Pass
3	192.184	34.55	-26.89	95.1	-60.65	Peak	333.00	100	Vertical	Pass
4	215.998	35.11	-26.21	95.1	-60.09	Peak	340.00	200	Vertical	Pass
5	407.912	40.98	-18.98	46.0	-5.02	Peak	360.00	100	Vertical	Pass
6	912.021	101.66	-11.24	95.1	6.56	Peak	99.00	100	Vertical	N/A

LOW CHANNEL 1 GHz to 10 GHz, ANT H



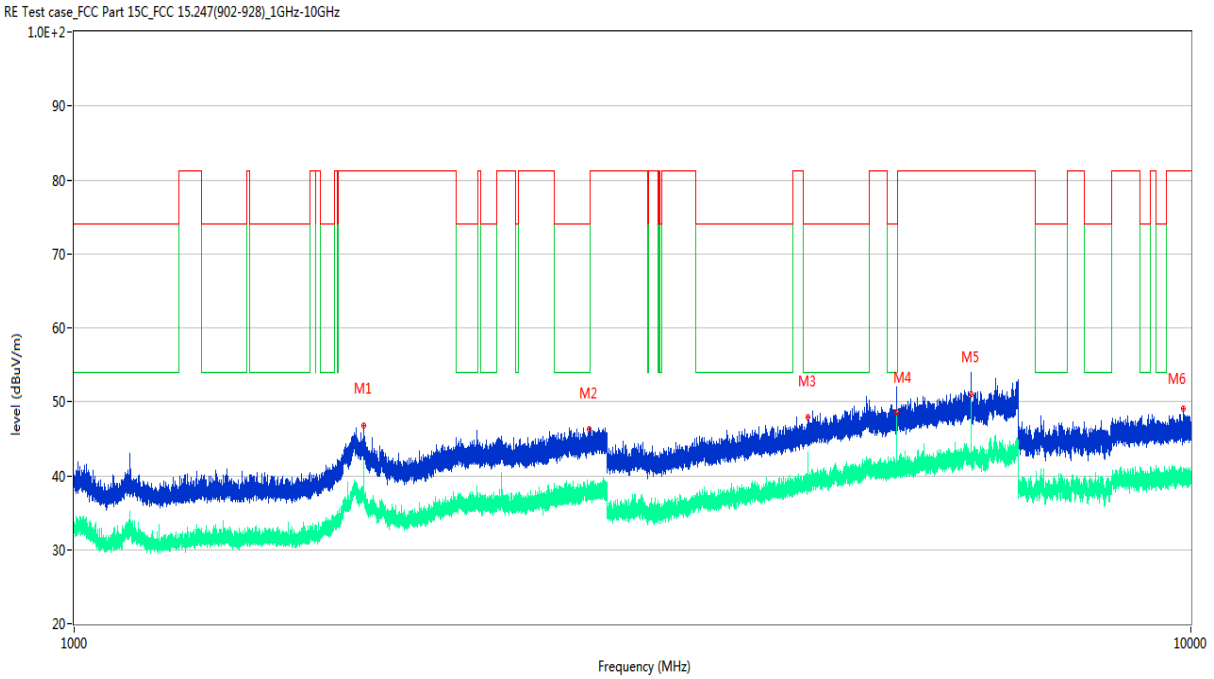
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1781.200	46.14	-7.73	81.9	-35.76	Peak	269.00	150	Horizontal	Pass
1**	1781.200	37.38	-7.73	81.9	-44.52	AV	269.00	150	Horizontal	Pass
2	2975.000	48.19	-5.50	81.9	-33.71	Peak	4.00	150	Horizontal	Pass
2**	2975.000	38.52	-5.50	81.9	-43.38	AV	4.00	150	Horizontal	Pass
3	5414.400	48.70	-2.80	74.0	-25.30	Peak	177.00	150	Horizontal	Pass
3**	5414.400	47.68	-2.80	54.0	-6.32	AV	177.00	150	Horizontal	Pass
4	6316.000	54.71	-1.52	81.9	-27.19	Peak	177.00	150	Horizontal	Pass
4**	6316.000	49.81	-1.52	81.9	-32.09	AV	177.00	150	Horizontal	Pass
5	7916.550	47.32	-2.40	81.9	-34.58	Peak	177.00	150	Horizontal	Pass
5**	7916.550	38.78	-2.40	81.9	-43.12	AV	177.00	150	Horizontal	Pass
6	9869.537	48.71	-0.80	81.9	-33.19	Peak	283.00	150	Horizontal	Pass
6**	9869.537	40.13	-0.80	81.9	-41.77	AV	283.00	150	Horizontal	Pass

LOW CHANNEL 1 GHz to 10 GHz, ANT H



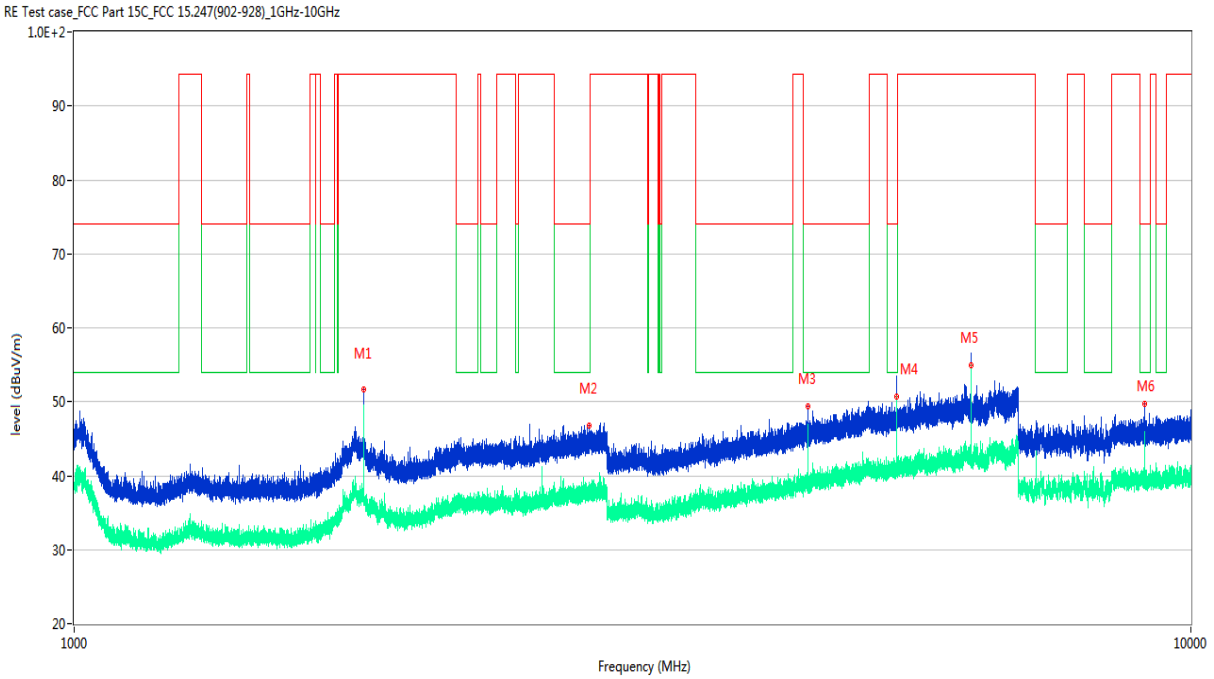
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1011.400	49.07	-13.40	74.0	-24.93	Peak	103.00	150	Vertical	Pass
1**	1011.400	40.13	-13.40	54.0	-13.87	AV	103.00	150	Vertical	Pass
2	1804.500	50.71	-8.73	94.1	-43.39	Peak	79.00	150	Vertical	Pass
2**	1804.500	47.48	-8.73	94.1	-46.62	AV	79.00	150	Vertical	Pass
3	4511.800	48.85	-4.09	74.0	-25.15	Peak	82.00	150	Vertical	Pass
3**	4511.800	45.29	-4.09	54.0	-8.71	AV	82.00	150	Vertical	Pass
4	5414.200	52.71	-2.79	74.0	-21.29	Peak	82.00	150	Vertical	Pass
4**	5414.200	49.90	-2.79	54.0	-4.10	AV	82.00	150	Vertical	Pass
5	6316.400	55.62	-1.53	94.1	-38.48	Peak	360.00	150	Vertical	Pass
5**	6316.400	54.60	-1.53	94.1	-39.50	AV	360.00	150	Vertical	Pass
6	8504.775	48.94	-1.38	94.1	-45.16	Peak	0.00	150	Vertical	Pass
6**	8504.775	40.24	-1.38	94.1	-53.86	AV	0.00	150	Vertical	Pass

MIDDLE CHANNEL 1 GHz to 10 GHz, ANT H



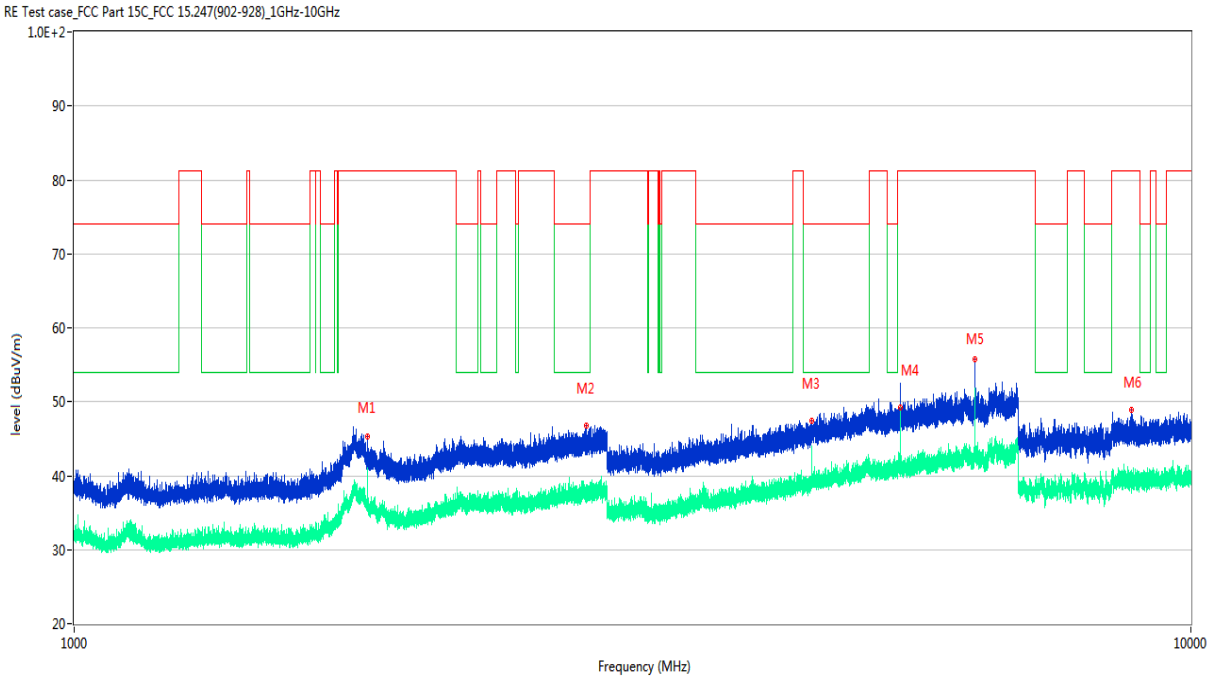
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1817.000	46.71	-8.75	81.3	-34.59	Peak	261.00	150	Horizontal	Pass
1**	1817.000	41.18	-8.75	81.3	-40.12	AV	261.00	150	Horizontal	Pass
2	2889.100	46.24	-5.88	74.0	-27.76	Peak	174.00	150	Horizontal	Pass
2**	2889.100	37.68	-5.88	54.0	-16.32	AV	174.00	150	Horizontal	Pass
3	4542.800	47.96	-4.22	74.0	-26.04	Peak	192.00	150	Horizontal	Pass
3**	4542.800	43.26	-4.22	54.0	-10.74	AV	192.00	150	Horizontal	Pass
4	5451.600	49.97	-2.26	74.0	-24.03	Peak	205.00	150	Horizontal	Pass
4**	5451.600	48.50	-2.26	54.0	-5.50	AV	205.00	150	Horizontal	Pass
5	6359.800	52.59	-2.09	81.3	-28.71	Peak	205.00	150	Horizontal	Pass
5**	6359.800	51.02	-2.09	81.3	-30.28	AV	205.00	150	Horizontal	Pass
6	9850.276	48.98	-0.70	81.3	-32.32	Peak	120.00	150	Horizontal	Pass
6**	9850.276	40.12	-0.70	81.3	-41.18	AV	120.00	150	Horizontal	Pass

MIDDLE CHANNEL 1 GHz to 10 GHz, ANT V



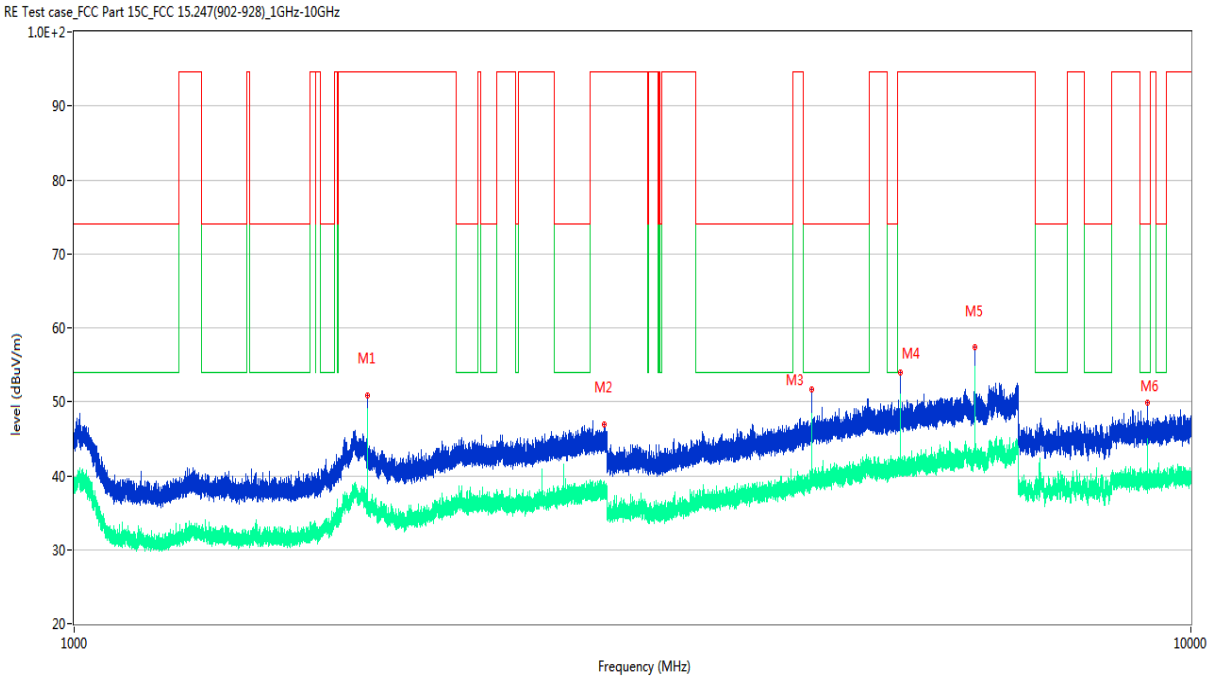
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1817.100	51.61	-8.77	94.3	-42.69	Peak	53.00	150	Vertical	Pass
1**	1817.100	49.05	-8.77	94.3	-45.25	AV	53.00	150	Vertical	Pass
2	2890.800	46.80	-5.91	74.0	-27.20	Peak	340.00	150	Vertical	Pass
2**	2890.800	38.99	-5.91	54.0	-15.01	AV	340.00	150	Vertical	Pass
3	4542.600	49.33	-4.22	74.0	-24.67	Peak	243.00	150	Vertical	Pass
3**	4542.600	46.80	-4.22	54.0	-7.20	AV	243.00	150	Vertical	Pass
4	5450.800	52.33	-2.32	74.0	-21.67	Peak	243.00	150	Vertical	Pass
4**	5450.800	50.69	-2.32	54.0	-3.31	AV	243.00	150	Vertical	Pass
5	6360.000	56.62	-2.08	94.3	-37.68	Peak	60.00	150	Vertical	Pass
5**	6360.000	54.94	-2.08	94.3	-39.36	AV	60.00	150	Vertical	Pass
6	9084.951	49.66	-1.35	74.0	-24.34	Peak	99.00	150	Vertical	Pass
6**	9084.951	43.79	-1.35	54.0	-10.21	AV	99.00	150	Vertical	Pass

HIGH CHANNEL 1 GHz to 10 GHz, ANT H



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1829.500	45.37	-10.05	81.3	-35.93	Peak	76.00	150	Horizontal	Pass
1**	1829.500	38.47	-10.05	81.3	-42.83	AV	76.00	150	Horizontal	Pass
2	2874.800	46.70	-6.16	74.0	-27.30	Peak	149.00	150	Horizontal	Pass
2**	2874.800	38.18	-6.16	54.0	-15.82	AV	149.00	150	Horizontal	Pass
3	4574.600	47.46	-3.89	74.0	-26.54	Peak	360.00	150	Horizontal	Pass
3**	4574.600	43.99	-3.89	54.0	-10.01	AV	360.00	150	Horizontal	Pass
4	5489.400	51.53	-2.31	81.3	-29.77	Peak	233.00	150	Horizontal	Pass
4**	5489.400	49.27	-2.31	81.3	-32.03	AV	233.00	150	Horizontal	Pass
5	6404.200	55.69	-0.84	81.3	-25.61	Peak	233.00	150	Horizontal	Pass
5**	6404.200	51.35	-0.84	81.3	-29.95	AV	233.00	150	Horizontal	Pass
6	8839.999	48.82	-0.90	81.3	-32.48	Peak	0.00	150	Horizontal	Pass
6**	8839.999	40.02	-0.90	81.3	-41.28	AV	0.00	150	Horizontal	Pass

HIGH CHANNEL 1 GHz to 10 GHz, ANT V

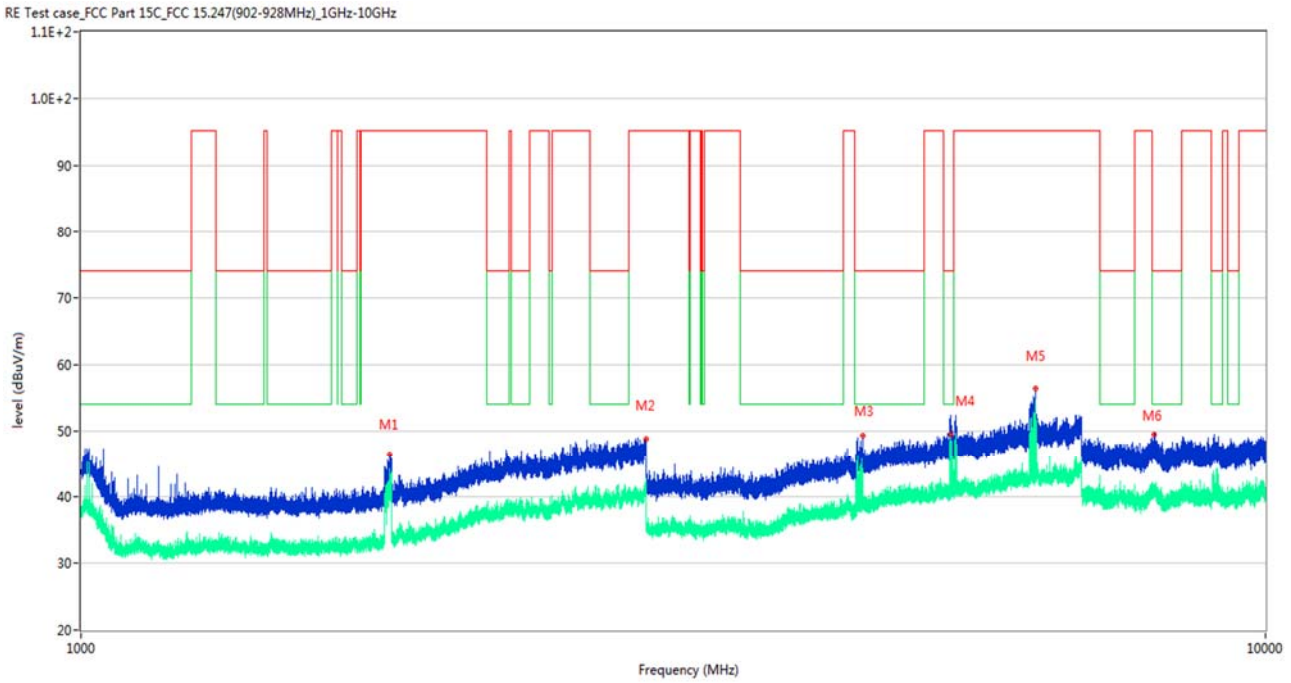


No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1829.800	50.85	-10.07	94.6	-43.75	Peak	91.00	150	Vertical	Pass
1**	1829.800	48.60	-10.07	94.6	-46.00	AV	91.00	150	Vertical	Pass
2	2984.200	46.92	-5.48	94.6	-47.68	Peak	242.00	150	Vertical	Pass
2**	2984.200	38.42	-5.48	94.6	-56.18	AV	242.00	150	Vertical	Pass
3	4574.200	51.72	-3.89	74.0	-22.28	Peak	84.00	150	Vertical	Pass
3**	4574.200	46.84	-3.89	54.0	-7.16	AV	84.00	150	Vertical	Pass
4	5489.200	53.99	-2.31	94.6	-40.61	Peak	72.00	150	Vertical	Pass
4**	5489.200	49.98	-2.31	94.6	-44.62	AV	72.00	150	Vertical	Pass
5	6404.600	57.31	-0.80	94.6	-37.29	Peak	47.00	150	Vertical	Pass
5**	6404.600	53.57	-0.80	94.6	-41.03	AV	47.00	150	Vertical	Pass
6	9149.350	49.81	-1.53	74.0	-24.19	Peak	193.00	150	Vertical	Pass
6**	9149.350	44.04	-1.53	54.0	-9.96	AV	193.00	150	Vertical	Pass

Hopping Low Channel 1 GHz to 10 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1005.200	45.62	-9.34	74.0	-28.38	Peak	359.00	100	Horizontal	Pass
1**	1005.200	35.08	-9.34	54.0	-18.92	AV	359.00	100	Horizontal	Pass
2	2841.200	48.79	-3.39	74.0	-25.21	Peak	139.00	100	Horizontal	Pass
2**	2841.200	40.75	-3.39	54.0	-13.25	AV	139.00	100	Horizontal	Pass
3	4447.400	47.55	-2.36	83.0	-35.45	Peak	60.00	100	Horizontal	Pass
3**	4447.400	39.08	-2.36	83.0	-43.92	AV	60.00	100	Horizontal	Pass
4	5580.800	50.22	0.90	83.0	-32.78	Peak	308.00	100	Horizontal	Pass
4**	5580.800	42.25	0.90	83.0	-40.75	AV	308.00	100	Horizontal	Pass
5	6392.600	53.34	2.69	83.0	-29.66	Peak	294.00	100	Horizontal	Pass
5**	6392.600	48.80	2.69	83.0	-34.20	AV	294.00	100	Horizontal	Pass
6	8631.850	49.99	18.13	83.0	-33.01	Peak	340.00	100	Horizontal	Pass
6**	8631.850	40.29	18.13	83.0	-42.71	AV	340.00	100	Horizontal	Pass

Hopping Low Channel 1 GHz to 10 GHz, ANT V



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1821.900	46.43	-10.67	95.1	-48.67	Peak	146.00	100	Vertical	Pass
1**	1821.900	44.12	-10.67	95.1	-50.98	AV	146.00	100	Vertical	Pass
2	2997.600	48.86	-2.48	95.1	-46.24	Peak	173.00	100	Vertical	Pass
2**	2997.600	41.22	-2.48	95.1	-53.88	AV	173.00	100	Vertical	Pass
3	4570.200	49.30	-2.35	74.0	-24.70	Peak	282.00	100	Vertical	Pass
3**	4570.200	43.73	-2.35	54.0	-10.27	AV	282.00	100	Vertical	Pass
4	5421.000	49.05	-0.44	74.0	-24.95	Peak	266.00	100	Vertical	Pass
4**	5421.000	49.48	-0.44	54.0	-4.52	AV	266.00	100	Vertical	Pass
5	6401.200	56.45	3.10	95.1	-38.65	Peak	129.00	100	Vertical	Pass
5**	6401.200	53.59	3.10	95.1	-41.51	AV	129.00	100	Vertical	Pass
6	8053.000	49.54	18.19	74.0	-24.46	Peak	58.00	100	Vertical	Pass
6**	8053.000	40.02	18.19	54.0	-13.98	AV	58.00	100	Vertical	Pass

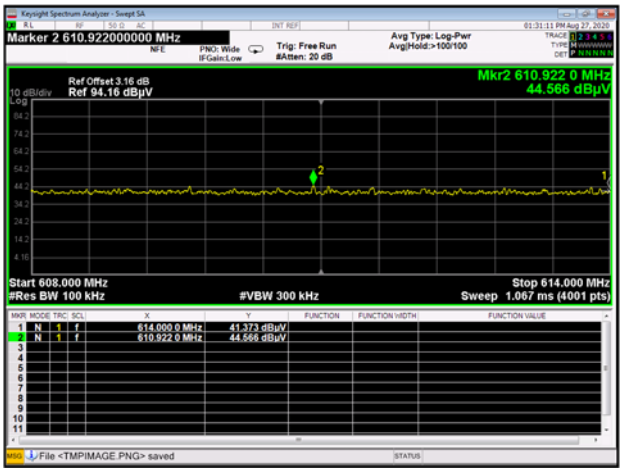
A.10 Band Edge (Restricted-band band-edge)

Note [1]: The lowest and highest channels are tested to verify the band edge emissions. Please refer to the following the plots for emissions values.
Note [2]: The test data all are tested in the vertical and horizontal antenna which the trace is max hold. So these plots have shown the worst case.
Note [3]: 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 [4]: The Level (dBuV/m) has been corrected by factor.

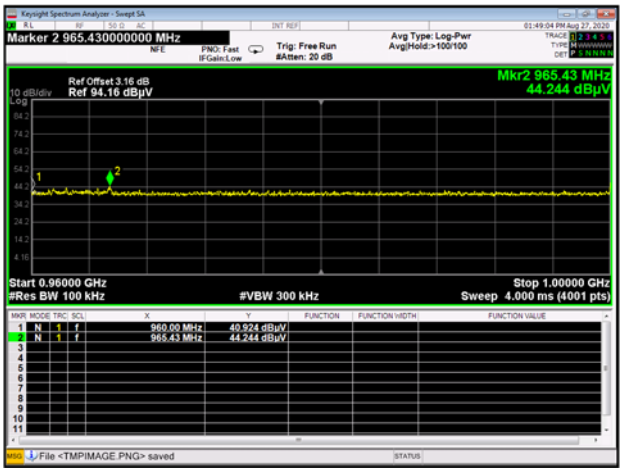
Test Mode	Test Channel	Frequency (MHz)	Level (dBuV/m)	Factor (dB)	Limit Line (dBuV/m)	Margin (dB)	Remark	Verdict
LoRa	Low	614	44.566	3.16	74	29.434	PEAK	Pass
		614	N/A	N/A	54	N/A	AVERAGE	Pass
LoRa	HIGH	960	47.396	28	74	26.604	PEAK	Pass
		960	N/A	N/A	54	N/A	AVERAGE	Pass
LoRa HOPPING	Low	614	41.432	3.16	74	32.568	PEAK	Pass
		614	N/A	N/A	54	N/A	AVERAGE	Pass
LoRa HOPPING	HIGH	960	47.594	28.00	74	26.406	PEAK	Pass
		960	N/A	N/A	54	N/A	AVERAGE	Pass

Test Plots

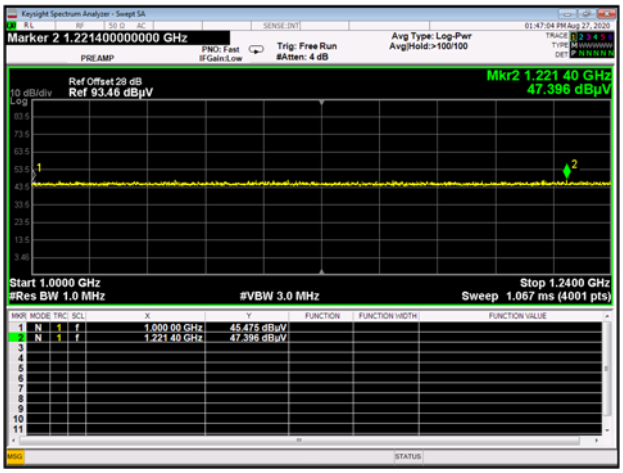
LOW CHANNEL, PEAK



HIGH CHANNEL, PEAK

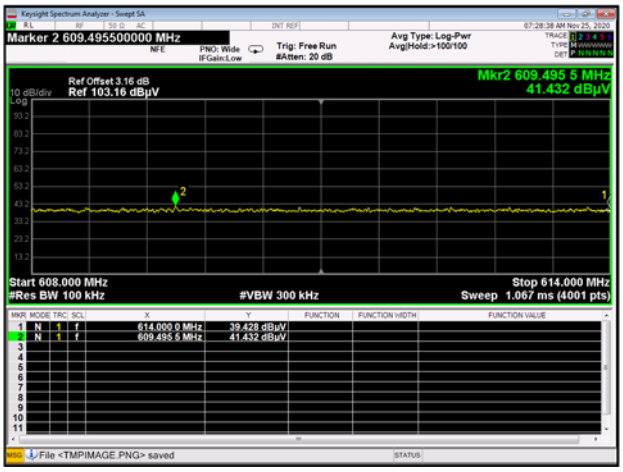


HIGH CHANNEL, AV

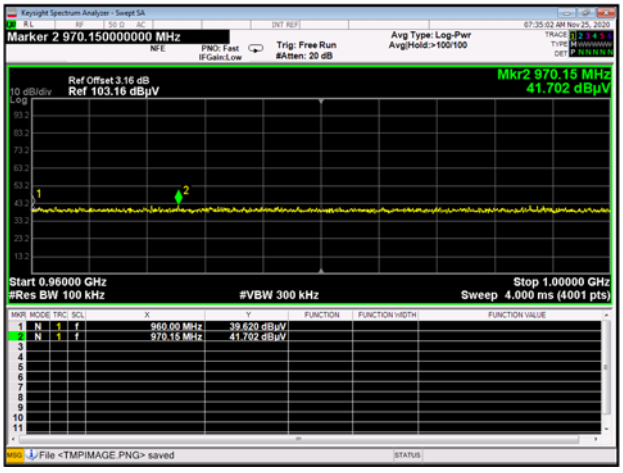


Hopping

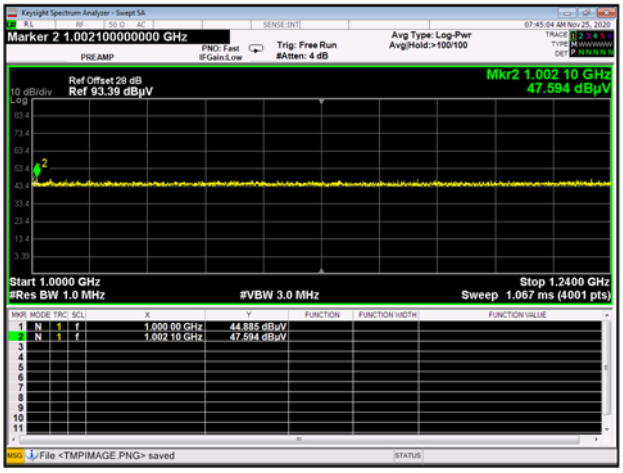
LOW CHANNEL, PEAK



HIGH CHANNEL, PEAK



HIGH CHANNEL, AV



ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-SZ2080372-AR.PDF”.

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ2080372-AW.PDF”.

ANNEX D EUT INTERNAL PHOTOS

Please refer the document “BL-SZ2080372-AI.PDF”.

--END OF REPORT--