FCC/ISED RF TEST REPORT

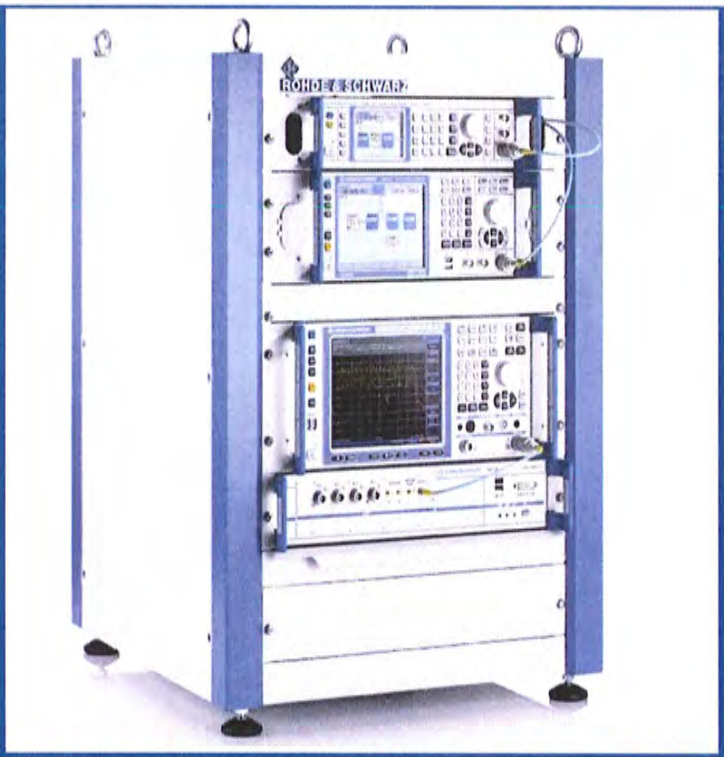
ISSUED BY
Shenzhen BALUN Technology Co., Ltd.

FOR

LoRa USB Modem

ISSUED TO
SG Wireless Limited

Unit 4, 5/, Sun Fung Industrial Building, 8 Ma Kok Street, Tsuen Wan New Territories, Hong Kong



Tested by: Ye Hongji
Ye Hongji
Date Nov. 19, 2020

Approved by:
Wei Yanquan
(Chief Engineer)
Date Nov. 19, 2020

Report No.:	BL-SZ2080617-601
EUT Name:	LoRa USB Modem
Model Name:	SGW8100
Brand Name:	SG Wireless
Test Standard:	47 CFR Part 15 Subpart C
	RSS-Gen (Issue 5, March 2019)
	RSS-247 (Issue 2, February 2017)
FCC ID:	2AS9405
ISED Number:	25021-05
Test Conclusion:	Pass
Test Date:	Sep. 03, 2020 ~ Nov. 05, 2020
Date of Issue:	Nov. 19, 2020

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Revision History

Version	Issue Date	Revisions Content
Rev. 01	Nov. 19, 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	SG Wireless Limited
Address	Unit 4, 5/F, Sun Fung Industrial Building, 8 Ma Kok Street, Tsuen Wan New Territories, Hong Kong

2.2 Manufacturer Information

Manufacturer	Dongguan Macson Electronics Ltd.
Address	No.5, Jun Da Lu, DongKeng, Dongguan, Guangdong China 523451

2.3 Factory Information

Factory	Dongguan Macson Electronics Ltd.
Address	No.5, Jun Da Lu, DongKeng, Dongguan, Guangdong China 523451

2.4 General Description for Equipment under Test (EUT)

EUT Type	LoRa USB Modem
Model Name Under Test	SGW8100
Series Model Name	N/A
Description of Model name differentiation	N/A
Serial Number	7C:51:89:12:34:56
Hardware Version	V1.0
Software Version	V1.00
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.5 Technical Information

Network and Wireless connectivity	LoRa

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

Modulation Technology	Hybrid 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	128 for FHSS, 79 for FHSS, and 33 for DTS
Tested Channel	125KHz: 0 (902.3 MHz), 64 (915.1 MHz), 127 (927.7 MHz) 250KHz: 0 (902.40 MHz), 50 (914.94 MHz), 100 (927.48 MHz) 500KHz: 0 (903.0 MHz), 15 (915.0 MHz), 32 (927.5 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:

125KHz for FHSS

Channel number	Freq. (MHz)	Channel number	Freq. (MHz)	Channel number	Freq. (MHz)	Channel number	Freq. (MHz)
0	**902.3**	32	908.7	**64**	**915.1**	96	921.5
1	902.5	33	908.9	65	915.3	97	921.7
2	902.7	34	909.1	66	915.5	98	921.9
3	902.9	35	909.3	67	915.7	99	922.1
4	903.1	36	909.5	68	915.9	100	922.3
5	903.3	37	909.7	69	916.1	101	922.5
6	903.5	38	909.9	70	916.3	102	922.7
7	903.7	39	910.1	71	916.5	103	922.9
8	903.9	40	910.3	72	916.7	104	923.1
9	904.1	41	910.5	73	916.9	105	923.3
10	904.3	42	910.7	74	917.1	106	923.5
11	904.5	43	910.9	75	917.3	107	923.7
12	904.7	44	911.1	76	917.5	108	923.9
13	904.9	45	911.3	77	917.7	109	924.1
14	905.1	46	911.5	78	917.9	110	924.3
15	905.3	47	911.7	79	918.1	111	924.5
16	905.5	48	911.9	80	918.3	112	924.7
17	905.7	49	912.1	81	918.5	113	924.9
18	905.9	50	912.3	82	918.7	114	925.1
19	906.1	51	912.5	83	918.9	115	925.3
20	906.3	52	912.7	84	919.1	116	925.5
21	906.5	53	912.9	85	919.3	117	925.7
22	906.7	54	913.1	86	919.5	118	925.9
23	906.9	55	913.3	87	919.7	119	926.1
24	907.1	56	913.5	88	919.9	120	926.3
25	907.3	57	913.7	89	920.1	121	926.5
26	907.5	58	913.9	90	920.3	122	926.7
27	907.7	59	914.1	91	920.5	123	926.9
28	907.9	60	914.3	92	920.7	124	927.1
29	908.1	61	914.5	93	920.9	125	927.3
30	908.3	62	914.7	94	921.1	126	927.5
31	908.5	63	914.9	95	921.3	**127**	**927.7**

250KHz for FHSS

Channel number	Freq. (MHz)	Channel number	Freq. (MHz)	Channel number	Freq. (MHz)	Channel number	Freq. (MHz)
0	**902.4**	20	909	40	915.6	60	922.2
1	902.73	21	909.33	41	915.93	61	922.53
2	903.06	22	909.66	42	916.26	62	922.86
3	903.39	23	909.99	43	916.59	63	923.19
4	903.72	24	910.32	44	916.92	64	923.52
5	904.05	25	910.65	45	917.25	65	923.85
6	904.38	26	910.98	46	917.58	66	924.18
7	904.71	27	911.31	47	917.91	67	924.51
8	905.04	28	911.64	48	918.24	68	924.84
9	905.37	29	911.97	49	918.57	69	925.17
10	905.7	30	912.3	50	918.9	70	925.5
11	906.03	31	912.63	51	919.23	71	925.83
12	906.36	32	912.96	52	919.56	72	926.16
13	906.69	33	913.29	53	919.89	73	926.49
14	907.02	34	913.62	54	920.22	74	926.82
15	907.35	35	913.95	55	920.55	75	927.15
16	907.68	36	914.28	56	920.88	**76**	**927.48**
17	908.01	37	914.61	57	921.21		
18	908.34	**38**	**914.94**	58	921.54		
19	908.67	39	915.27	59	921.87		

500KHz for DTS

Channel number	Freq. (MHz)	Channel number	Freq. (MHz)	Channel number	Freq. (MHz)	Channel number	Freq. (MHz)
0	**903**	9	910.2	18	917.4	27	924.5
1	903.8	10	911	19	918.2	28	925.1
2	904.6	11	911.8	20	919	29	925.7
3	905.4	12	912.6	21	919.8	30	926.3
4	906.2	13	913.4	22	920.6	31	926.9
5	907	14	914.2	23	921.4	**32**	**927.5**
6	907.8	**15**	**915**	24	922.2		
7	908.6	16	915.8	25	923.3		
8	909.4	17	916.6	26	923.9		

2.6 Additional Instructions

EUT Software Settings:

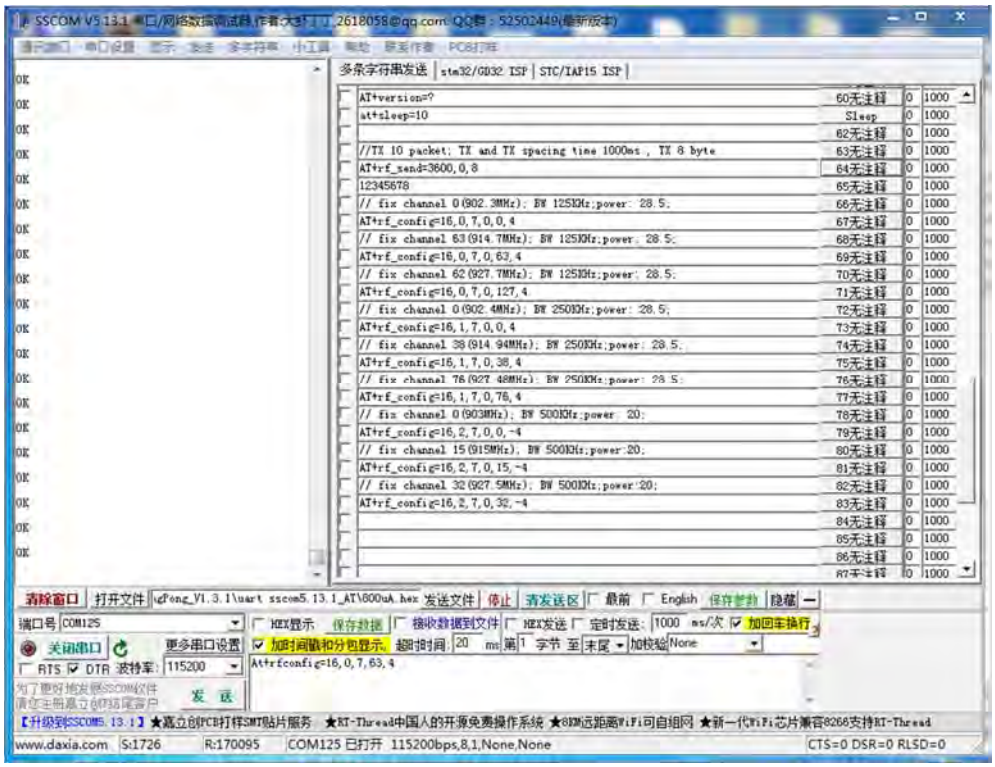
Mode	☒ Special software is used. The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

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 V5.13.1		
Support Units (Software installation media)	Description	Manufacturer	Model
	Notebook	DELL	N/A

Mode	Channel	Soft Set
125KHz	902.3 MHz	4
	915.1 MHz	4
	927.7 MHz	4
250KHz	902.3 MHz	4
	914.9 MHz	4
	927.4 MHz	4
500KHz	903.0 MHz	-4
	915.0 MHz	-4
	927.5 MHz	-4

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	RSS-Gen (Issue 5, Mar. 2019)	General Requirements for Compliance of Radio Apparatus
3	RSS-247 (Issue 2, February 2017)	Digital Transmission Systems (DTSs), Frequency Hopping Systems(FHSs) and Licence-Exemp Local Area Network (LE-LAN) Devices
4	FCC PUBLIC NOTICE DA 00-705 (Mar. 30, 2000)	Filling and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
5	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices
6	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.	ISED Part No.	Modulation Technology	Channel	Test Result	Verdict
1	Antenna Requirement	15.203	RSS-247, 5.4 (f)	N/A	N/A	--	Pass Note1
2	Peak Output Power	15.247(b)	RSS-247, 5.4 (d)	Hybrid system	Low/Middle/ High	ANNEX A.1	Pass
3	Occupied Bandwidth	15.247(a)	RSS-GEN, 6.7; RSS-247, 5.2 (a)	Hybrid system	Low/Middle/ High	ANNEX A.2	Pass
4	Carrier Frequency Separation	15.247(a)	RSS-GEN, 6.7; RSS-247, 5.2 (a)	Frequency hopping mode	Hopping Mode	ANNEX A.3	Pass
5	Time of Occupancy (Dwell time)	15.247(a)	RSS-GEN, 6.7; RSS-247, 5.2 (a)	Frequency hopping mode	Hopping Mode	ANNEX A.4	Pass
6	Conducted Spurious Emission & Authorized-band band-edge	15.247(d)	RSS-247, 5.5;	Hybrid system	Low/Middle/ High, Hopping Mode	ANNEX A.5	Pass
7	Conducted Emission	15.207	RSS-GEN, 8.8	Hybrid system	Low/Middle/ High	ANNEX A.6	Pass
8	Radiated Spurious Emission	15.209 15.247(d)	RSS-247, 5.5	Hybrid system	Low/Middle/ High, Hopping Mode	ANNEX A.7	Pass
9	Band Edge(Restricted-band band-edge)	15.209 15.247(d)	RSS-247, 5.5	Hybrid system	Low/Middle/ High, Hopping Mode	ANNEX A.8	Pass
10	Power spectral density (PSD)	15.247(e)	RSS-247, 5.2 (b)	Hybrid system	Low/Middle/ High	ANNEX A.9	Pass
Note [1]: 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℃ to +25℃
Working Voltage of the EUT	NV (Normal Voltage)	5 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	2019.11.12	2020.11.11
Ear Simulator	B&K	4185	2409449	2019.11.12	2020.11.11
Ear Simulator	B&K	4195	2418189	2019.11.12	2020.11.11

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Audio analyzer	B&K	UPL 16	100129	2019.11.12	2020.11.11

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.

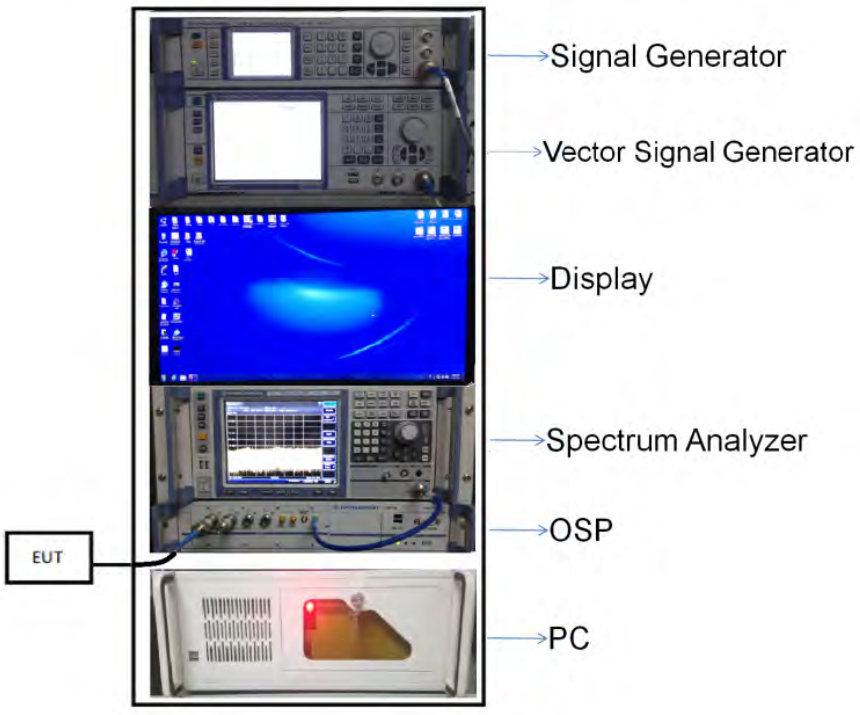
Measurement	Value
Occupied Channel Bandwidth	±4%
RF output power, conducted	±1.4 dB
Power Spectral Density, conducted	±2.5 dB
Unwanted Emissions, conducted	±2.8 dB
All emissions, radiated	±5.4 dB
Temperature	±1°C
Humidity	±4%

4.4 Description of Test Setup

4.4.1 For Antenna Port Test

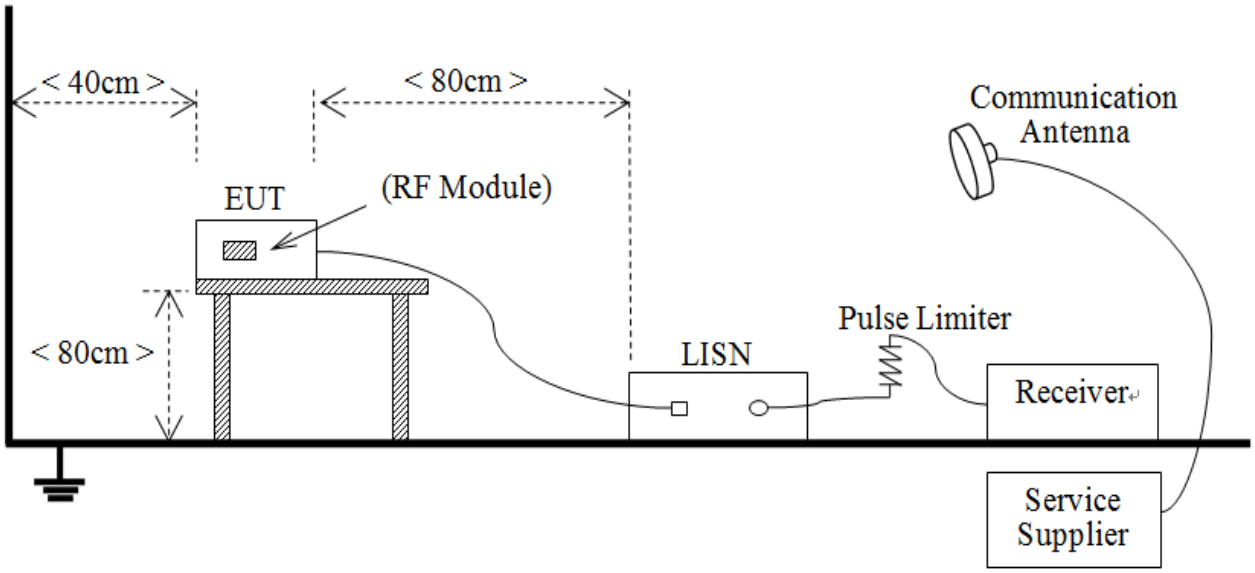
Conducted value (dBm) = Measurement value (dBm) + cable loss (dB)

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



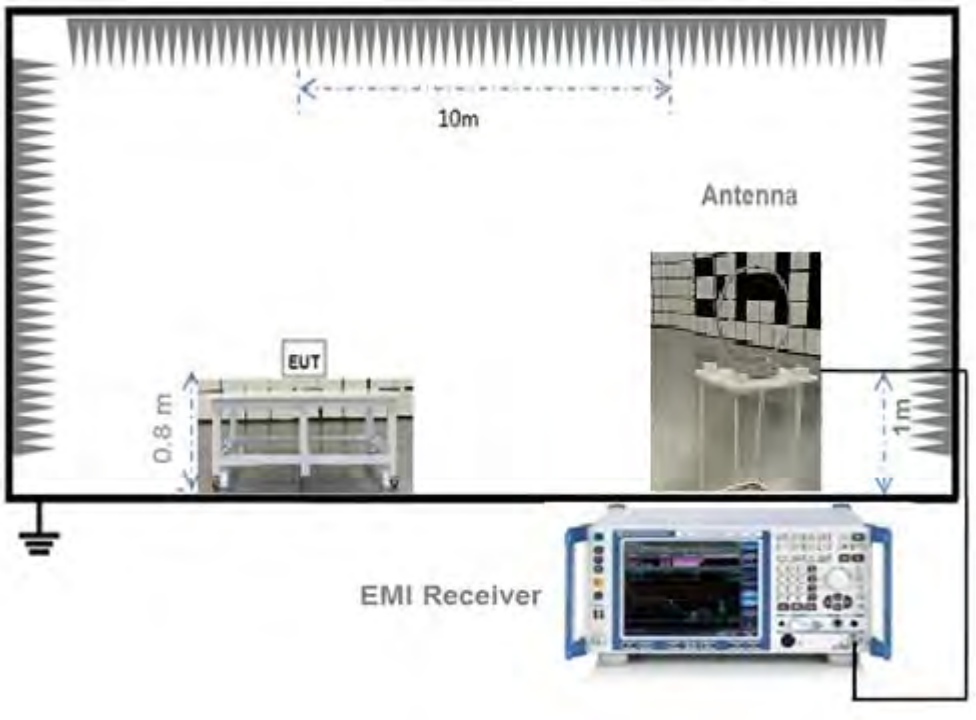
(Diagram 1)

4.4.2 For AC Power Supply Port Test



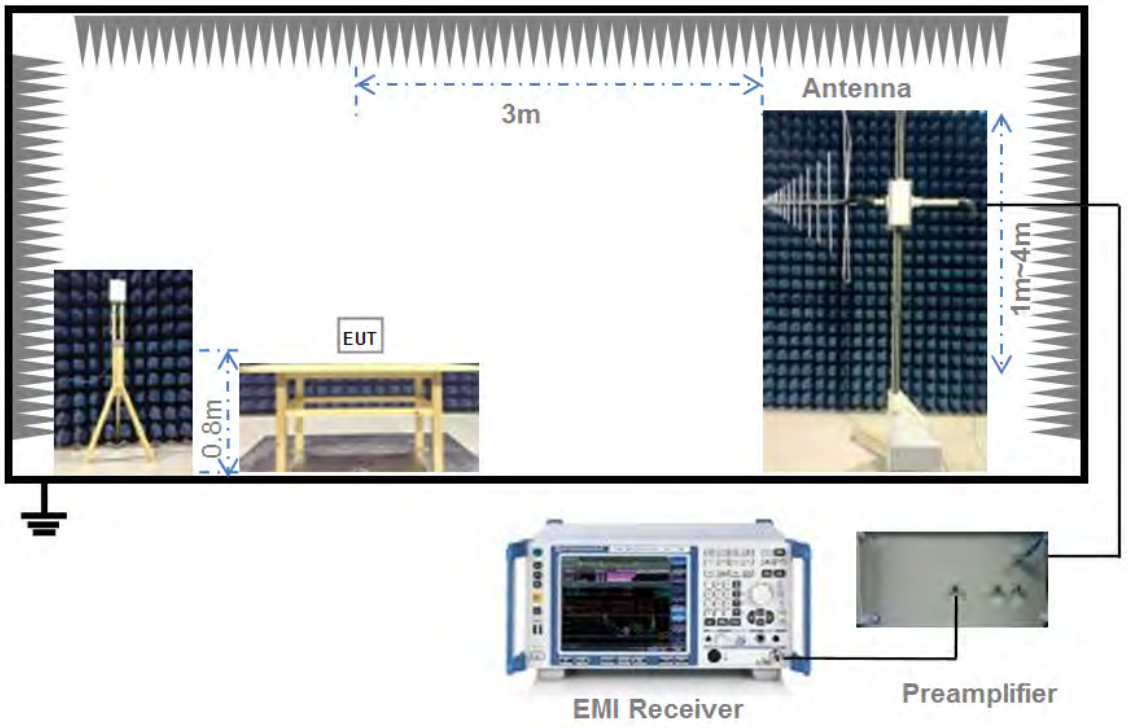
(Diagram 2)

4.4.3 For Radiated Test (Below 30 MHz)



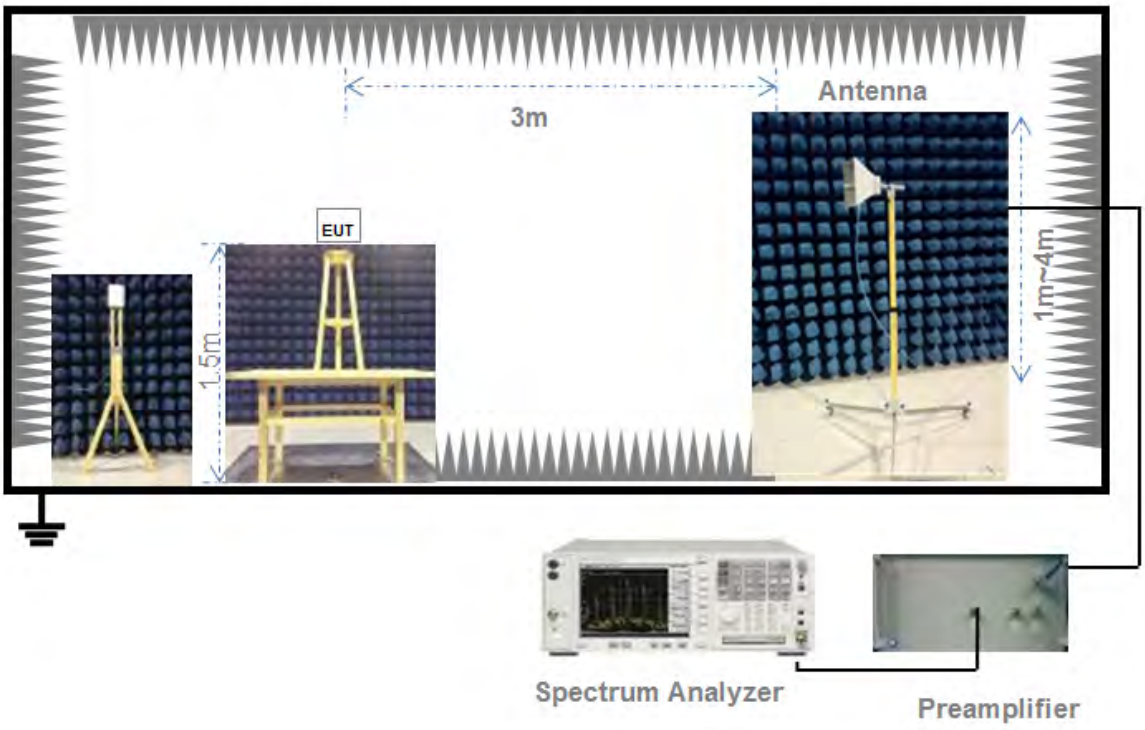
(Diagram 3)

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 - Hybrid

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	The antenna is welded on the mainboard, can't be replaced by the consumer

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 Peak Output Power and E.I.R.P

5.2.1 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 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).

5.2.2 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.

5.2.3 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.

5.2.4 Test Result

Please refer to ANNEX A.1.

5.3 Occupied Bandwidth

5.3.1 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.

5.3.2 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

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.

5.3.4 Test Result

Please refer to ANNEX A.2.

5.4 Carrier Frequency Separation

5.4.1 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.

5.4.2 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

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.

5.4.4 Test Result

Please refer to ANNEX A.3.

5.5 Time of Occupancy (Dwell time)

5.5.1 Limit

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

For the purposes of this section, hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques. The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned-off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4.

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 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.

5.5.4 Test Result

Please refer to ANNEX A.4.

5.6 Conducted Spurious Emission & Authorized-band band-edge

5.6.1 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.

5.6.2 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

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

5.6.4 Test Result

Please refer to ANNEX A.6 and A.5

5.7 Conducted Emission

5.7.1 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

5.7.2 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.

5.7.3 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.

5.7.4 Test Result

Please refer to ANNEX A.6.

5.8 Radiated Spurious Emission

5.8.1 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).

5.8.2 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.

5.8.3 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.

5.8.4 Test Result

Please refer to ANNEX A.7.

5.9 Band Edge (Restricted-band band-edge)

5.9.1 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).

5.9.2 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 Power Spectral density (PSD)

5.10.1 Limit

FCC §15.247(e); RSS-247, 5.2 (2)

The same method of determining the conducted output power shall be used to determine the power spectral density. If a peak output power is measured, then a peak power spectral density measurement is required. If an average output power is measured, then an average power spectral density measurement should be used.

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of Section 5.4(4), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

5.10.2 Test Setup

See section 4.4.1 (Diagram 1) for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.10.3 Test Procedure

Set analyzer center frequency to DTS channel center frequency.

Set the span to 1.5 times the DTS bandwidth.

Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.

Set the VBW ≥ 3 RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

5.10.4 Test Result

Please refer to ANNEX A.9.

6 TEST ITEMS - DTS

6.1 Output Power

6.1.1 Test Limit

FCC § 15.247(b)

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements.

RSS-247, 5.4 (4)

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(5), the e.i.r.p. shall not exceed 4 W.

6.1.2 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.

6.1.3 Test Procedure

a) Maximum peak conducted output power

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

Set the RBW ≥ DTS bandwidth.

Set VBW ≥ 3 x RBW.

Set span ≥ 3 x RBW

Sweep time = auto couple.

Detector = peak.

Trace mode = max hold.

Allow trace to fully stabilize.

Use peak marker function to determine the peak amplitude level.

b) Measurements of duty cycle

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal.

Set the center frequency of the instrument to the center frequency of the transmission.

Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value.

Set VBW ≥ RBW. Set detector = peak or average.

The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

6.1.4 Test Result

Please refer to ANNEX A.1.

6.2 Occupied Bandwidth

6.2.1 Limit

FCC §15.247(a); RSS-247, 5.1 (1); RSS-GEN, 6.6

Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW. The 6 dB bandwidth must be greater than 500 kHz.

6.2.2 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.

6.2.3 Test Procedure

Use the following spectrum analyzer settings:

Set RBW = 100 kHz.

Set the video bandwidth (VBW) ≥ 3 RBW.

Detector = Peak.

Trace mode = max hold.

Sweep = auto couple.

Allow the trace to stabilize.

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

6.2.4 Test Result

Please refer to ANNEX A.2.

6.3 Conducted Spurious Emission

6.3.1 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.

6.3.2 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.

6.3.3 Test Procedure

The DTS rules specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:

a) If the maximum peak conducted output power procedure was used to demonstrate compliance as described in 9.1, then the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 20 dBc).

b) If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc).

c) In either case, attenuation to levels below the 15.209 general radiated emissions limits is not required.

The following procedures shall be used to demonstrate compliance to these limits. Note that these procedures can be used in either an antenna-port conducted or radiated test set-up. Radiated tests must conform to the test site requirements and utilize maximization procedures defined herein.

Reference level measurement:

Establish a reference level by using the following procedure:

Set instrument center frequency to DTS channel center frequency.

Set the span to ≥ 1.5 times the DTS bandwidth.

Set the RBW = 100 kHz.

Set the VBW ≥ 3 x RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum PSD level.

Emission level measurement:

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.

Set the RBW = 100 kHz.

Set the VBW ≥ 3 x RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

6.3.4 Test Result

Please refer to ANNEX A.5.

6.4 Band Edge (Authorized-band band-edge)

6.4.1 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.

6.4.2 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.

6.4.3 Test Procedure

The following procedures may be used to determine the peak or average field strength or power of an unwanted emission that is within 2 MHz of the authorized band edge. If a peak detector is utilized, use the procedure described in 13.2.1. Use the procedure described in 13.2.2 when using an average detector and the EUT can be configured to transmit continuously (i.e., duty cycle ≥ 98%). Use the procedure described in 13.2.3 when using an average detector and the EUT cannot be configured to transmit continuously but the duty cycle is constant (i.e., duty cycle variations are less than ± 2 percent). Use the procedure described in 13.2.4 when using an average detector for those cases where the EUT cannot be configured to transmit continuously and the duty cycle is not constant (duty cycle variations equal or exceed 2 percent).

When using a peak detector to measure unwanted emissions at or near the band edge (within 2 MHz of the authorized band), the following integration procedure can be used.

Set instrument center frequency to the frequency of the emission to be measured (must be within 2 MHz of the authorized band edge).

Set span to 2 MHz

RBW = 100 kHz.

VBW ≥ 3 x RBW.

Detector = peak.

Sweep time = auto.

Trace mode = max hold.

Allow sweep to continue until the trace stabilizes (required measurement time may increase for low duty cycle applications)

Compute the power by integrating the spectrum over 1 MHz using the analyzer's band power measurement function with band limits set equal to the emission frequency (femission) ± 0.5 MHz. If the instrument does not have a band power function, then sum the amplitude levels (in power units) at 100 kHz intervals extending across the 1 MHz spectrum defined by femission ± 0.5 MHz.

6.4.4 Test Result

Please refer to ANNEX A.5.

6.5 Conducted Emission

6.5.1 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

6.5.2 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.

6.5.3 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.

6.5.4 Test Result

Please refer to ANNEX A.6.

6.6 Radiated Spurious Emission

6.6.1 Limit

FCC §15.209&15.247(d); RSS-GEN, 8.9; 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	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Note:

5. Field Strength (dBμV/m) = 20*log[Field Strength (μV/m)].
6. In the emission tables above, the tighter limit applies at the band edges.
7. 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.
8. For above 1000 MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK).

6.6.2 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.

6.6.3 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.

6.6.4 Test Result

Please refer to ANNEX A.7.

6.7 Band Edge (Restricted-band band-edge)

6.7.1 Limit

FCC §15.209&15.247(d); RSS-GEN, 8.9; 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).

6.7.2 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.

6.7.3 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.

For transmitters operating above 1 GHz repeat the measurement with an average detector.

1.1.1 Test Result

Please refer to ANNEX A.8.

6.8 Power Spectral density (PSD)

6.8.1 Limit

FCC §15.247(e); RSS-247, 5.2 (2)

The same method of determining the conducted output power shall be used to determine the power spectral density. If a peak output power is measured, then a peak power spectral density measurement is required. If an average output power is measured, then an average power spectral density measurement should be used.

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of Section 5.4(4), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

6.8.2 Test Setup

See section 4.4.1 (Diagram 1) for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

6.8.3 Test Procedure

Set analyzer center frequency to DTS channel center frequency.

Set the span to 1.5 times the DTS bandwidth.

Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.

Set the VBW ≥ 3 RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

6.8.4 Test Result

Please refer to ANNEX A.9.

ANNEX A TEST RESULT

A.1 Peak Output Power and E.I.R.P

Peak Power Test Data

Channel	Measured Output Peak Power		Limit		Verdict
	LoRa (125kHz)		dBm	mW	
	dBm	mW			
Low	27.23	528.45	30	1000	Pass
Middle	27.37	545.76			Pass
High	27.27	533.33			Pass

Channel	Measured Output Peak Power		Limit		Verdict
	LoRa (250KHz)		dBm	mW	
	dBm	mW			
Low	27.47	558.47	30	1000	Pass
Middle	27.43	553.35			Pass
High	27.46	557.19			Pass

Channel	Measured Output Peak Power		Limit		Verdict
	LoRa (500kHz)		dBm	mW	
	dBm	mW			
Low	19.33	85.70	30	1000	Pass
Middle	19.45	88.10			Pass
High	19.52	89.54			Pass

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

Channel	E.I.R.P		Limit		Verdict
	LoRa (125kHz)		dBm	mW	
	dBm	mW			
Low	29.23	837.53	36	4000	Pass
Middle	29.37	864.97			Pass
High	29.27	845.28			Pass

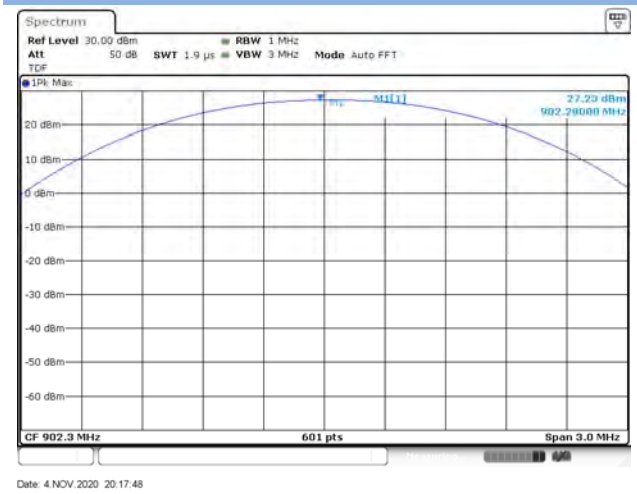
Channel	E.I.R.P		Limit		Verdict
	LoRa (250kHz)		dBm	mW	
	dBm	mW			
Low	29.47	885.12	36	4000	Pass
Middle	29.43	877.00			Pass
High	29.46	883.08			Pass

Channel	E.I.R.P		Limit		Verdict
	LoRa (250kHz)		dBm	mW	
	dBm	mW			
Low	21.33	135.83	36	4000	Pass
Middle	21.45	139.64			Pass
High	21.52	141.91			Pass

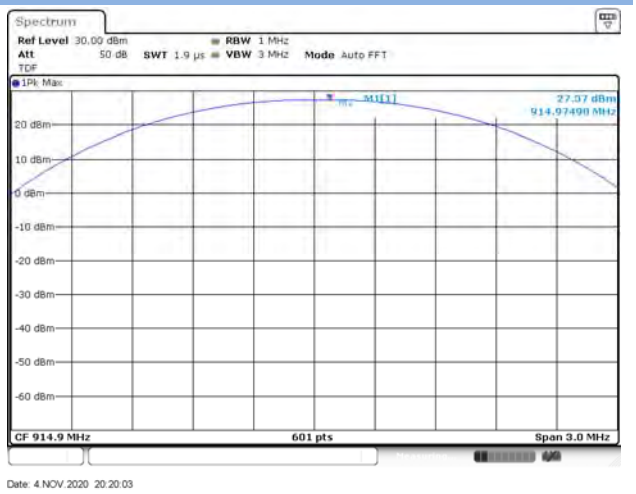
Test plots

125kHz

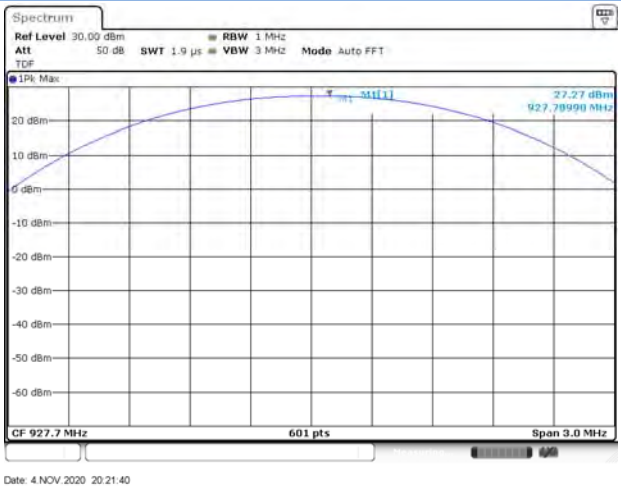
LOW CHANNEL



MIDDLE CHANNEL



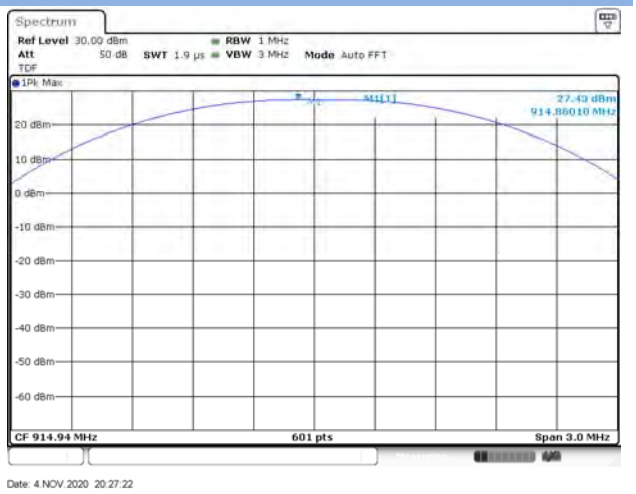
HIGH CHANNEL



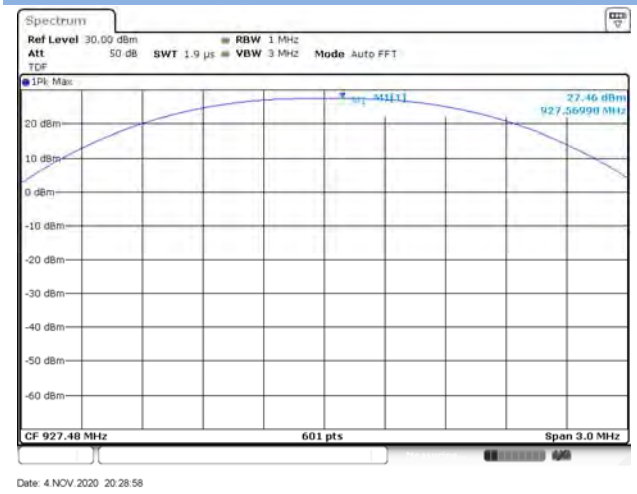
250kHz

LOW CHANNEL

MIDDLE CHANNEL



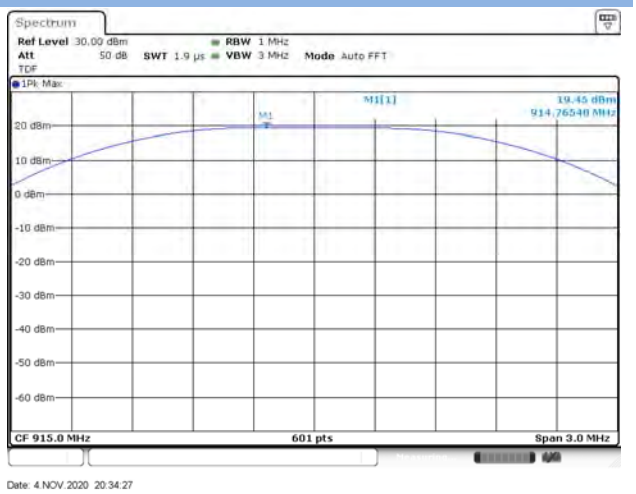
HIGH CHANNEL



500kHz

LOW CHANNEL

MIDDLE CHANNEL



HIGH CHANNEL

A.2 20 dB and 99% bandwidth

Test Data

LoRa (125kHz)			
Channel	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)	Verdict
Low	0.140869	0.125200	Pass
Middle	0.138550	0.124000	Pass
High	0.138550	0.124400	Pass

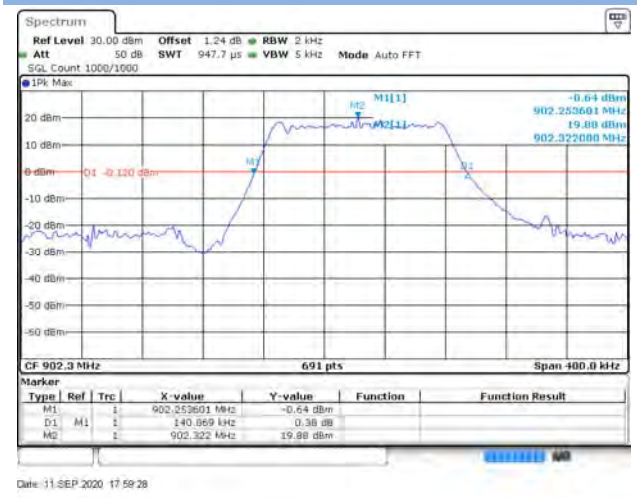
LoRa (250KHz)			
Channel	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)	Verdict
Low	0.293640	0.258600	Pass
Middle	0.294617	0.259800	Pass
High	0.294617	0.259800	Pass

LoRa (500KHz)			
Channel	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)	Verdict
Low	0.758301	0.786000	Pass
Middle	0.730469	0.766000	Pass
High	0.716553	0.764000	Pass

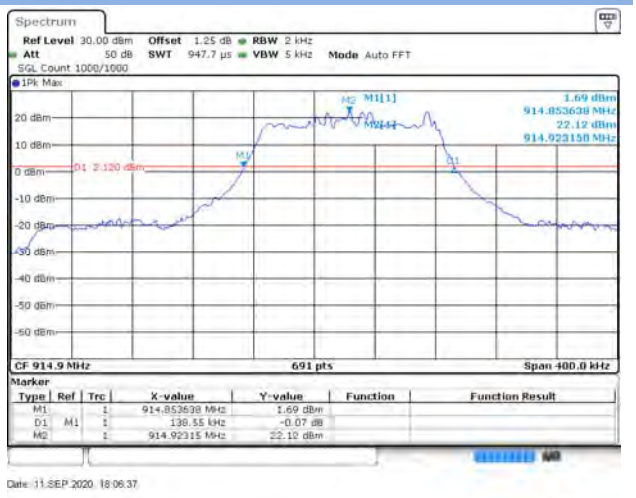
Test plots (20 dB Bandwidth)

125kHz

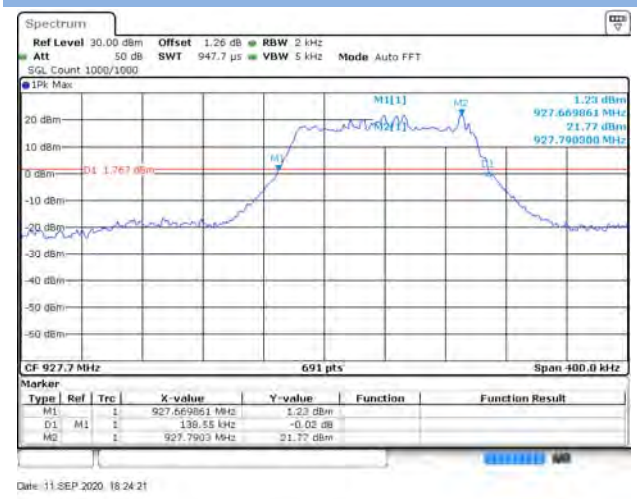
LOW CHANNEL



MIDDLE CHANNEL



HIGH CHANNEL

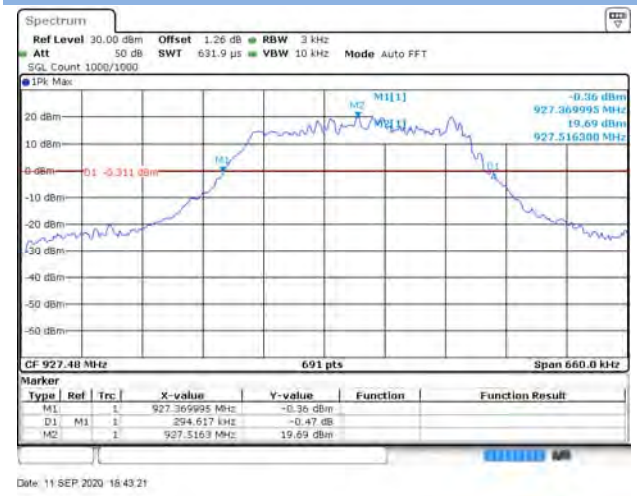


250kHz

LOW CHANNEL

MIDDLE CHANNEL

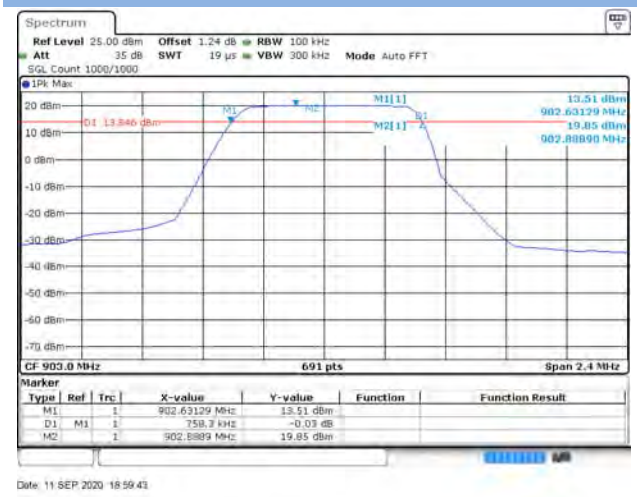
HIGH CHANNEL



Test plots (6 dB Bandwidth)

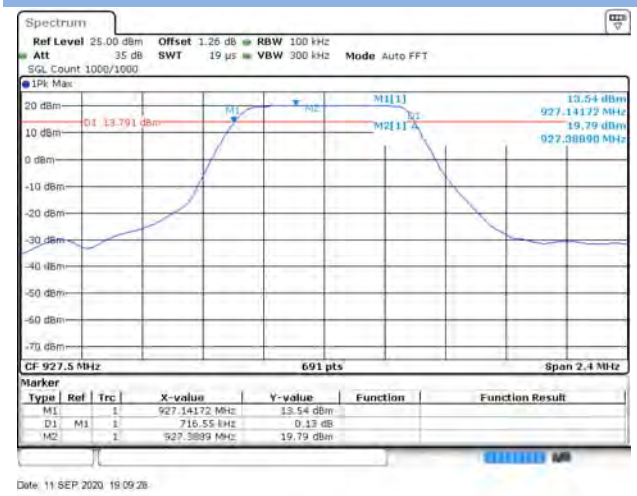
500kHz

LOW CHANNEL



MIDDLE CHANNEL

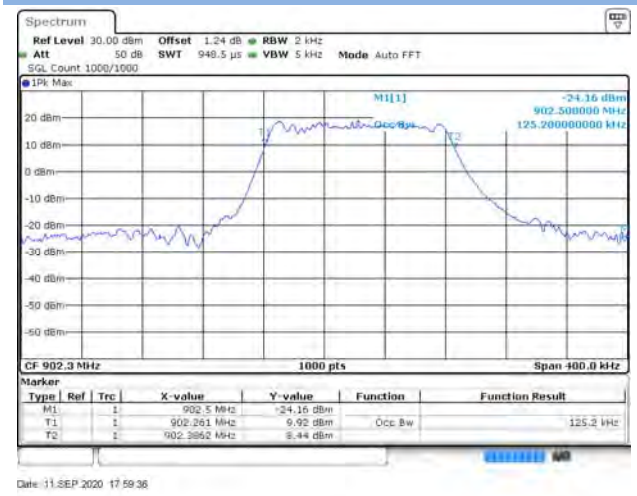
HIGH CHANNEL



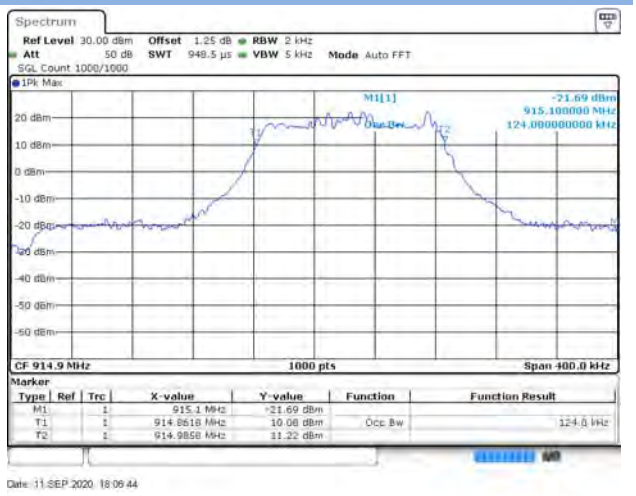
Test plots (99% Bandwidth)

125kHz

LOW CHANNEL



MIDDLE CHANNEL



HIGH CHANNEL

250kHz

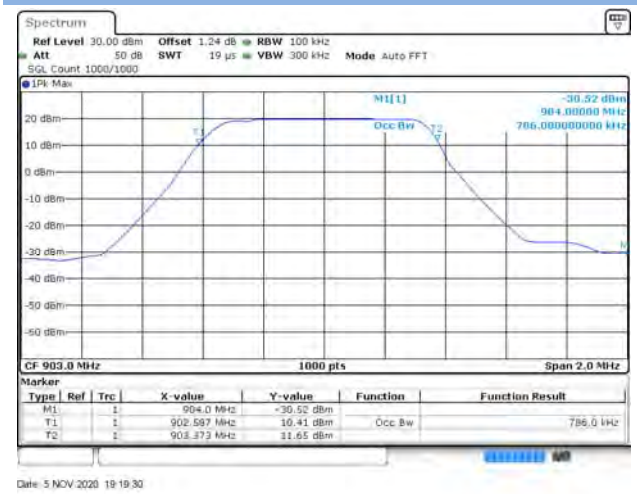
LOW CHANNEL

MIDDLE CHANNEL

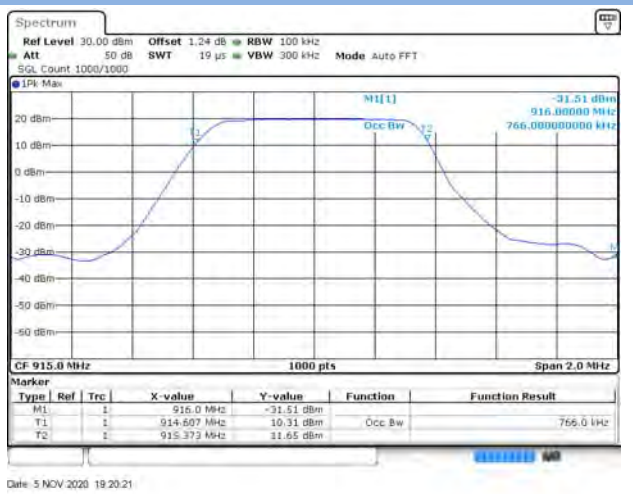
HIGH CHANNEL

500kHz

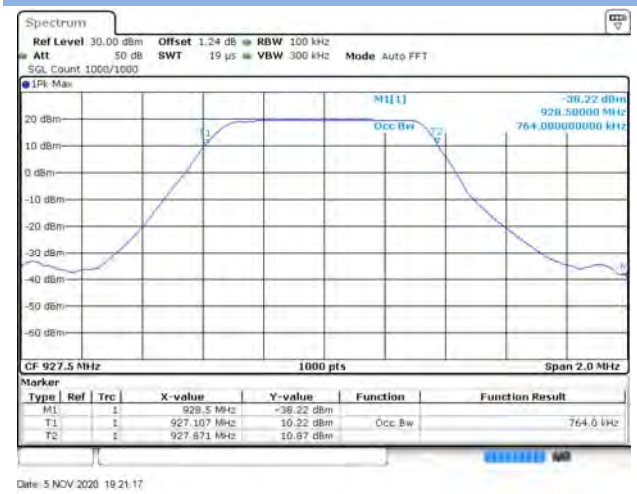
LOW CHANNEL



MIDDLE CHANNEL



HIGH CHANNEL



A.3 Hopping Frequency Separation

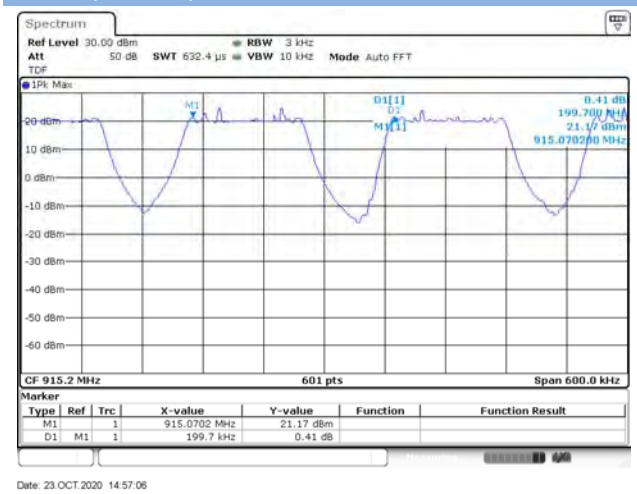
Test Data

Mode	Frequency separation (MHz)	Max 20 dB Bandwidth (MHz)	Verdict
LoRa (125kHz)	0.1997	0.140869	Pass

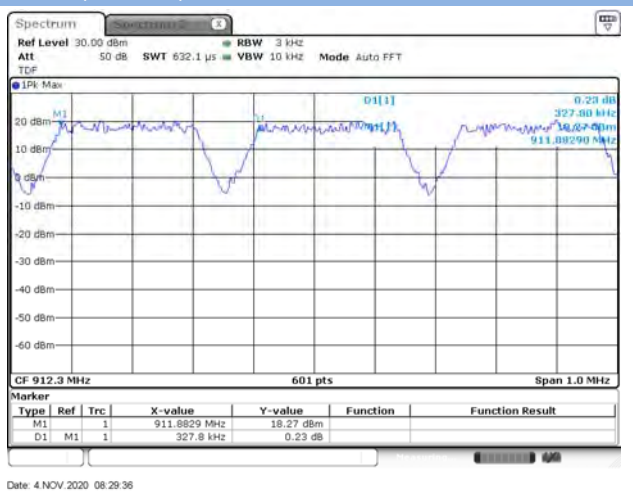
Mode	Frequency separation (MHz)	Max 20 dB Bandwidth (MHz)	Verdict
LoRa (250KHz)	0.3278	0.294617	Pass

Test Plots

LoRa (125kHz)



LoRa (250kHz)



A.4 Average Time of Occupancy

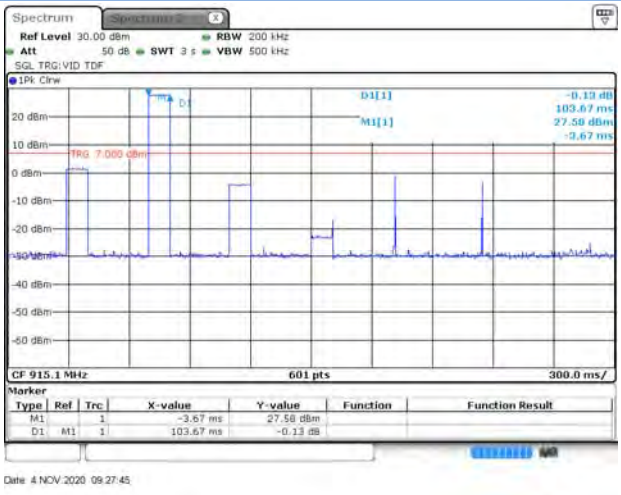
Test Data

Mode	Total of Dwell (ms)	Limit (sec)	Verdict
LoRa (125KHz)	207.340	0.4	Pass

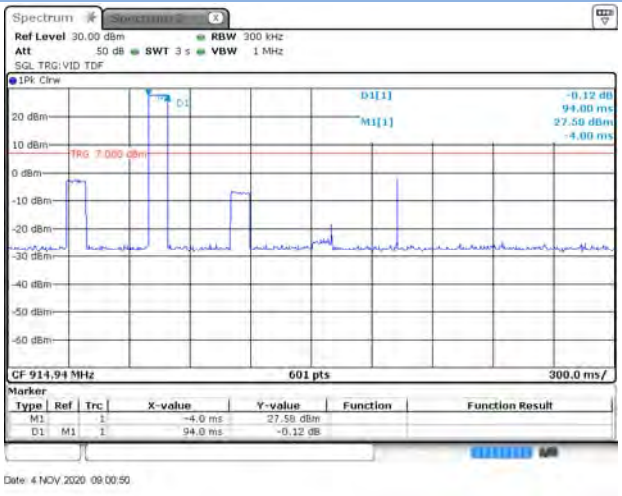
Mode	Total of Dwell (ms)	Limit (sec)	Verdict
LoRa (250KHz)	282.000	0.4	Pass

Test Plots

LoRa (125kHz)



LoRa (250kHz)



A.5 Conducted Spurious Emissions & Authorized-band band-edge

Test Data

LoRa (125KHz)				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-14.50	27.01	7.01	Pass
Middle	-25.33	27.12	7.12	Pass
High	-6.85	27.05	7.05	Pass
LoRa (125KHz)				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Hopping	-4.60	27.97	7.97	Pass

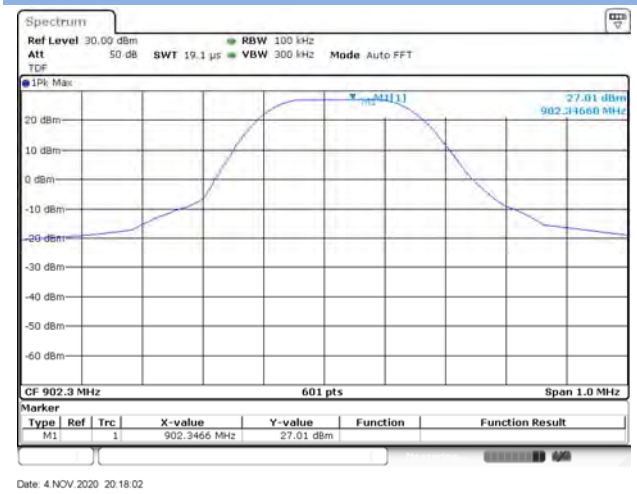
LoRa (250KHz)				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-15.67	27.24	7.24	Pass
Middle	-25.51	27.20	7.20	Pass
High	-17.00	27.24	7.24	Pass
LoRa (250KHz)				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Hopping	-10.46	27.71	7.71	Pass

LoRa (500KHz)				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-25.79	19.22	-0.78	Pass
Middle	-25.92	19.41	-0.59	Pass
High	-25.72	19.37	-0.63	Pass
LoRa (500KHz)				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-32.00	19.22	-0.78	Pass
High	-10.82	19.37	-0.63	Pass

Test Plots

125kHz

LOW CHANNEL, CARRIER LEVEL



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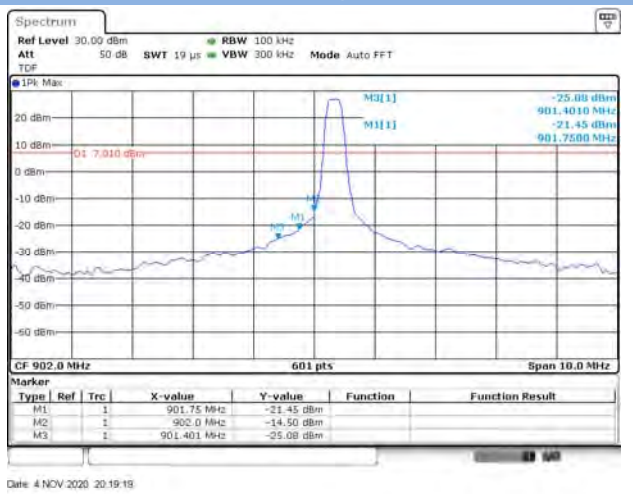
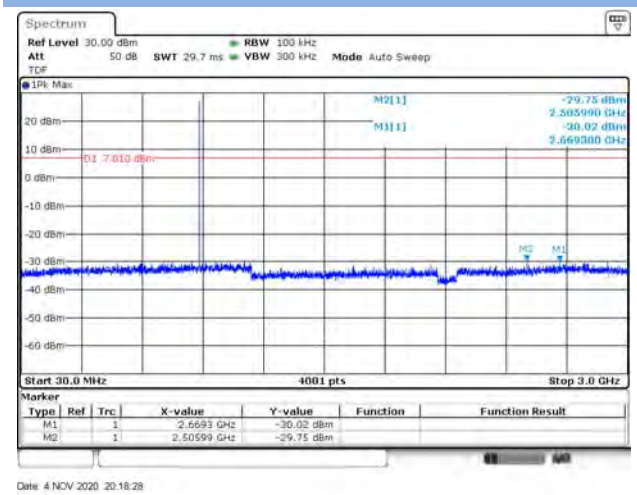
LOW CHANNEL, Band Edge



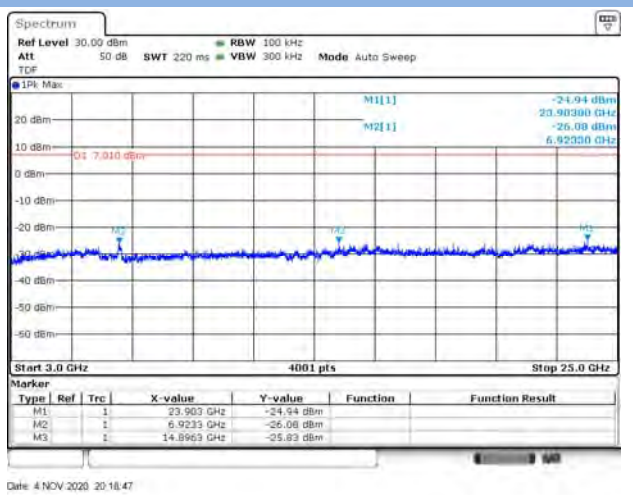
Date: 4.NOV.2020 20:19:13

LOW CHANNEL , SPURIOUS 30 MHz ~ 1 GHz



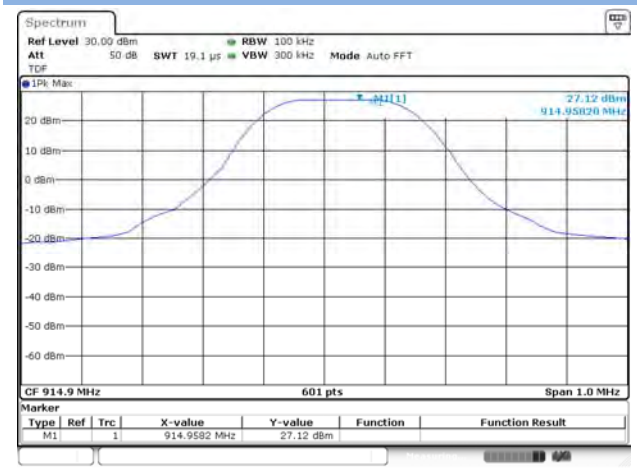
Date: 4.NOV.2020 20:18:28

LOW CHANNEL , SPURIOUS 1 GHz ~ 10 GHz



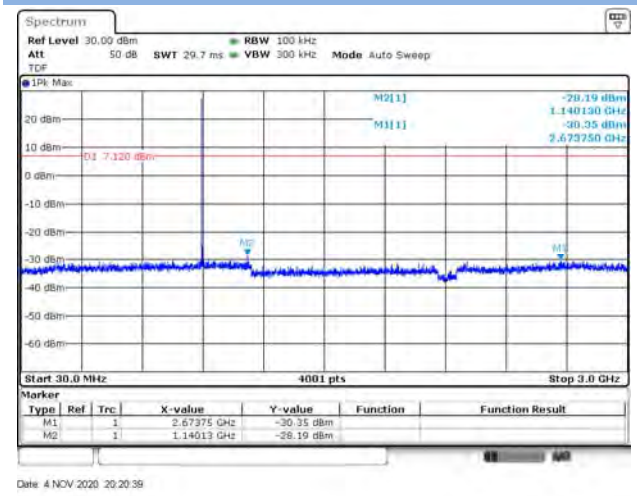
Date: 4.NOV.2020 20:18:47

MIDDLE CHANNEL, CARRIER LEVEL

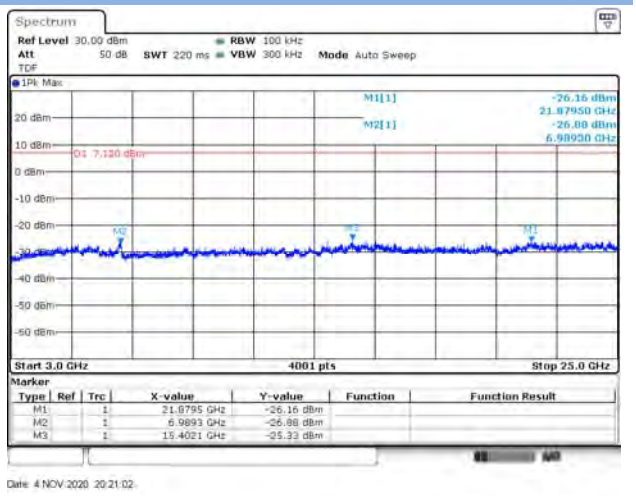


Date: 4.NOV.2020 20:20:16

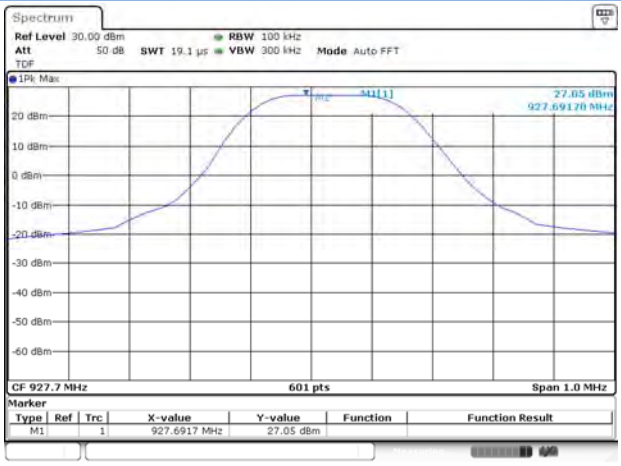
MIDDLE CHANNEL , SPURIOUS 30 MHz ~ 1 GHz



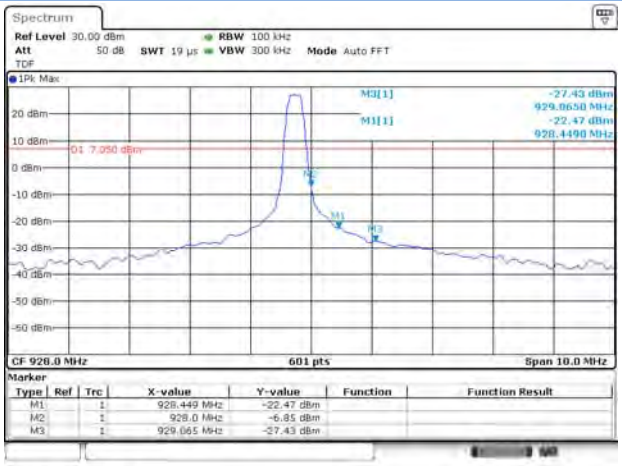
MIDDLE CHANNEL , SPURIOUS 1 GHz ~ 10 GHz



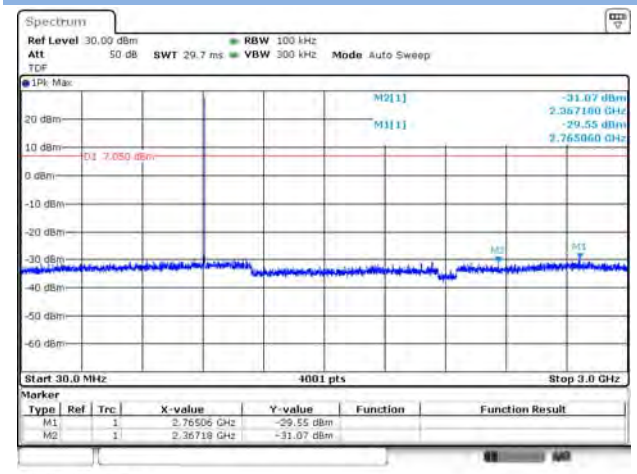
HIGH CHANNEL, CARRIER LEVEL



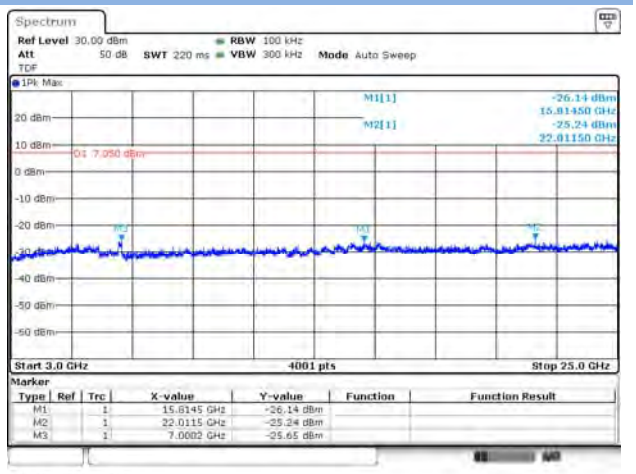
HIGH CHANNEL , BAND EDGE



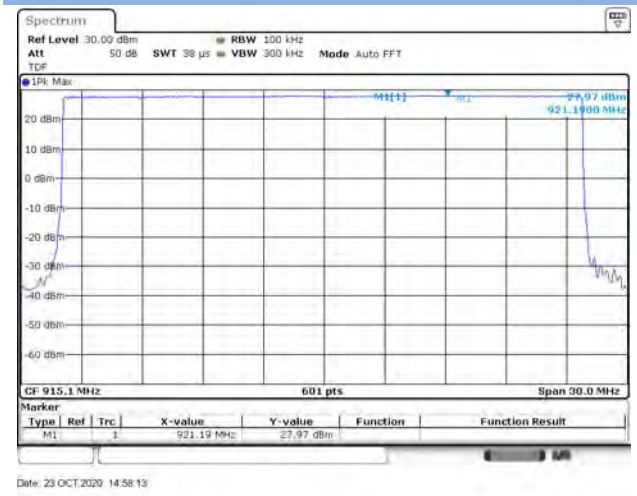
HIGH CHANNEL , SPURIOUS 30 MHz ~ 1 GHz



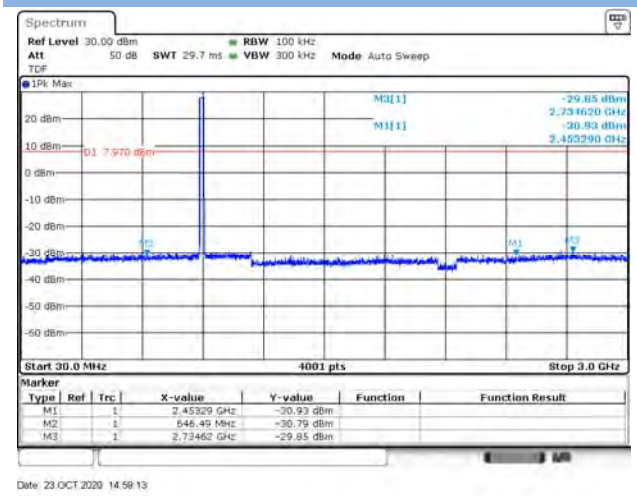
HIGH CHANNEL , SPURIOUS 1 GHz ~ 10 GHz



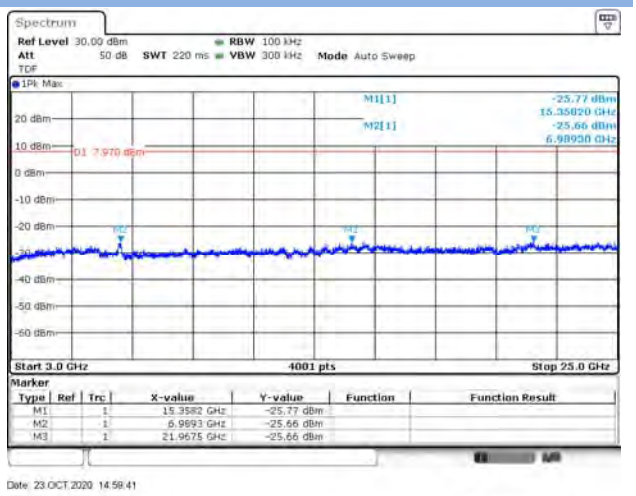
MIDDLE CHANNEL HOPPING, CARRIER LEVEL



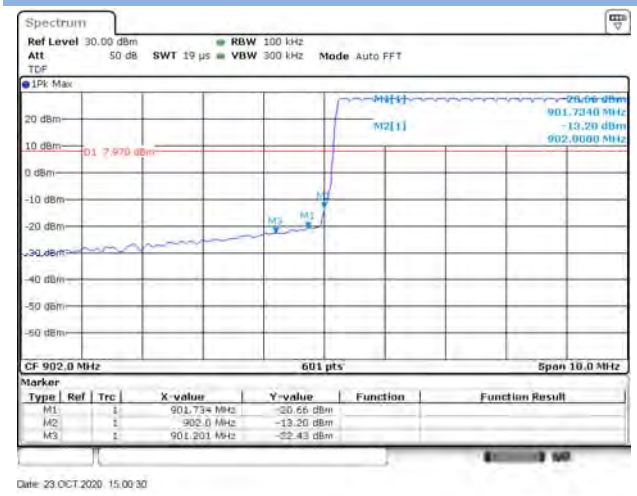
MIDDLE CHANNEL HOPPING , SPURIOUS 30 MHz ~ 1 GHz



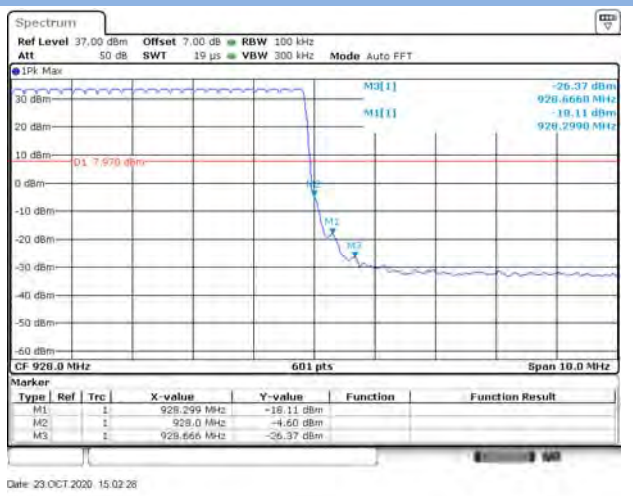
MIDDLE CHANNEL HOPPING, SPURIOUS 1 GHz ~ 10 GHz



LOW CHANNEL HOPPING, BAND EDGE



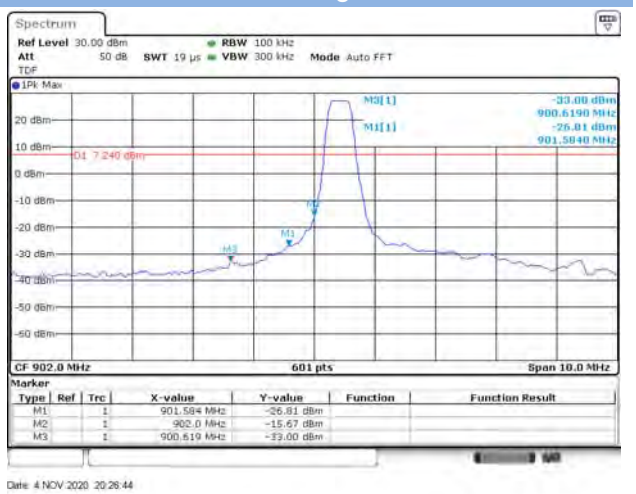
HIGH CHANNEL HOPPING, BAND EDGE



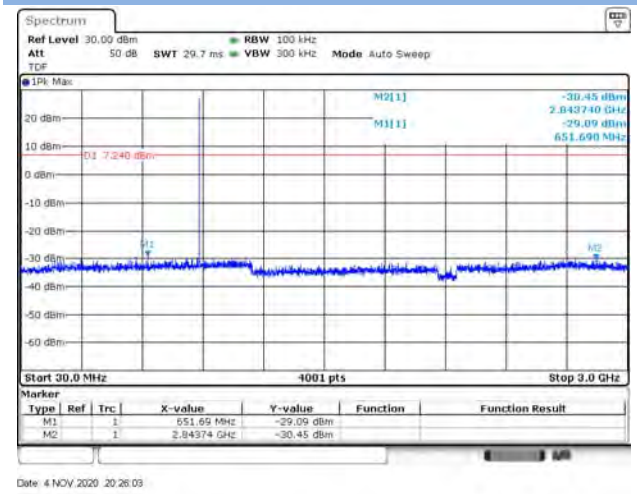
250kHz

LOW CHANNEL, CARRIER LEVEL

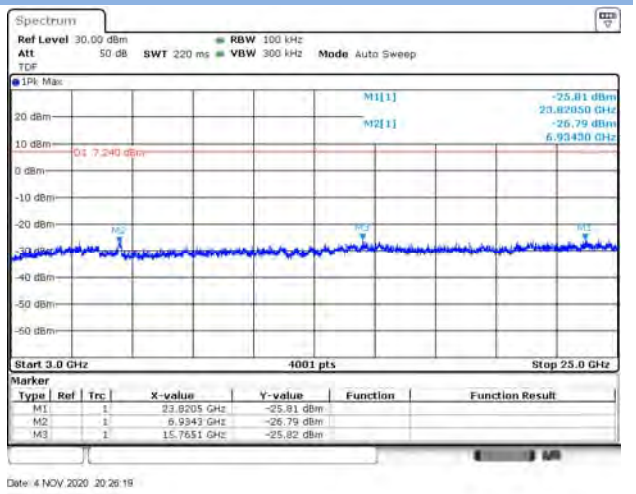
LOW CHANNEL, Band Edge



LOW CHANNEL , SPURIOUS 30 MHz ~ 1 GHz

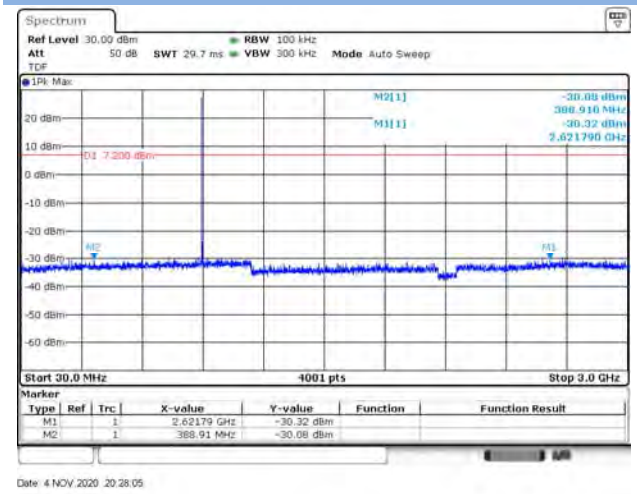


LOW CHANNEL , SPURIOUS 1 GHz ~ 10 GHz



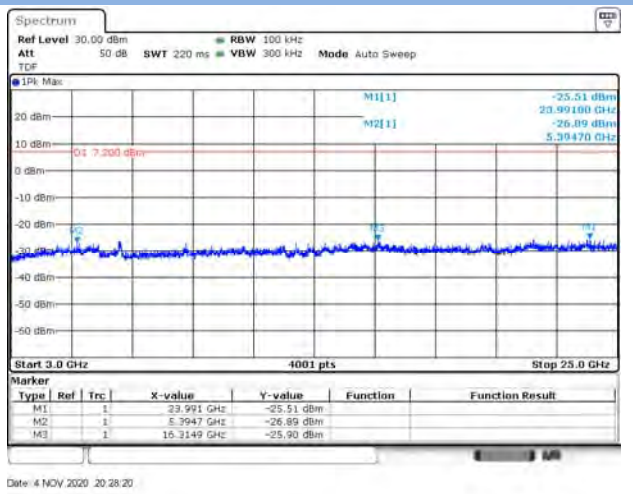
MIDDLE CHANNEL, CARRIER LEVEL

MIDDLE CHANNEL , SPURIOUS 30 MHz ~ 1 GHz



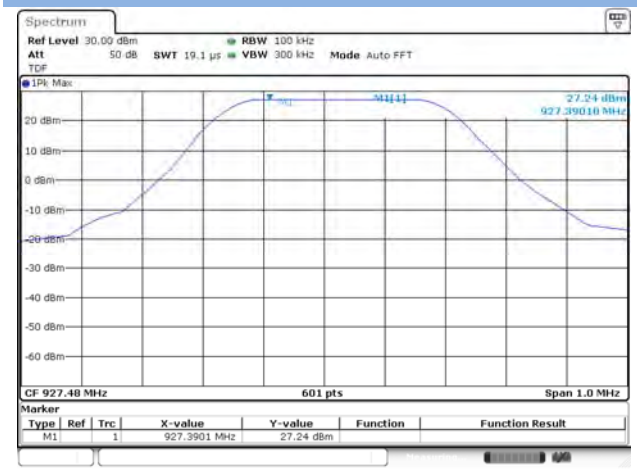
Date: 4.NOV.2020 20:28:05

MIDDLE CHANNEL , SPURIOUS 1 GHz ~ 10 GHz



Date: 4.NOV.2020 20:28:20

HIGH CHANNEL, CARRIER LEVEL



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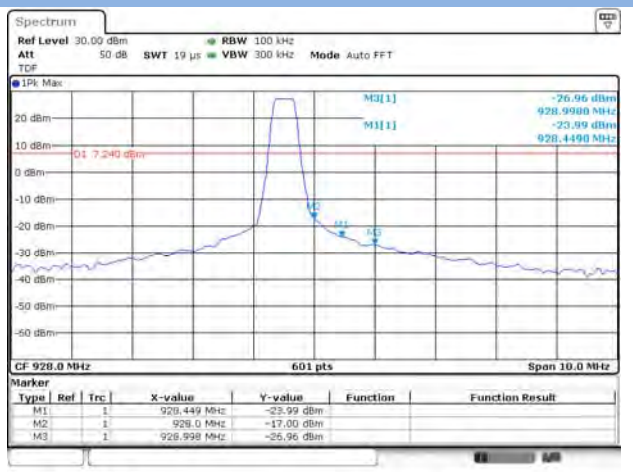
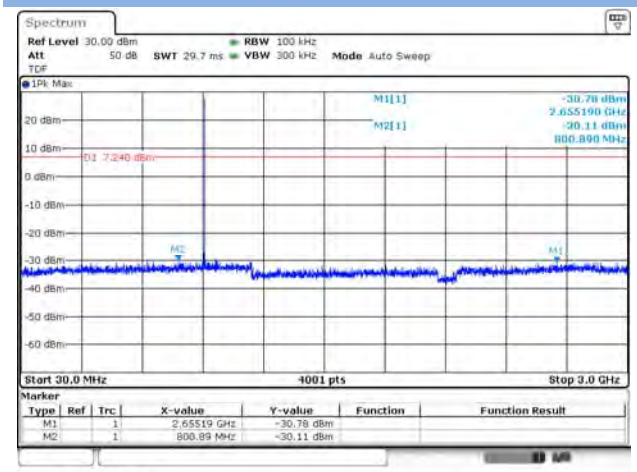
HIGH CHANNEL , BAND EDGE



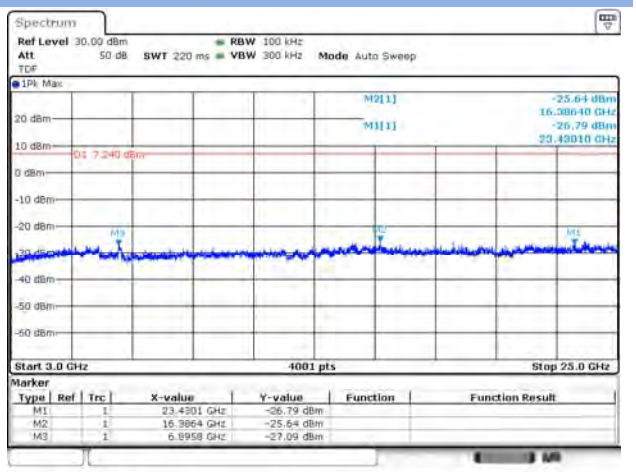
Date: 4.NOV.2020 20:30:06

HIGH CHANNEL , SPURIOUS 30 MHz ~ 1 GHz



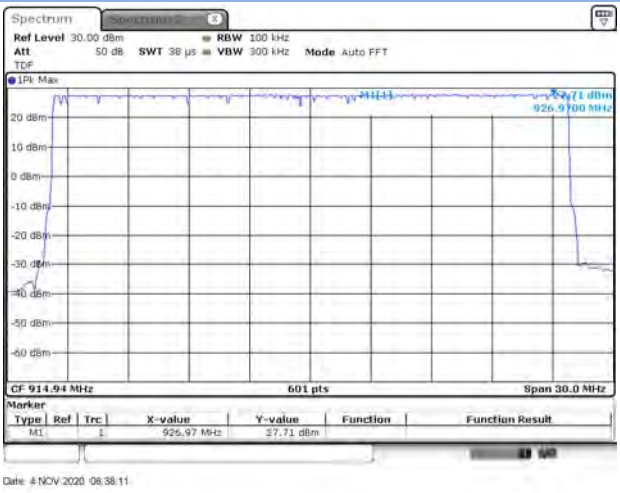
Date: 4.NOV.2020 20:29:25

HIGH CHANNEL , SPURIOUS 1 GHz ~ 10 GHz

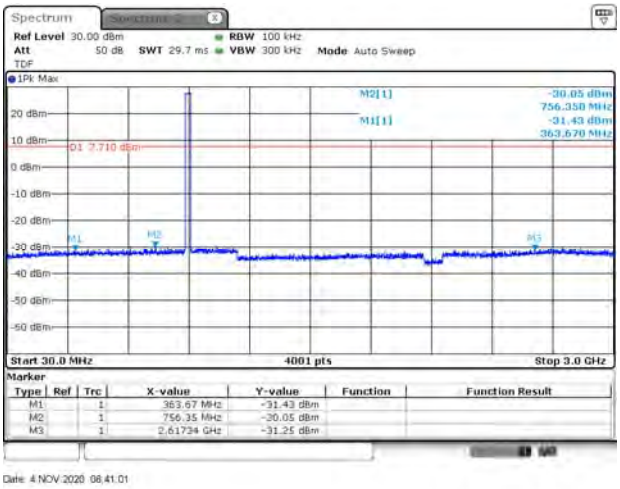


Date: 4.NOV.2020 20:29:42

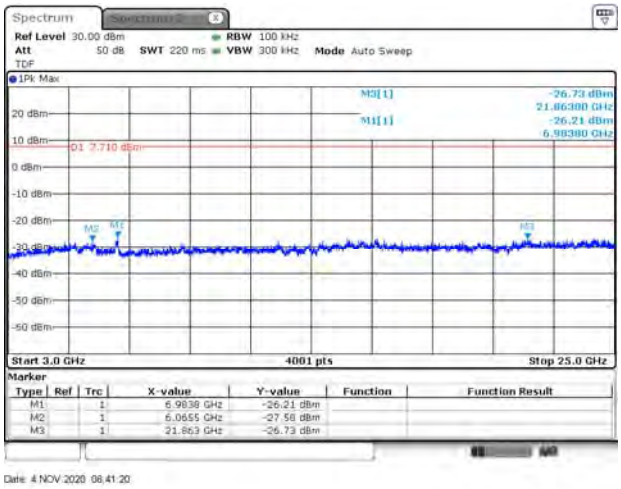
MIDDLE CHANNEL HOPPING, CARRIER LEVEL



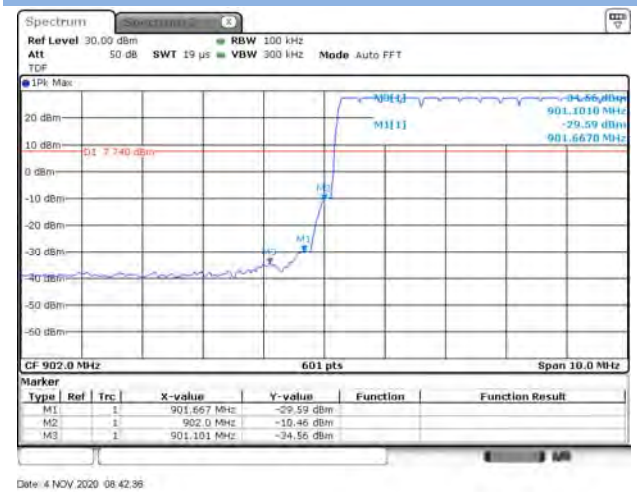
MIDDLE CHANNEL HOPPING , SPURIOUS 30 MHz ~ 1 GHz



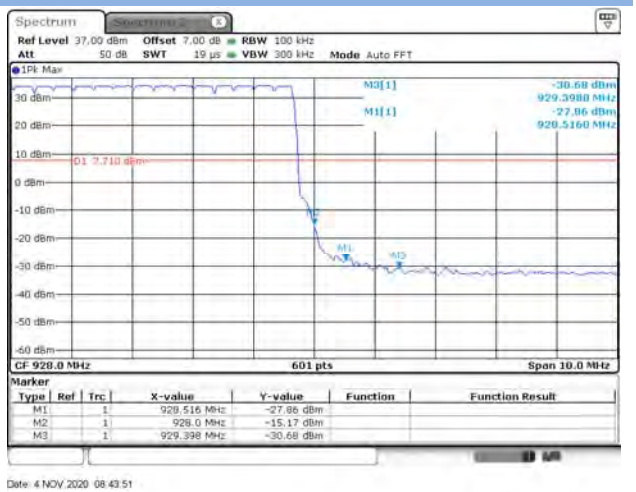
MIDDLE CHANNEL HOPPING, SPURIOUS 1 GHz ~ 10 GHz



LOW CHANNEL HOPPING, BAND EDGE

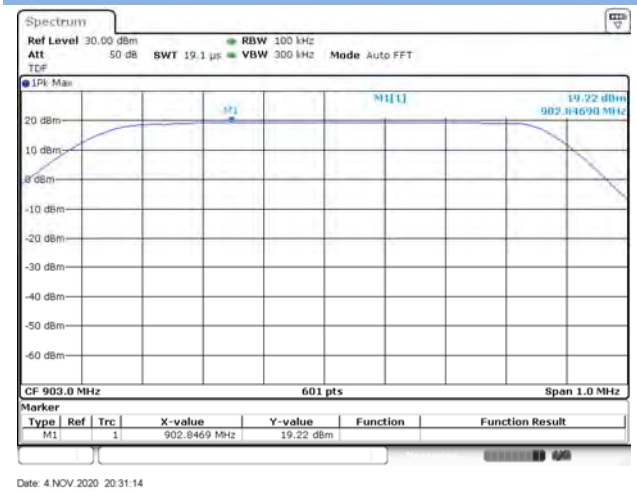


HIGH CHANNEL HOPPING, BAND EDGE

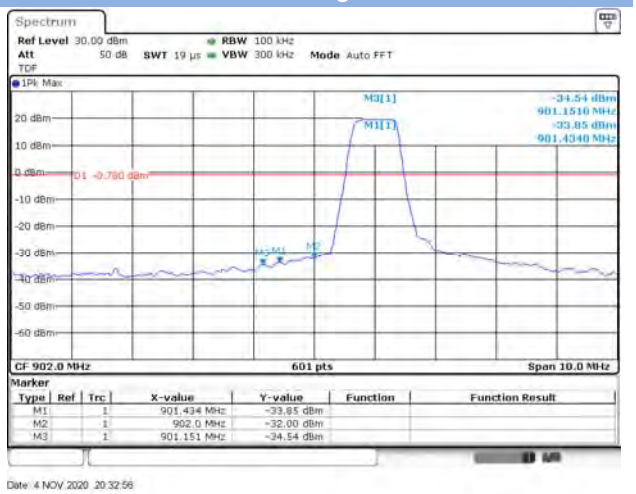


500kHz

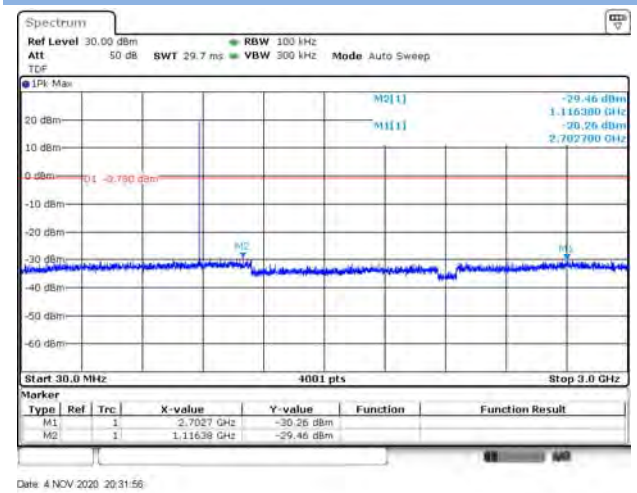
LOW CHANNEL, CARRIER LEVEL



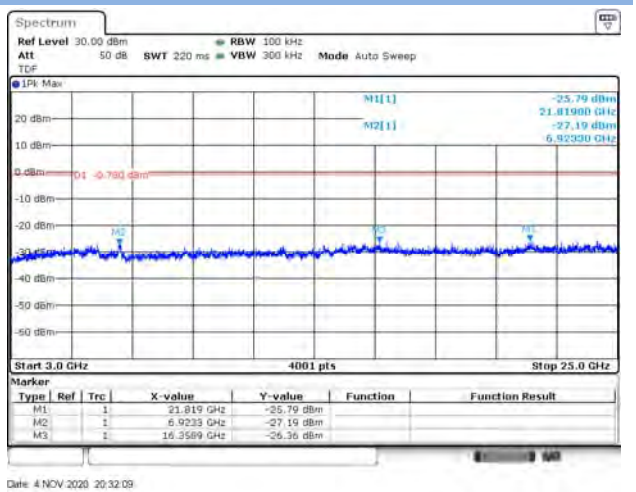
LOW CHANNEL, Band Edge



LOW CHANNEL , SPURIOUS 30 MHz ~ 1 GHz

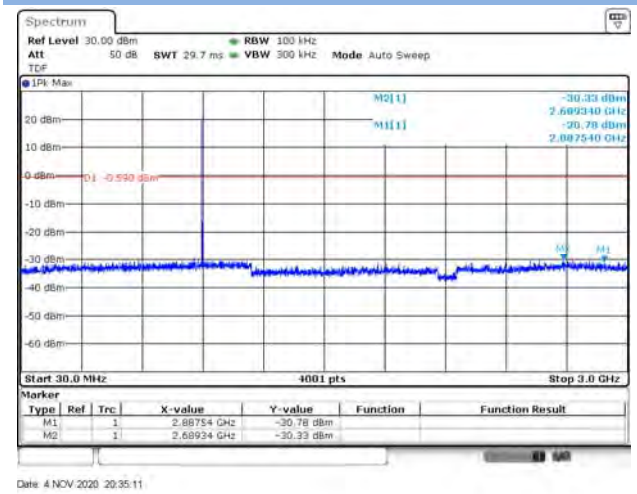


LOW CHANNEL , SPURIOUS 1 GHz ~ 10 GHz

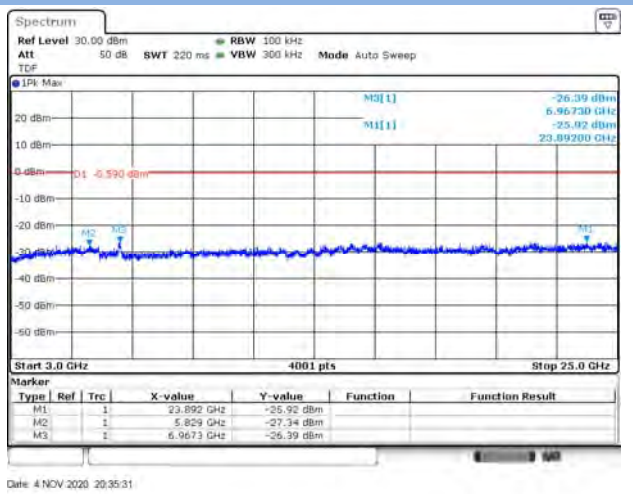


MIDDLE CHANNEL, CARRIER LEVEL

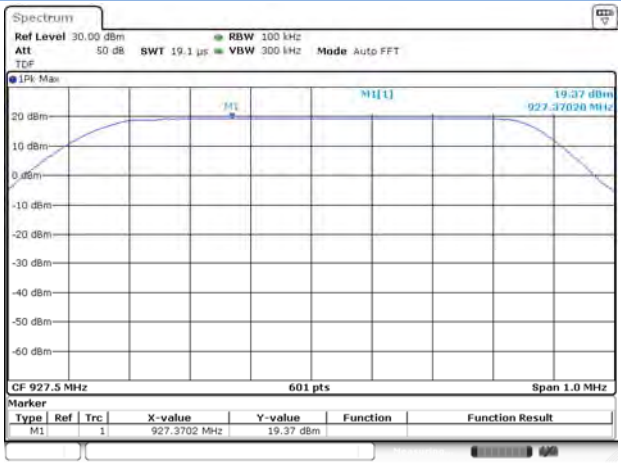
MIDDLE CHANNEL , SPURIOUS 30 MHz ~ 1 GHz



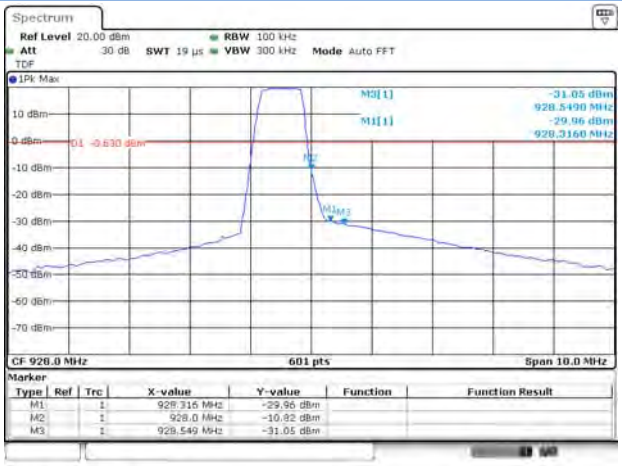
MIDDLE CHANNEL , SPURIOUS 1 GHz ~ 10 GHz



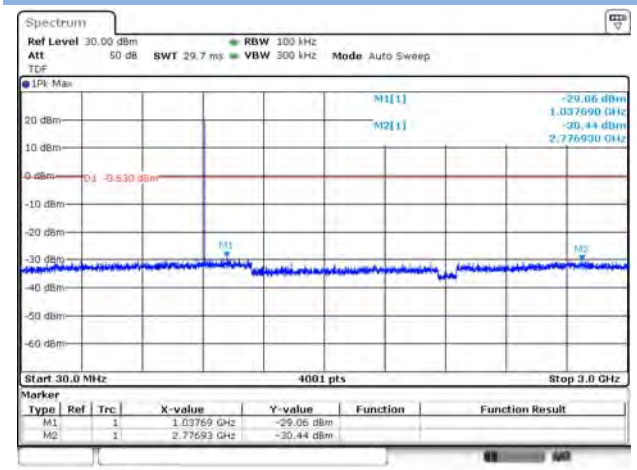
HIGH CHANNEL, CARRIER LEVEL



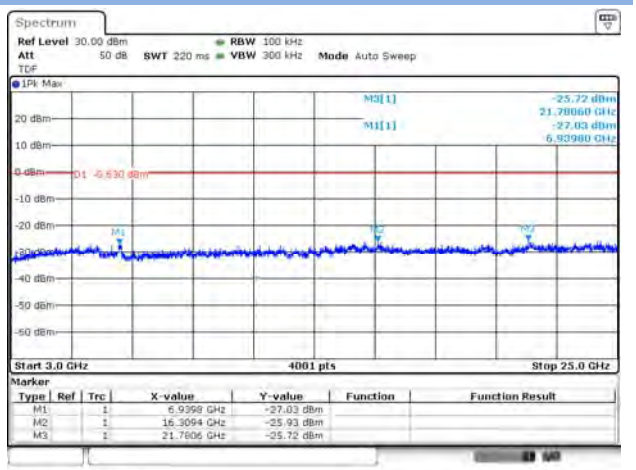
HIGH CHANNEL , BAND EDGE



HIGH CHANNEL , SPURIOUS 30 MHz ~ 1 GHz



HIGH CHANNEL , SPURIOUS 1 GHz ~ 10 GHz

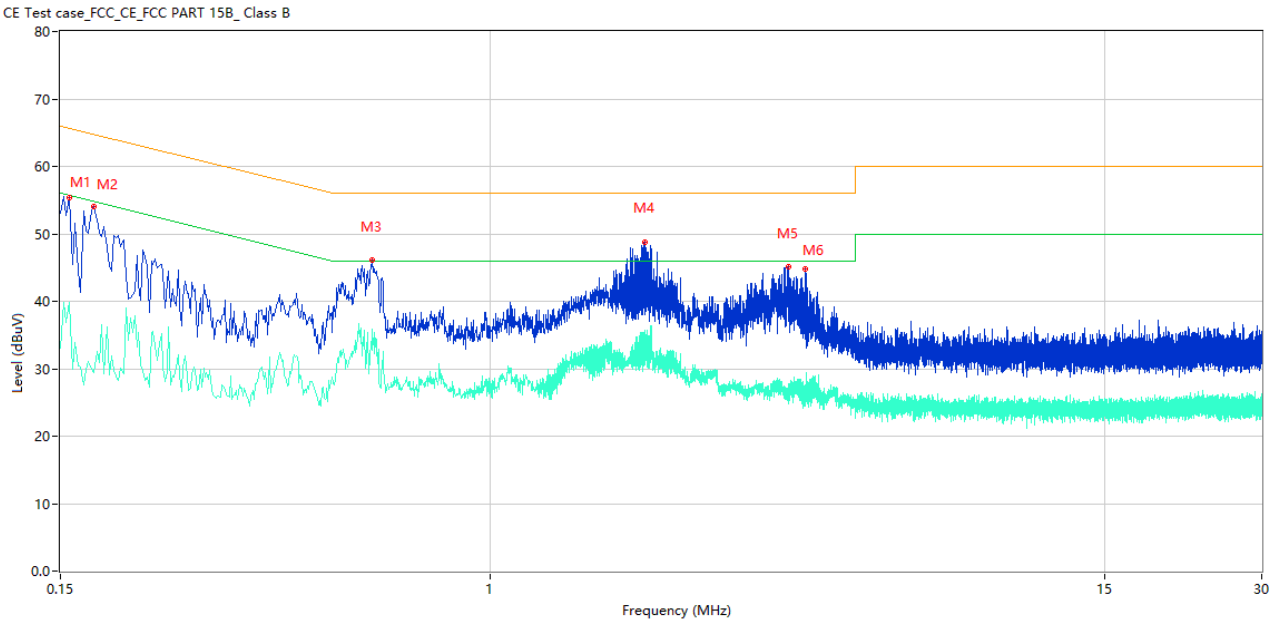


A.6 Conducted Emissions

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)

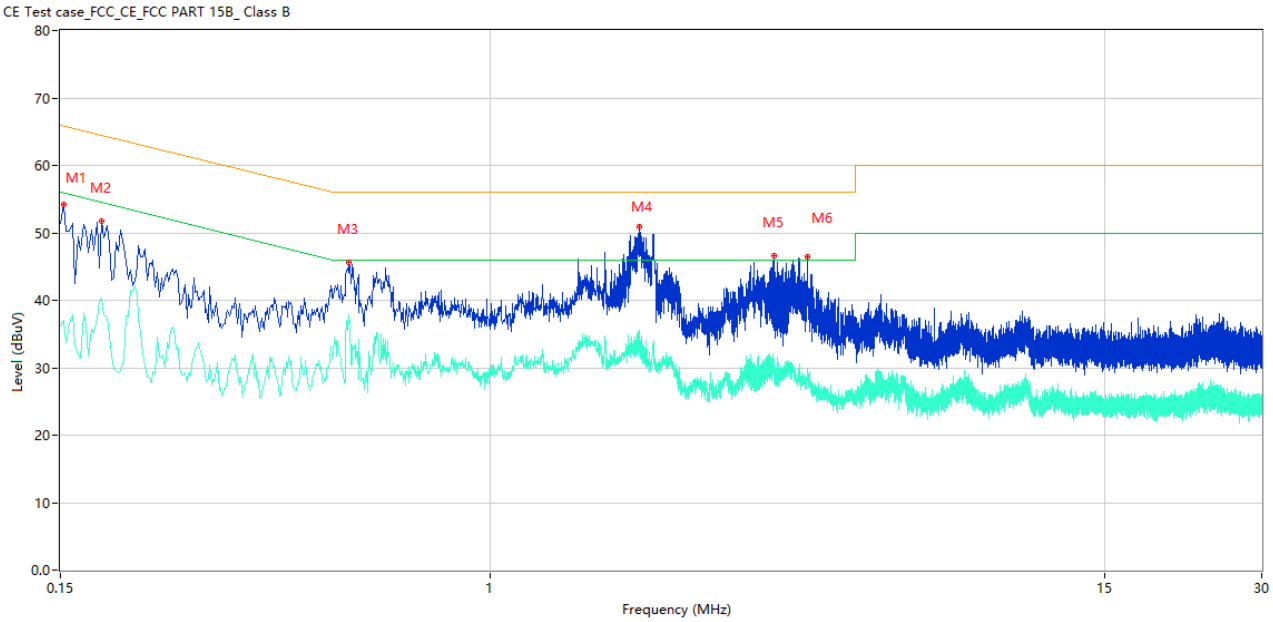
Test Data and Plots

PHASE L



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.156	55.41	10.41	65.67	-10.26	Peak	L	Pass
1**	0.156	39.77	10.41	55.67	-15.90	AV	L	Pass
2	0.174	54.03	10.39	64.77	-10.74	Peak	L	Pass
2**	0.174	29.46	10.39	54.77	-25.31	AV	L	Pass
3	0.594	46.09	10.28	56.00	-9.91	Peak	L	Pass
3**	0.594	35.90	10.28	46.00	-10.10	AV	L	Pass
4	1.974	48.68	10.26	56.00	-7.32	Peak	L	Pass
4**	1.974	34.84	10.26	46.00	-11.16	AV	L	Pass
5	3.728	45.15	10.29	56.00	-10.85	Peak	L	Pass
5**	3.728	27.78	10.29	46.00	-18.22	AV	L	Pass
6	4.000	44.75	10.30	56.00	-11.25	Peak	L	Pass
6**	4.000	27.57	10.30	46.00	-18.43	AV	L	Pass

PHASE N



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.150	51.42	10.41	66.00	-14.58	Peak	N	Pass
1**	0.150	36.23	10.41	56.00	-19.77	AV	N	Pass
2	0.180	51.72	10.39	64.49	-12.77	Peak	N	Pass
2**	0.180	40.39	10.39	54.49	-14.10	AV	N	Pass
3	0.536	45.61	10.29	56.00	-10.39	Peak	N	Pass
3**	0.536	36.68	10.29	46.00	-9.32	AV	N	Pass
4	1.930	50.93	10.25	56.00	-5.07	Peak	N	Pass
4**	1.930	34.96	10.25	46.00	-11.04	AV	N	Pass
5	3.500	46.59	10.29	56.00	-9.41	Peak	N	Pass
5**	3.500	30.60	10.29	46.00	-15.40	AV	N	Pass
6	4.054	46.49	10.31	56.00	-9.51	Peak	N	Pass
6**	4.054	29.42	10.31	46.00	-16.58	AV	N	Pass

A.7 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.

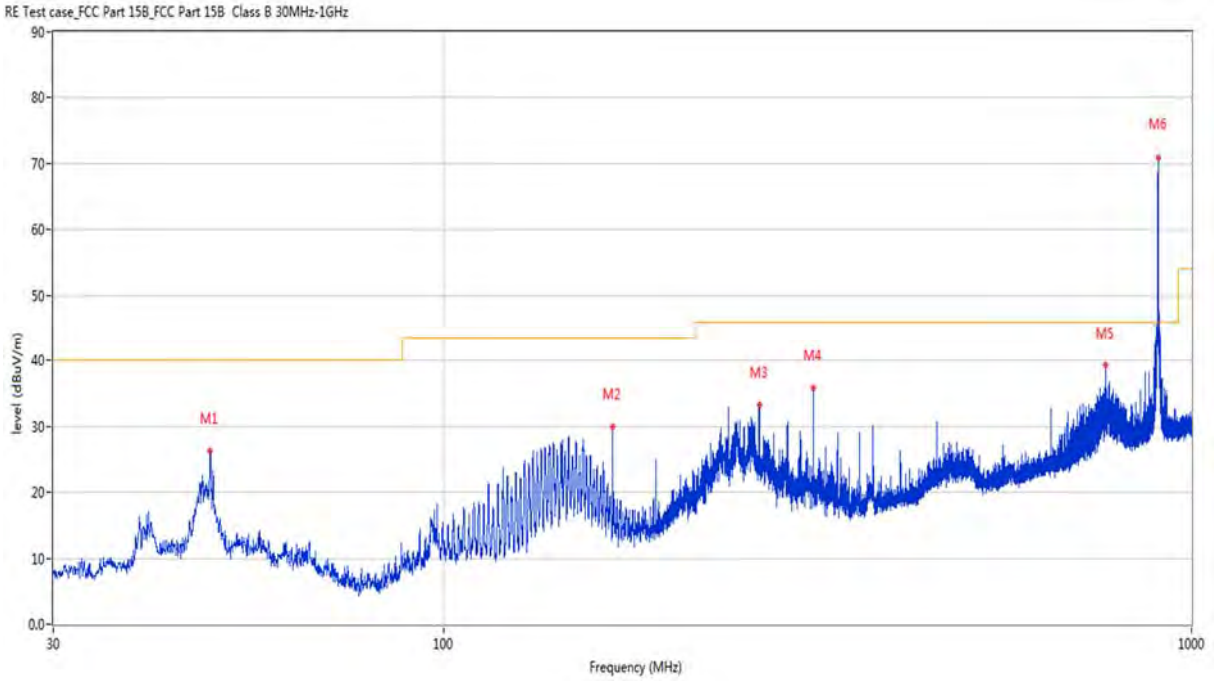
Note [3]: The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

Note [4]: The marked spikes near 900MHz with circle should be ignored because they are Fundamental signal.

Test Data and Plots

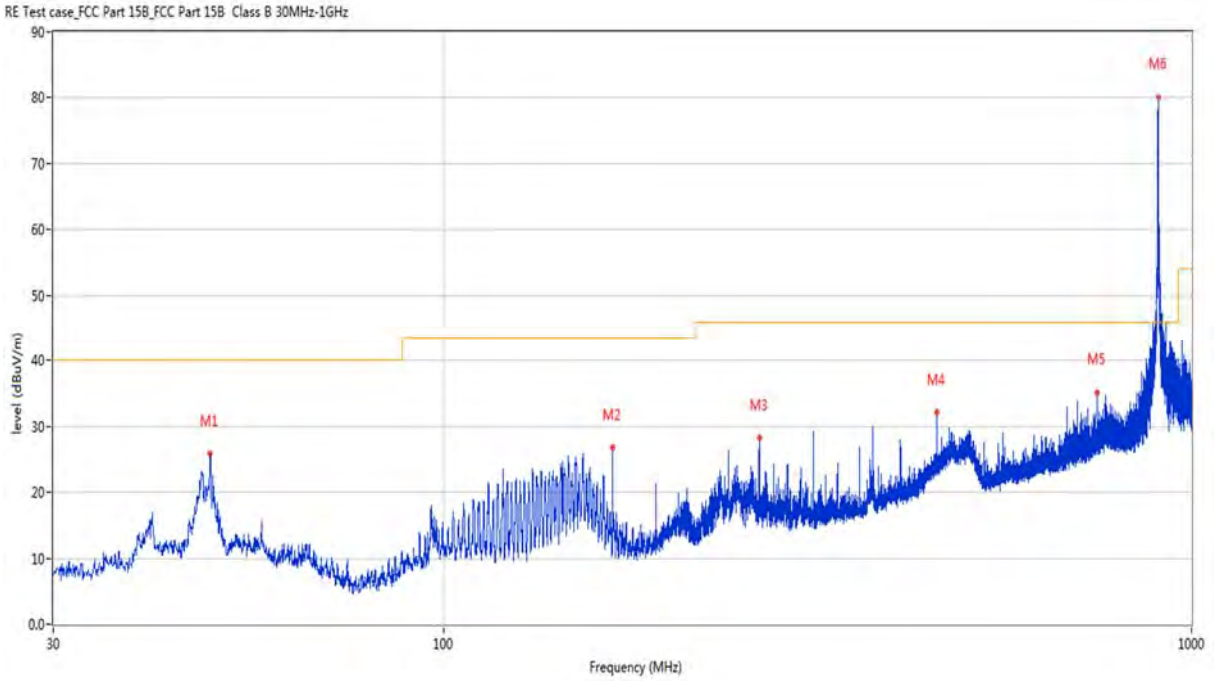
125KHz

LOW CHANNEL, ANT H



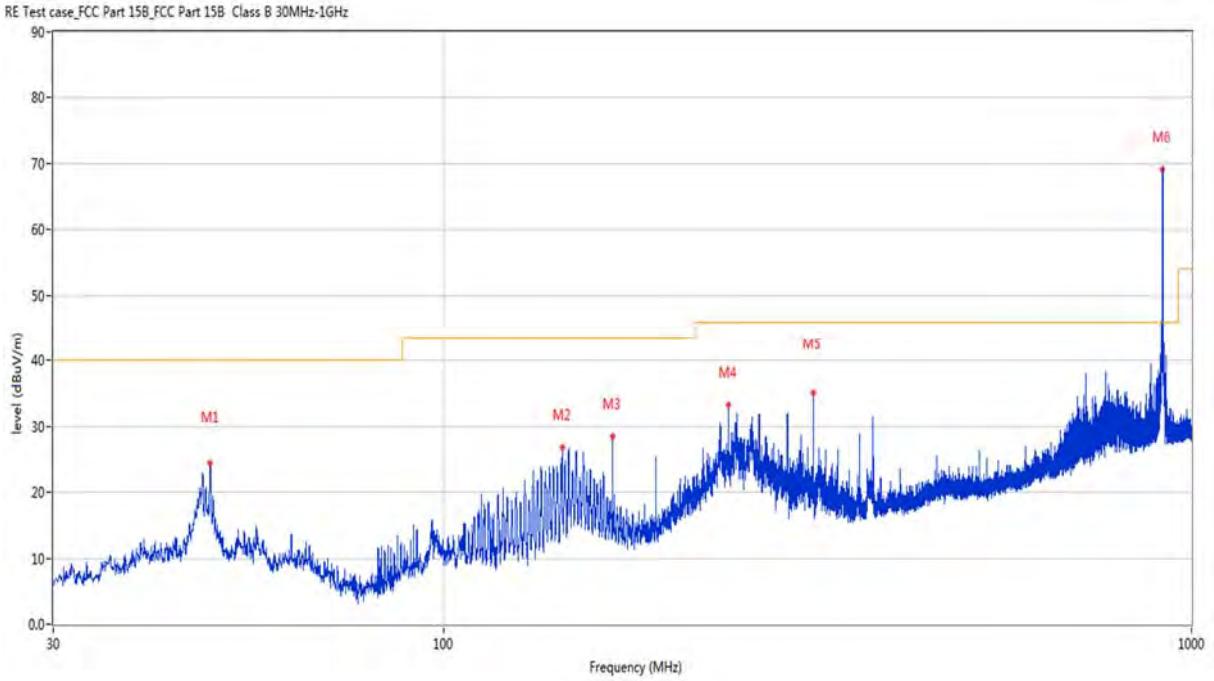
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	48.624	26.23	-23.80	40.0	-13.77	Peak	40.60	100	Horizontal	Pass
2	167.982	30.01	-27.35	43.5	-13.49	Peak	96.60	200	Horizontal	Pass
3	264.013	33.33	-22.23	46.0	-12.67	Peak	0.00	200	Horizontal	Pass
4	311.979	35.85	-21.25	46.0	-10.15	Peak	0.00	200	Horizontal	Pass
5	768.024	39.25	-9.91	46.0	-6.75	Peak	150.20	100	Horizontal	Pass
6	902.418	70.87	-7.17	46.0	24.87	Peak	354.90	100	Horizontal	N/A

LOW CHANNEL, ANT V



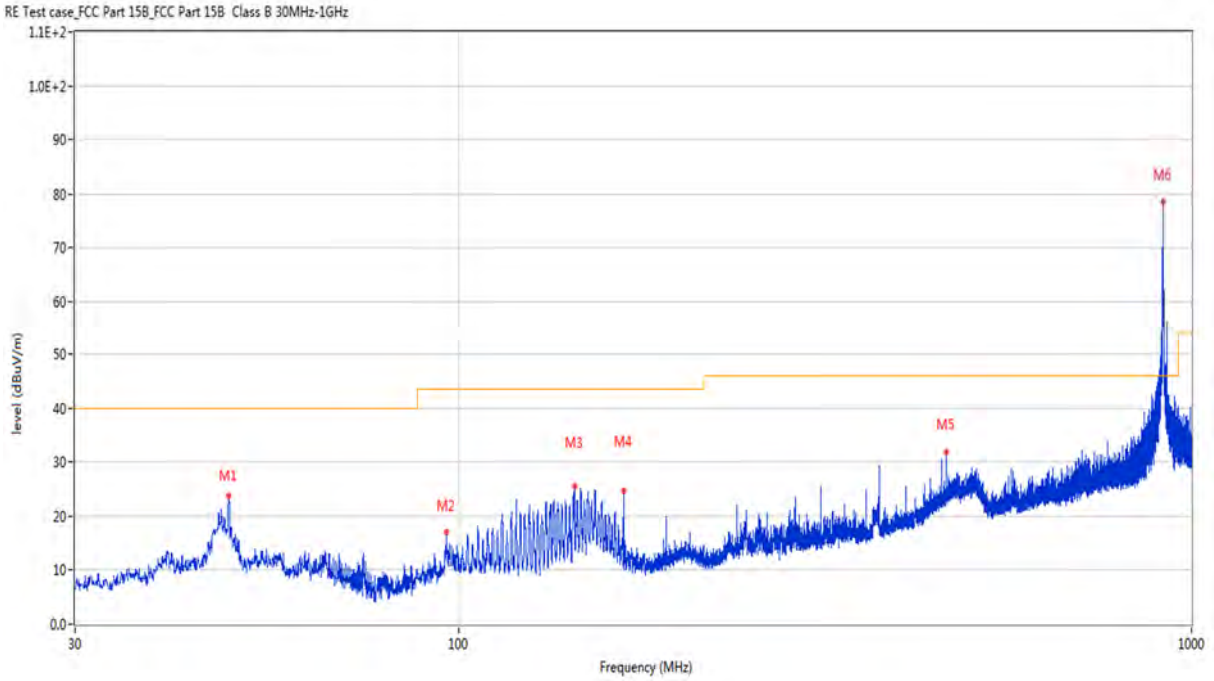
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	48.624	25.93	-23.80	40.0	-14.07	Peak	0.00	200	Vertical	Pass
2	167.982	26.82	-27.35	43.5	-16.68	Peak	187.60	200	Vertical	Pass
3	263.964	28.32	-22.24	46.0	-17.68	Peak	137.70	200	Vertical	Pass
4	455.975	32.09	-17.01	46.0	-13.91	Peak	344.40	100	Vertical	Pass
5	748.625	35.15	-10.49	46.0	-10.85	Peak	344.40	100	Vertical	Pass
6	902.806	80.05	-7.17	46.0	34.05	Peak	228.90	100	Vertical	N/A

MIDDLE CHANNEL, ANT H



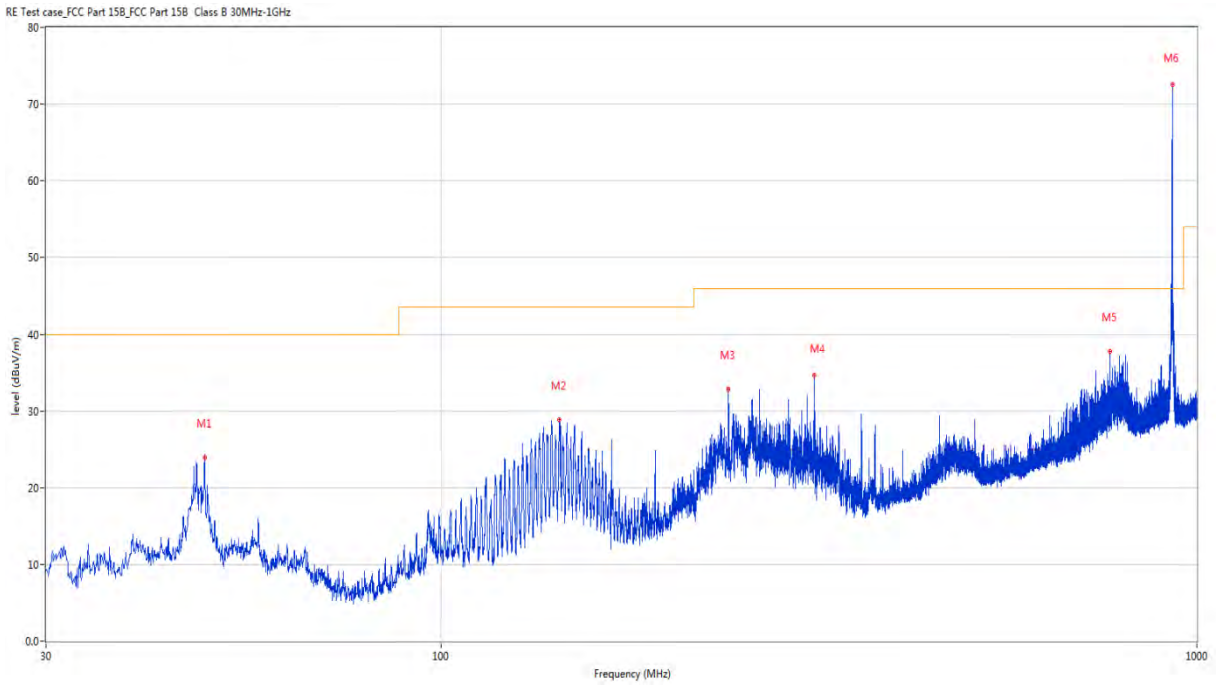
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	48.624	24.34	-23.80	40.0	-15.66	Peak	277.80	200	Horizontal	Pass
2	143.975	26.83	-28.30	43.5	-16.67	Peak	257.20	200	Horizontal	Pass
3	167.982	28.51	-27.35	43.5	-14.99	Peak	242.40	200	Horizontal	Pass
4	239.956	33.31	-23.09	46.0	-12.69	Peak	25.70	200	Horizontal	Pass
5	311.979	35.03	-21.25	46.0	-10.97	Peak	357.30	200	Horizontal	Pass
6	915.016	68.98	-7.24	46.0	22.98	Peak	298.50	200	Horizontal	N/A

MIDDLE CHANNEL, ANT V



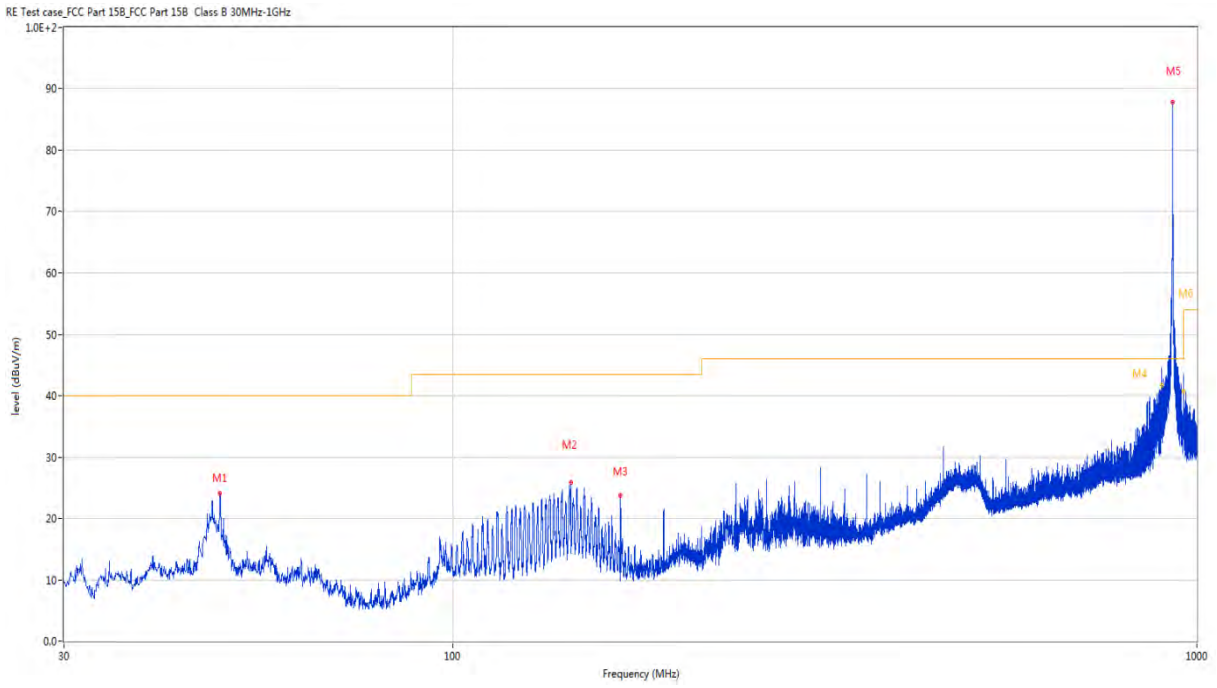
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	48.624	23.82	-23.80	40.0	-16.18	Peak	107.00	100	Vertical	Pass
2	96.348	17.02	-25.68	43.5	-26.48	Peak	36.90	200	Vertical	Pass
3	143.975	25.52	-28.30	43.5	-17.98	Peak	246.20	200	Vertical	Pass
4	167.982	24.66	-27.35	43.5	-18.84	Peak	151.50	200	Vertical	Pass
5	463.396	31.93	-16.54	46.0	-14.07	Peak	211.20	100	Vertical	Pass
6	915.167	78.52	-7.14	46.0	32.52	Peak	107.00	100	Vertical	N/A

HIGH CHANNEL, ANT H



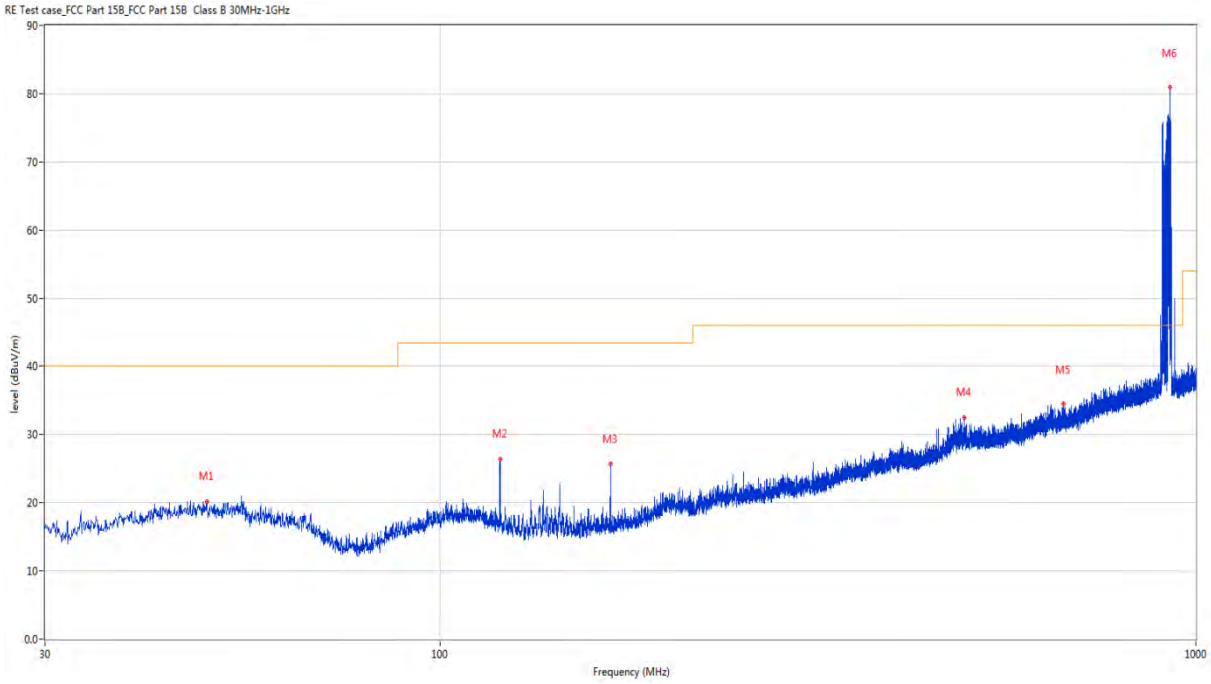
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	48.624	23.90	-23.80	40.0	-16.10	Peak	178.50	100	Horizontal	Pass
2	143.393	28.89	-28.43	43.5	-14.61	Peak	108.80	200	Horizontal	Pass
3	240.005	32.87	-23.08	46.0	-13.13	Peak	14.70	100	Horizontal	Pass
4	311.979	34.68	-21.25	46.0	-11.32	Peak	359.40	100	Horizontal	Pass
5	768.024	37.80	-9.91	46.0	-8.20	Peak	188.50	200	Horizontal	Pass
6	927.783	72.55	-7.44	46.0	26.55	Peak	294.60	100	Horizontal	N/A

HIGH CHANNEL, ANT V



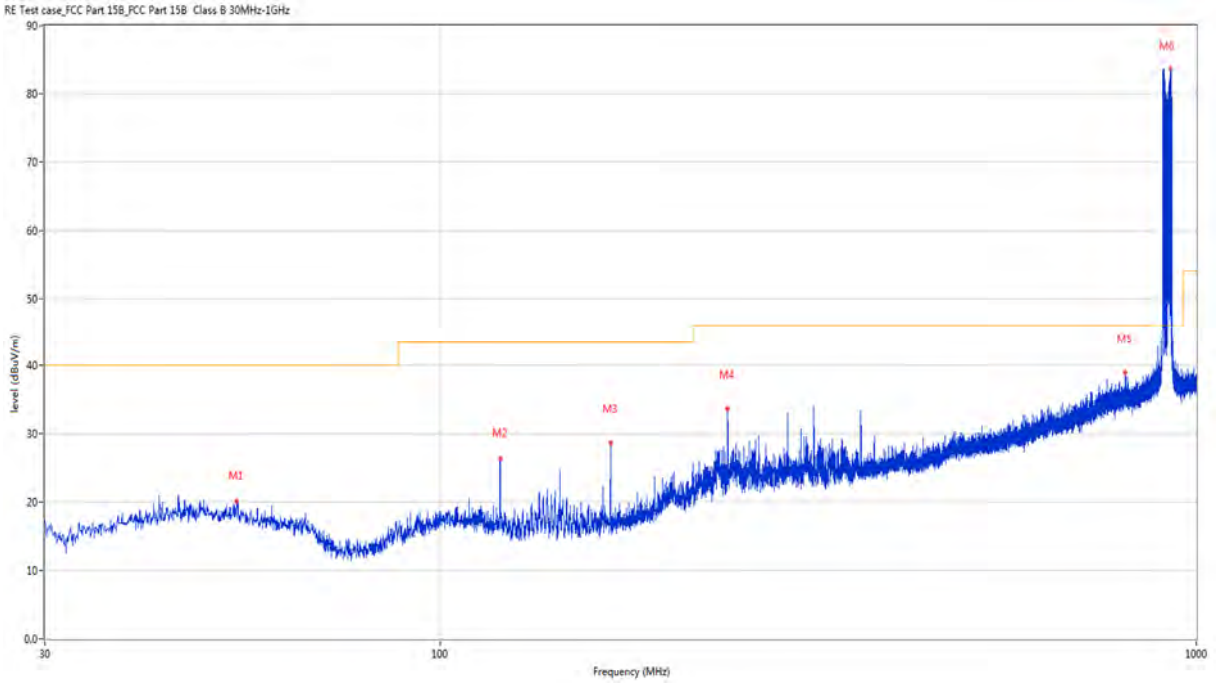
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	48.624	24.10	-23.80	40.0	-15.90	Peak	87.20	200	Vertical	Pass
2	143.975	25.84	-28.30	43.5	-17.66	Peak	193.20	200	Vertical	Pass
3	167.982	23.75	-27.35	43.5	-19.75	Peak	154.40	100	Vertical	Pass
4	895.684	44.56	-7.55	46.0	-1.44	Peak	221.40	108	Vertical	N/A
4*	895.684	41.62	-7.55	46.0	-4.38	QP	221.40	108	Vertical	Pass
5	927.783	87.83	-7.44	46.0	41.83	Peak	221.40	100	Vertical	N/A
6	959.778	43.42	-6.88	46.0	-2.58	Peak	221.40	154	Vertical	N/A
6*	959.778	40.82	-6.88	46.0	-5.18	QP	221.40	154	Vertical	Pass

HOPPING MODE, ANT H



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	49.109	20.17	-23.81	40.0	-19.83	Peak	6.90	100	Vertical	Pass
2	120.016	26.46	-26.38	43.5	-17.04	Peak	300.00	100	Vertical	Pass
3	168.031	25.74	-27.36	43.5	-17.76	Peak	101.90	200	Vertical	Pass
4	494.000	32.49	-15.91	46.0	-13.51	Peak	258.80	100	Vertical	Pass
5	669.036	34.52	-11.52	46.0	-11.48	Peak	0.00	200	Vertical	Pass
6	924.340	80.90	-2.31	46.0	34.90	Peak	350.20	100	Vertical	N/A

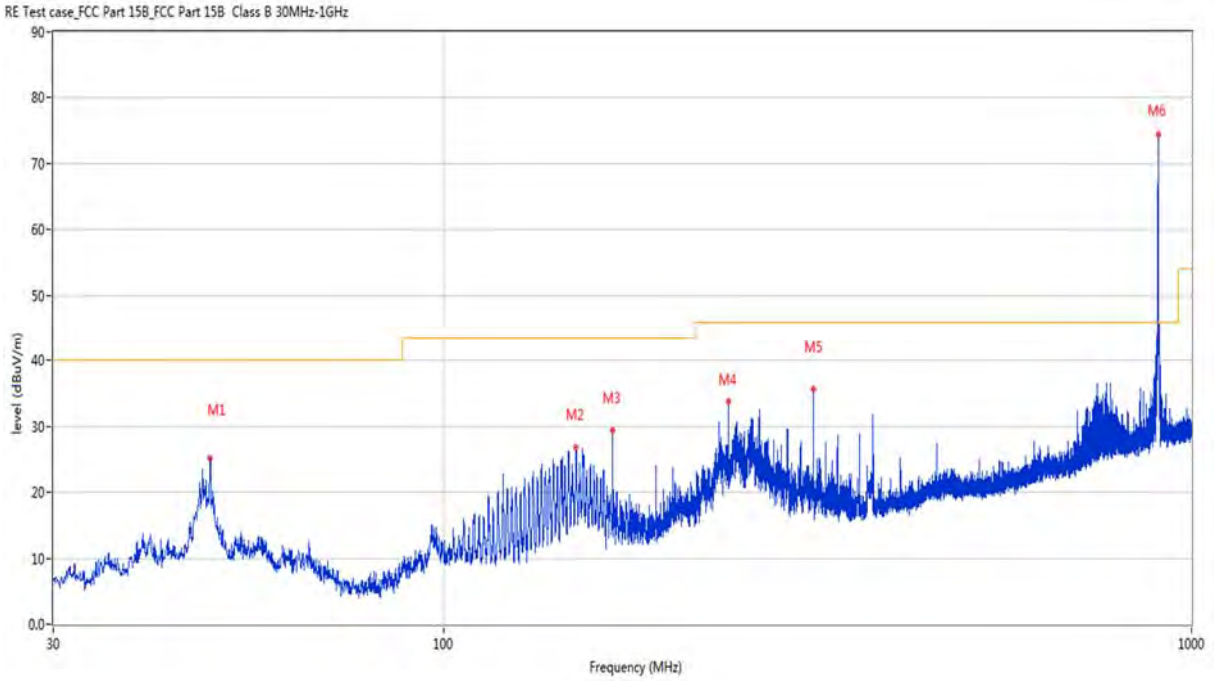
HOPPING MODE, ANT V



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	53.765	20.22	-24.04	40.0	-19.78	Peak	146.60	200	Horizontal	Pass
2	120.016	26.33	-26.38	43.5	-17.17	Peak	171.90	100	Horizontal	Pass
3	168.031	28.70	-27.36	43.5	-14.80	Peak	156.90	100	Horizontal	Pass
4	240.054	33.68	-23.07	46.0	-12.32	Peak	268.70	200	Horizontal	Pass
5	804.594	39.02	-8.86	46.0	-6.98	Peak	202.70	100	Horizontal	Pass
6	924.970	83.45	-6.25	46.0	37.45	Peak	96.30	100	Horizontal	N/A

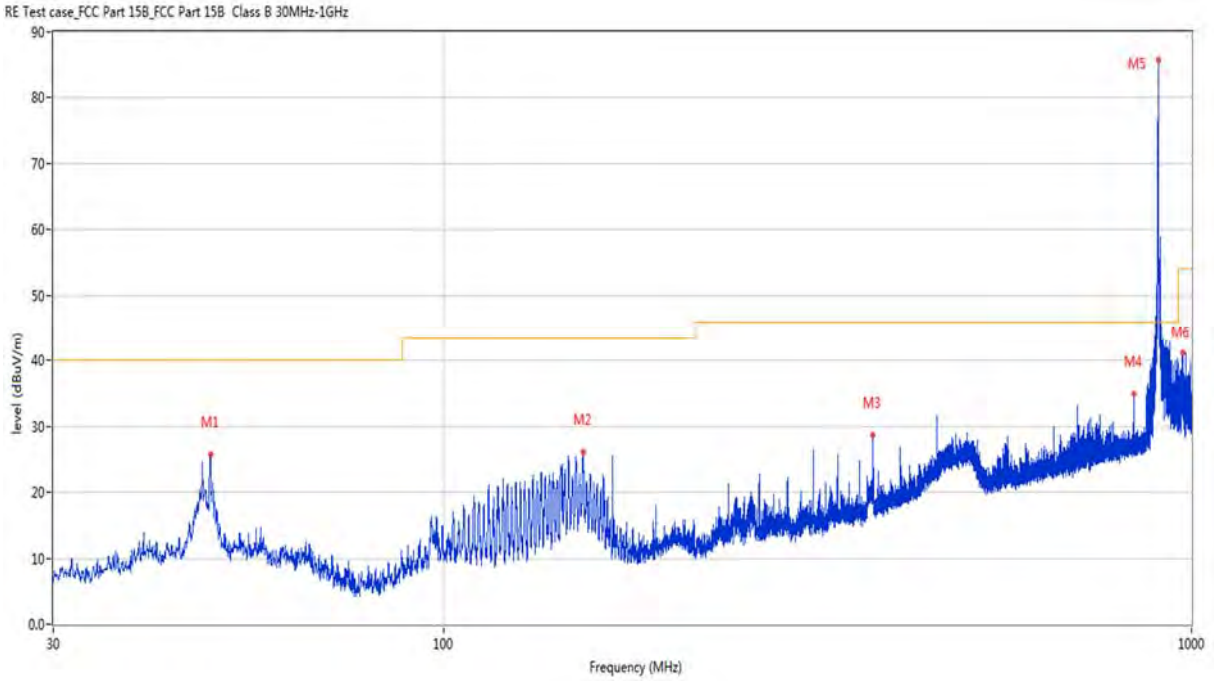
250KHz

LOW CHANNEL, ANT H



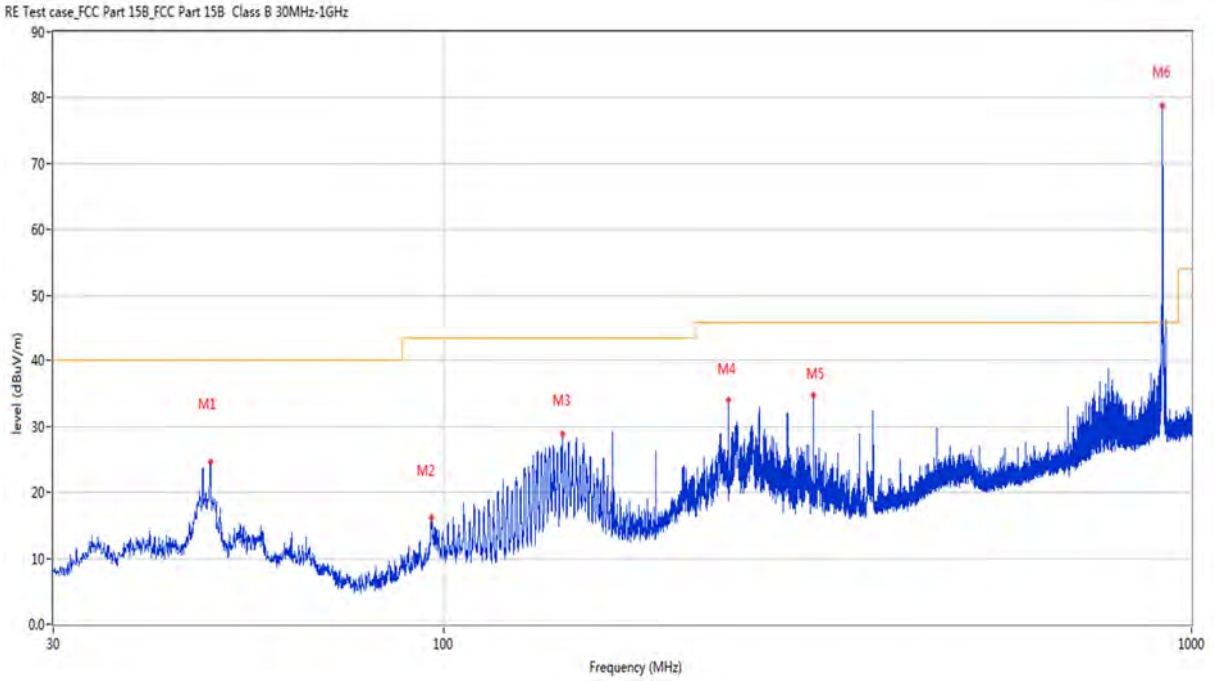
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	48.624	25.23	-23.80	40.0	-14.77	Peak	185.50	100	Horizontal	Pass
2	150.086	26.90	-28.33	43.5	-16.60	Peak	280.20	200	Horizontal	Pass
3	167.982	29.37	-27.35	43.5	-14.13	Peak	65.80	100	Horizontal	Pass
4	240.005	33.84	-23.08	46.0	-12.16	Peak	45.20	200	Horizontal	Pass
5	311.979	35.69	-21.25	46.0	-10.31	Peak	360.00	100	Horizontal	Pass
6	902.321	74.43	-7.19	46.0	28.43	Peak	125.60	100	Horizontal	N/A

LOW CHANNEL, ANT V



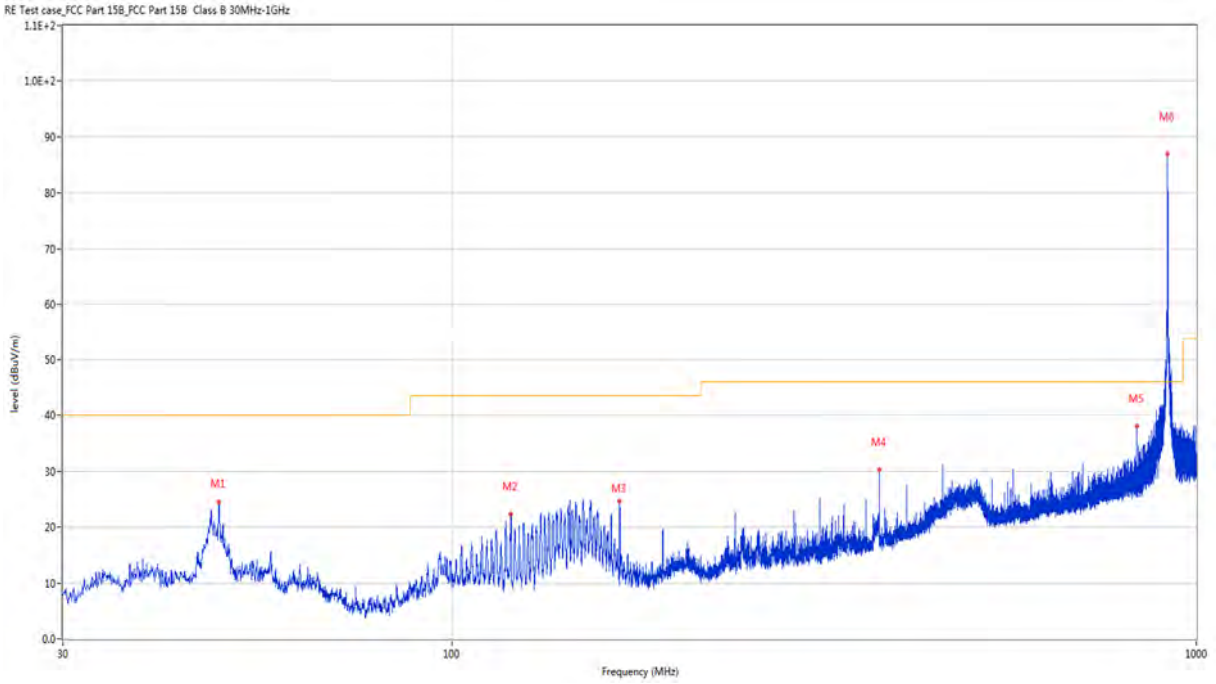
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	48.672	25.74	-23.80	40.0	-14.26	Peak	244.40	100	Vertical	Pass
2	153.335	26.04	-28.04	43.5	-17.46	Peak	194.20	200	Vertical	Pass
3	374.981	28.62	-18.63	46.0	-17.38	Peak	224.20	200	Vertical	Pass
4	836.652	34.84	-8.88	46.0	-11.16	Peak	288.90	200	Vertical	Pass
5	902.321	85.79	-7.19	46.0	39.79	Peak	204.20	100	Vertical	N/A
6	972.937	41.10	-6.66	54.0	-12.90	Peak	204.20	100	Vertical	Pass

MIDDLE CHANNEL, ANT H



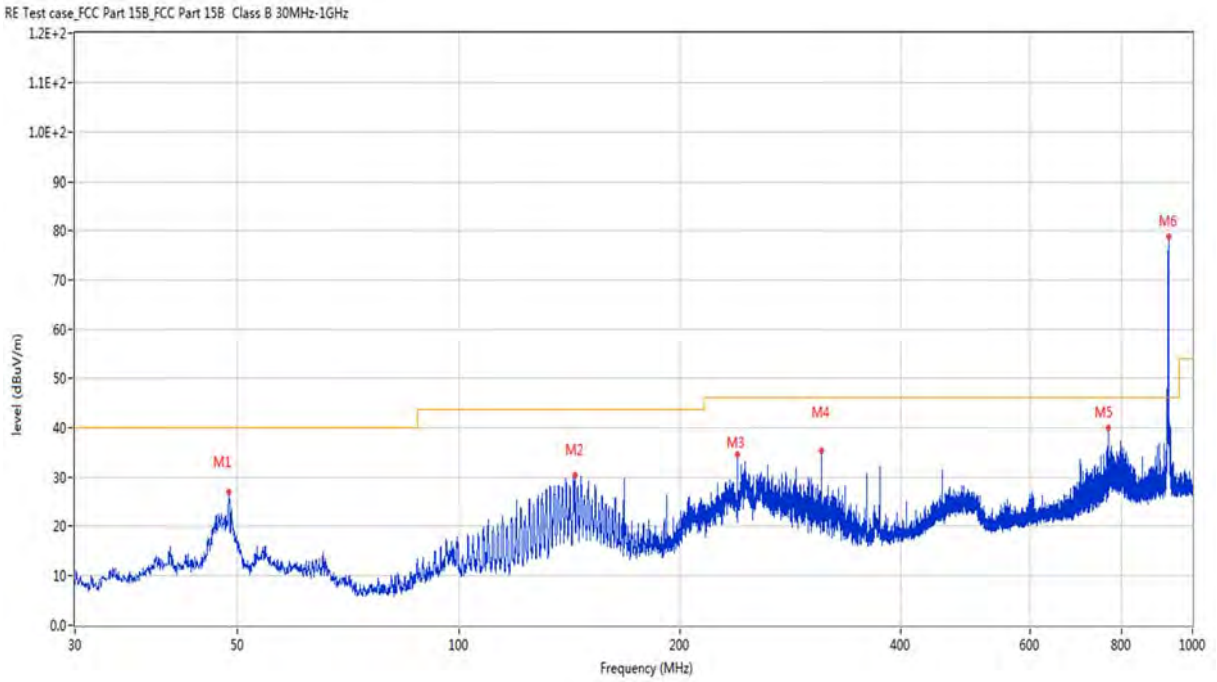
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	48.672	24.53	-23.80	40.0	-15.47	Peak	133.70	100	Horizontal	Pass
2	96.299	16.24	-25.68	43.5	-27.26	Peak	120.40	200	Horizontal	Pass
3	143.975	28.90	-28.30	43.5	-14.60	Peak	264.40	200	Horizontal	Pass
4	240.005	33.90	-23.08	46.0	-12.10	Peak	358.50	100	Horizontal	Pass
5	311.979	34.73	-21.25	46.0	-11.27	Peak	358.50	100	Horizontal	Pass
6	915.076	78.71	-7.18	46.0	32.71	Peak	353.30	200	Horizontal	N/A

MIDDLE CHANNEL, ANT V



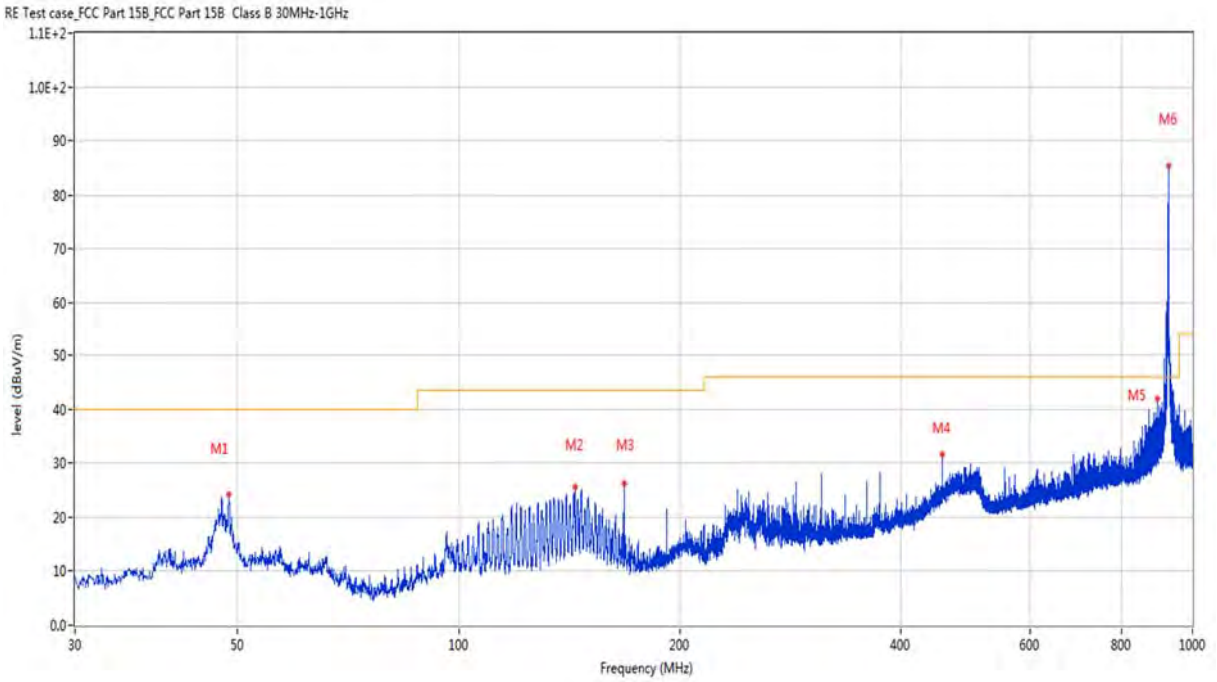
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	48.624	24.51	-23.80	40.0	-15.49	Peak	56.10	100	Vertical	Pass
2	119.967	22.41	-26.38	43.5	-21.09	Peak	358.30	100	Vertical	Pass
3	167.982	24.68	-27.35	43.5	-18.82	Peak	356.30	200	Vertical	Pass
4	375.029	30.22	-18.64	46.0	-15.78	Peak	351.80	100	Vertical	Pass
5	831.996	38.07	-9.10	46.0	-7.93	Peak	244.80	100	Vertical	Pass
6	915.076	87.10	-7.18	46.0	41.10	Peak	71.50	100	Vertical	N/A

HIGH CHANNEL, ANT H



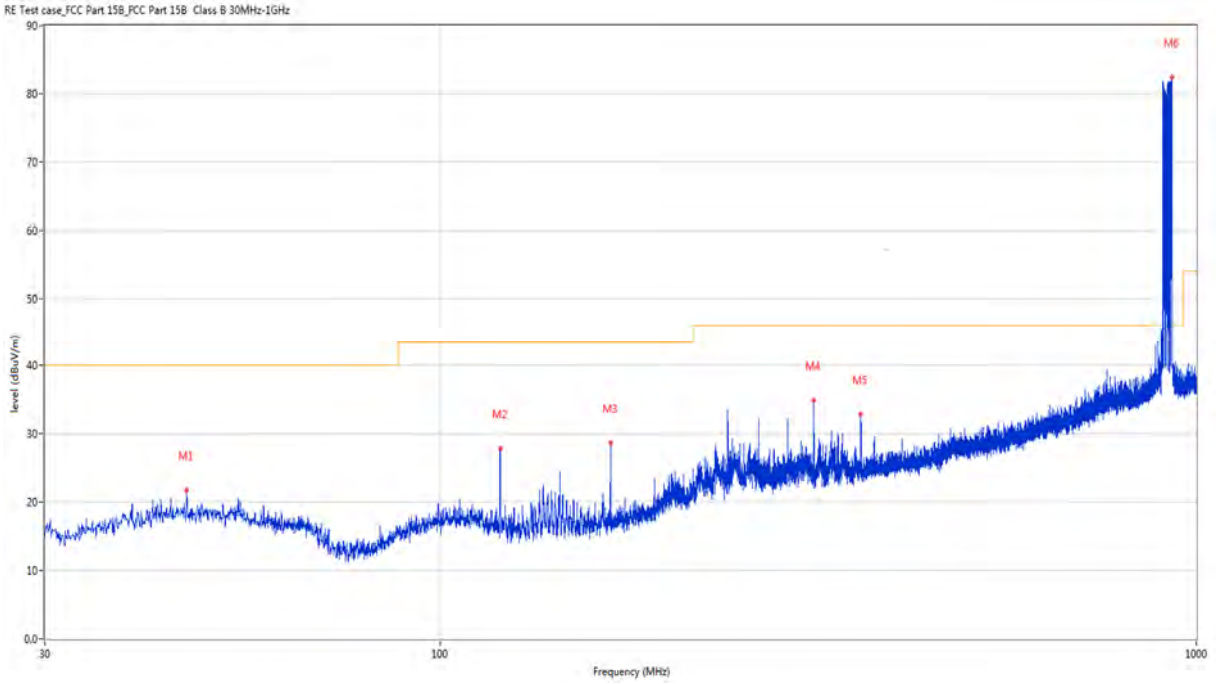
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	48.624	26.94	-22.51	40.0	-13.06	Peak	1.00	100	Horizontal	Pass
2	143.975	30.24	-27.70	43.5	-13.26	Peak	267.00	200	Horizontal	Pass
3	240.005	34.60	-23.06	46.0	-11.40	Peak	23.20	100	Horizontal	Pass
4	311.979	35.28	-21.30	46.0	-10.72	Peak	354.90	100	Horizontal	Pass
5	768.024	39.82	-11.74	46.0	-6.18	Peak	225.00	100	Horizontal	Pass
6	927.541	79.12	-9.59	46.0	33.12	Peak	145.50	200	Horizontal	N/A

HIGH CHANNEL, ANT V



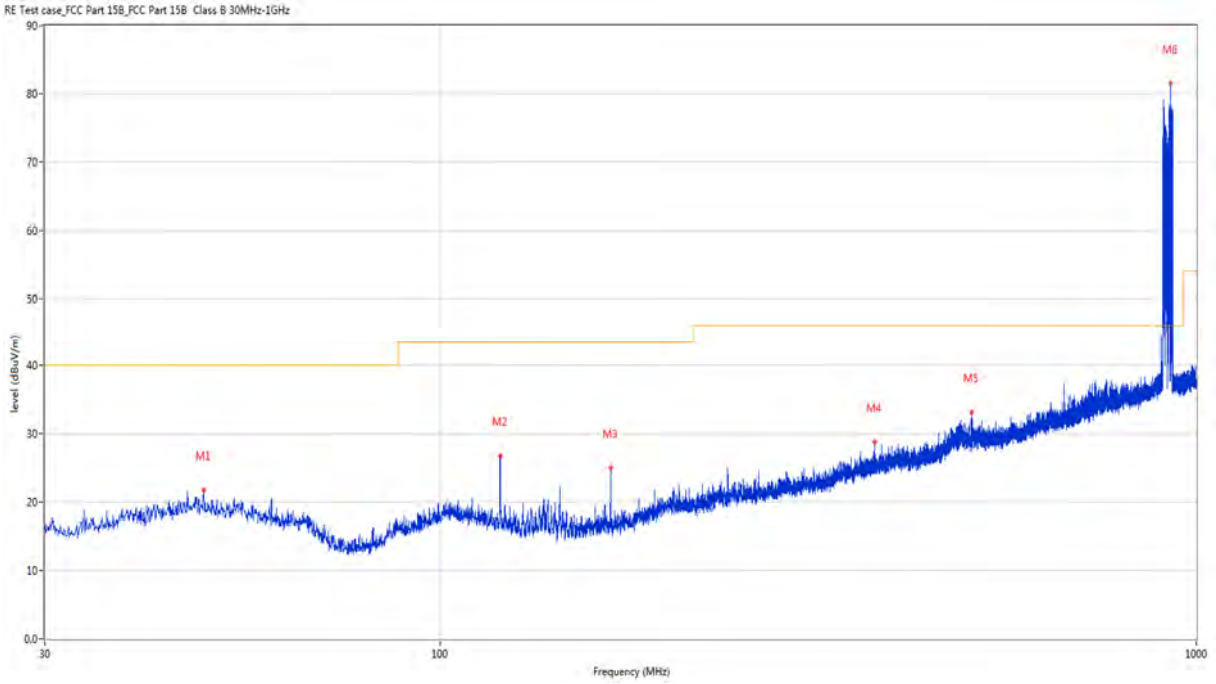
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	48.624	24.26	-23.80	40.0	-15.74	Peak	129.50	200	Vertical	Pass
2	143.975	25.70	-28.30	43.5	-17.80	Peak	224.00	100	Vertical	Pass
3	168.031	26.17	-27.36	43.5	-17.33	Peak	174.50	200	Vertical	Pass
4	456.024	31.55	-17.01	46.0	-14.45	Peak	20.60	100	Vertical	Pass
5	895.482	41.90	-7.53	46.0	-4.10	Peak	224.00	200	Vertical	Pass
6	927.638	85.60	-7.39	46.0	39.60	Peak	139.80	100	Vertical	N/A

HOPPING MODE, ANT H



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	46.199	21.74	-24.04	40.0	-18.26	Peak	325.10	200	Horizontal	Pass
2	120.016	27.84	-26.38	43.5	-15.66	Peak	0.80	200	Horizontal	Pass
3	168.031	28.76	-27.36	43.5	-14.74	Peak	189.30	100	Horizontal	Pass
4	312.027	34.86	-21.26	46.0	-11.14	Peak	270.10	200	Horizontal	Pass
5	360.042	32.85	-19.31	46.0	-13.15	Peak	264.90	100	Horizontal	Pass
6	927.735	81.26	-7.43	46.0	35.26	Peak	108.20	100	Horizontal	N/A

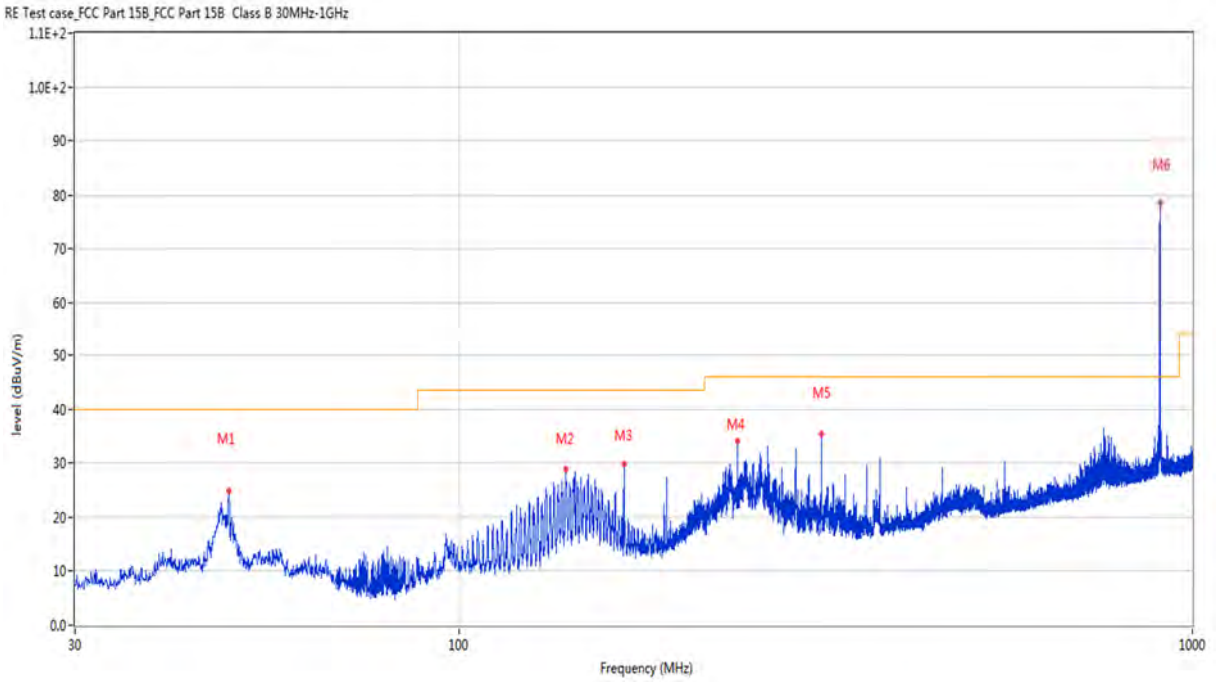
HOPPING MODE, ANT V



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	48.672	21.79	-23.80	40.0	-18.21	Peak	92.40	200	Vertical	Pass
2	120.016	26.81	-26.38	43.5	-16.69	Peak	298.30	100	Vertical	Pass
3	168.031	25.06	-27.36	43.5	-18.44	Peak	92.40	200	Vertical	Pass
4	374.981	28.80	-18.63	46.0	-17.20	Peak	162.20	100	Vertical	Pass
5	503.990	33.20	-15.59	46.0	-12.80	Peak	247.40	100	Vertical	Pass
6	919.878	81.01	-6.86	46.0	35.01	Peak	360.00	100	Vertical	N/A

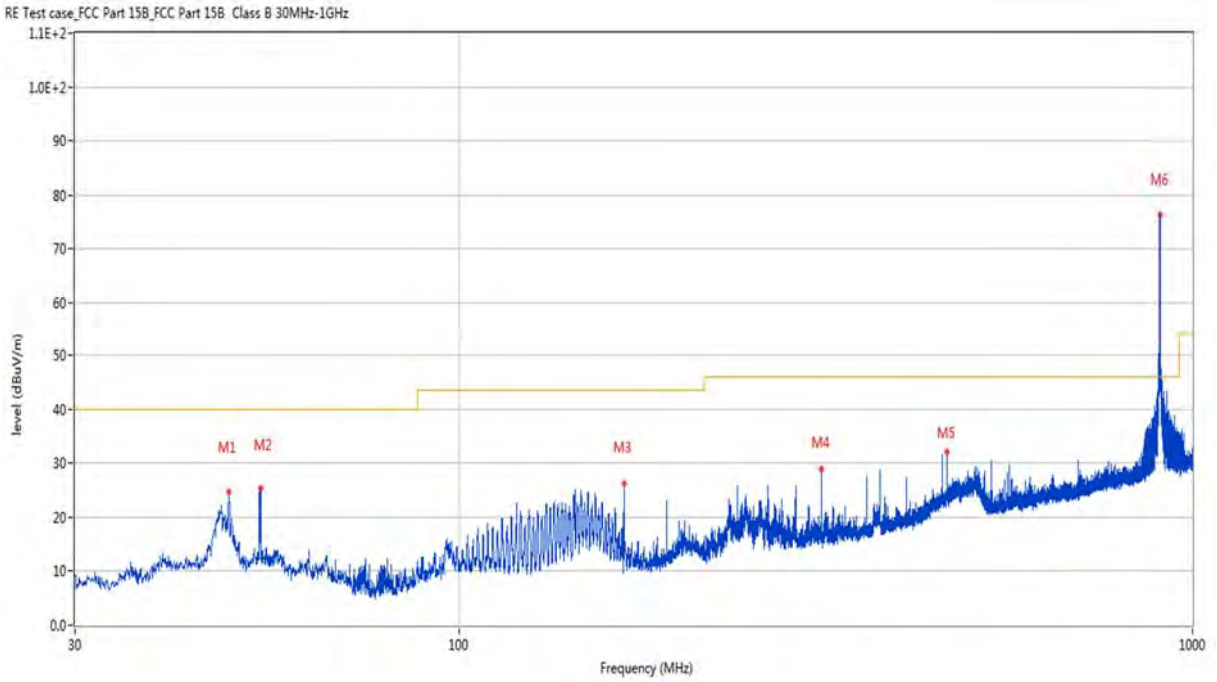
500KHz

LOW CHANNEL, ANT H



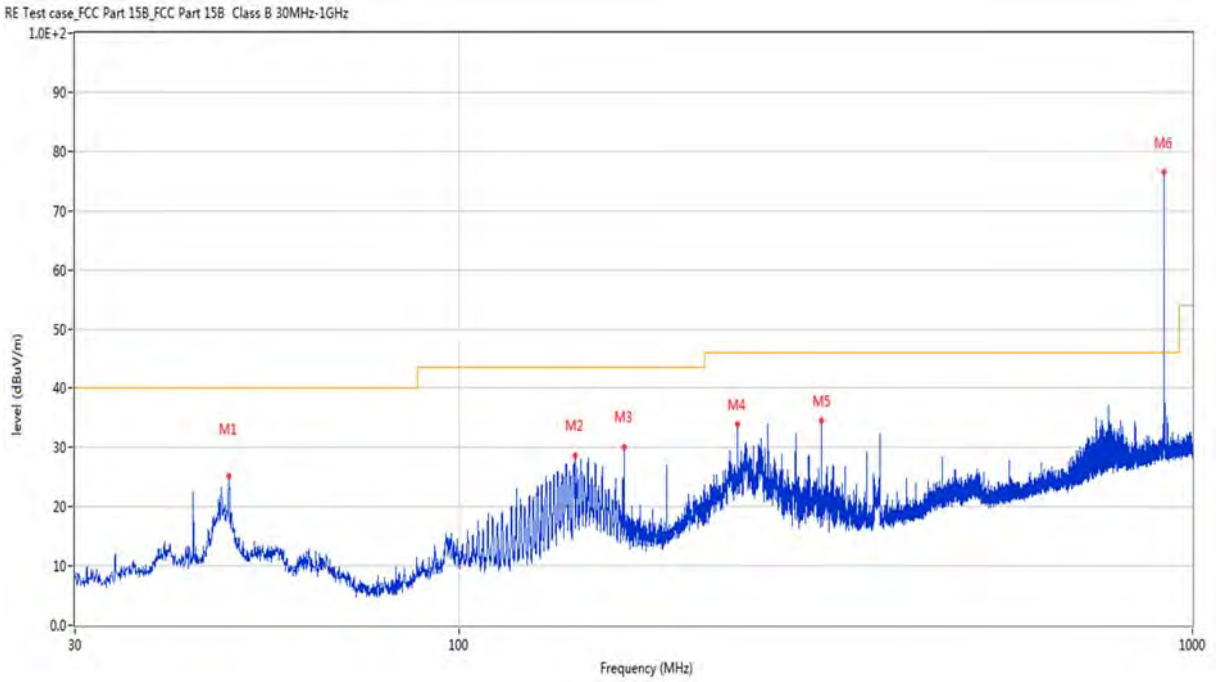
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	48.624	24.96	-23.80	40.0	-15.04	Peak	185.10	100	Horizontal	Pass
2	139.901	28.89	-28.17	43.5	-14.61	Peak	81.20	200	Horizontal	Pass
3	167.982	29.78	-27.35	43.5	-13.72	Peak	76.30	200	Horizontal	Pass
4	240.005	34.22	-23.08	46.0	-11.78	Peak	0.00	100	Horizontal	Pass
5	311.979	35.45	-21.25	46.0	-10.55	Peak	0.00	200	Horizontal	Pass
6	903.242	79.15	-7.14	46.0	33.15	Peak	0.00	200	Horizontal	N/A

LOW CHANNEL, ANT V



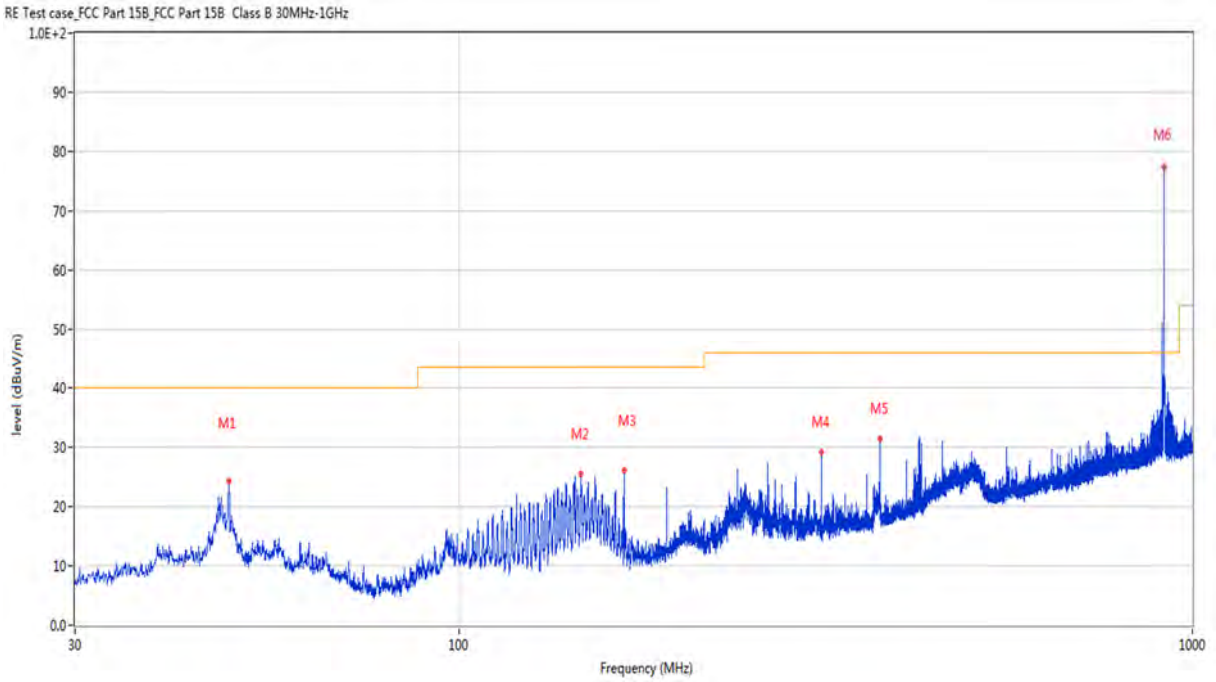
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	48.624	24.74	-23.80	40.0	-15.26	Peak	58.30	200	Vertical	Pass
2	53.717	25.30	-24.03	40.0	-14.70	Peak	0.00	200	Vertical	Pass
3	167.982	26.23	-27.35	43.5	-17.27	Peak	187.10	200	Vertical	Pass
4	311.979	28.89	-21.25	46.0	-17.11	Peak	157.20	200	Vertical	Pass
5	462.717	32.18	-16.65	46.0	-13.82	Peak	0.00	200	Vertical	Pass
6	903.242	76.43	-7.14	46.0	30.43	Peak	28.60	200	Vertical	N/A

MIDDLE CHANNEL, ANT H



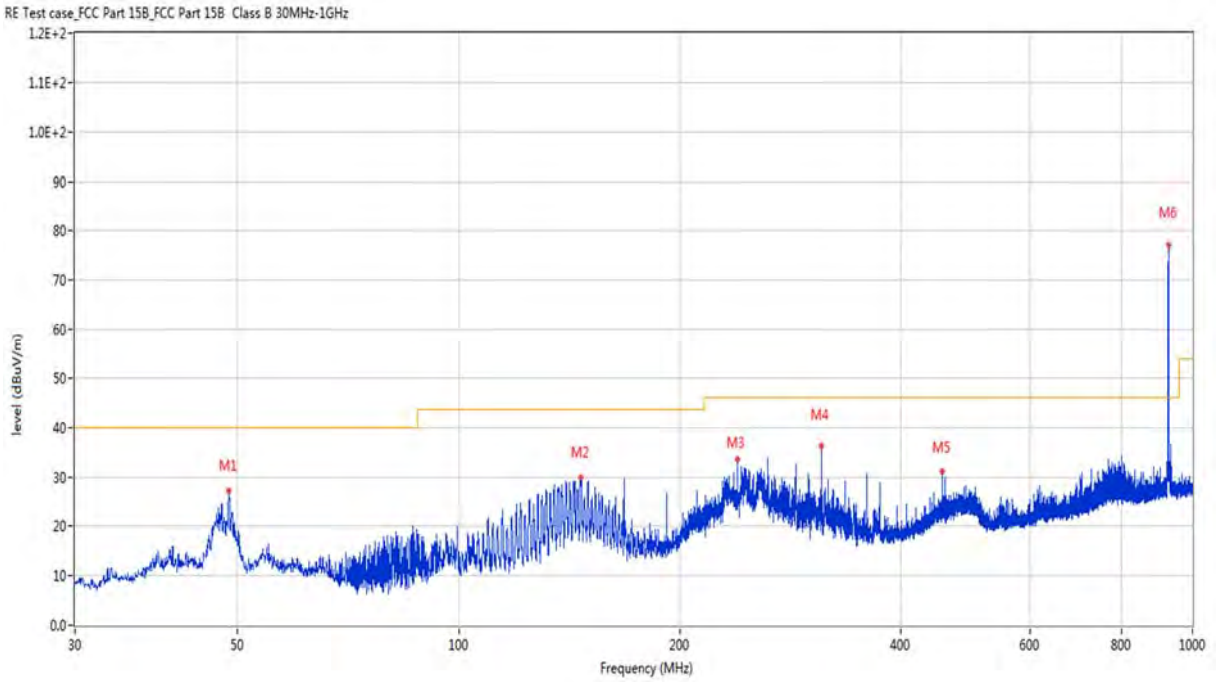
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	48.624	25.11	-23.80	40.0	-14.89	Peak	111.70	200	Horizontal	Pass
2	144.024	28.59	-28.30	43.5	-14.91	Peak	246.10	200	Horizontal	Pass
3	167.982	29.99	-27.35	43.5	-13.51	Peak	67.20	200	Horizontal	Pass
4	240.005	33.90	-23.08	46.0	-12.10	Peak	360.00	200	Horizontal	Pass
5	311.979	34.42	-21.25	46.0	-11.58	Peak	0.50	100	Horizontal	Pass
6	915.222	76.43	-7.16	46.0	30.43	Peak	360.00	200	Horizontal	N/A

MIDDLE CHANNEL, ANT V



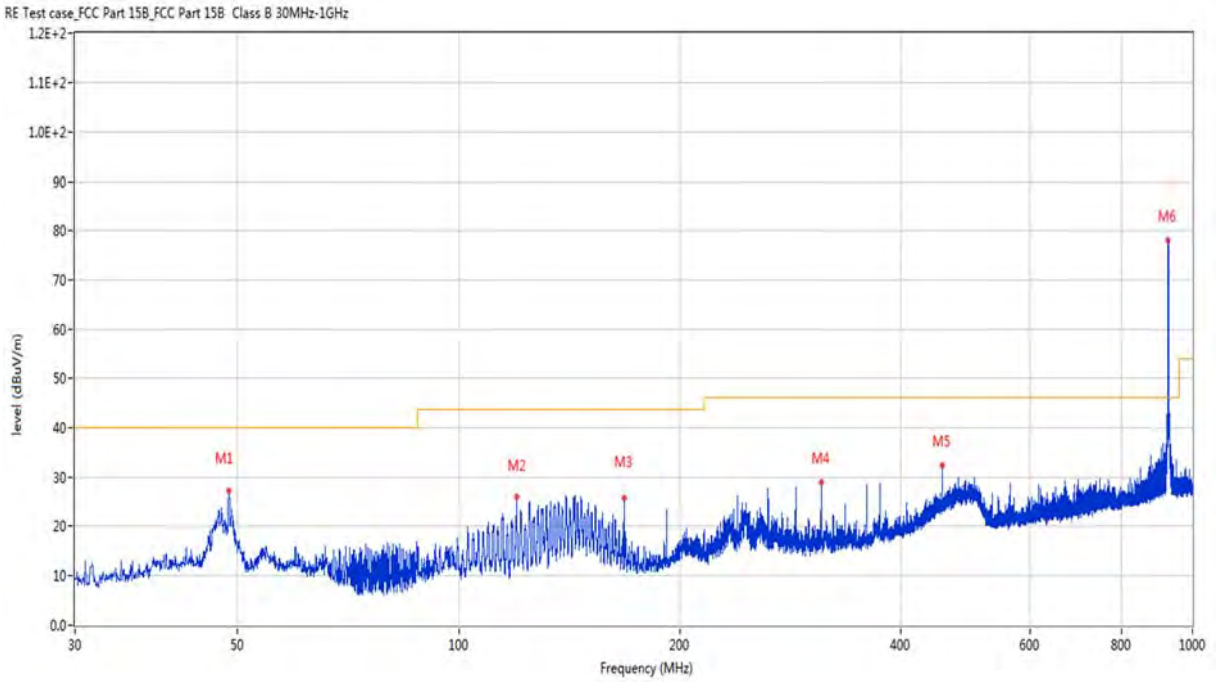
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	48.624	24.33	-23.80	40.0	-15.67	Peak	196.30	200	Vertical	Pass
2	146.740	25.55	-28.23	43.5	-17.95	Peak	181.40	200	Vertical	Pass
3	167.982	26.07	-27.35	43.5	-17.43	Peak	166.50	200	Vertical	Pass
4	311.979	29.26	-21.25	46.0	-16.74	Peak	176.20	200	Vertical	Pass
5	375.029	31.33	-18.64	46.0	-14.67	Peak	0.00	200	Vertical	Pass
6	915.271	77.53	-7.15	46.0	31.53	Peak	0.00	200	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	48.624	27.23	-22.51	40.0	-12.77	Peak	232.60	100	Horizontal	Pass
2	146.546	29.81	-27.62	43.5	-13.69	Peak	269.70	200	Horizontal	Pass
3	240.005	33.59	-23.06	46.0	-12.41	Peak	360.00	200	Horizontal	Pass
4	311.979	36.32	-21.30	46.0	-9.68	Peak	360.00	200	Horizontal	Pass
5	455.975	30.99	-17.94	46.0	-15.01	Peak	265.50	200	Horizontal	Pass
6	927.444	77.09	-9.54	46.0	31.09	Peak	88.30	200	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	48.624	27.21	-22.51	40.0	-12.79	Peak	290.60	200	Vertical	Pass
2	119.967	25.95	-25.81	43.5	-17.55	Peak	30.80	100	Vertical	Pass
3	167.982	25.59	-27.17	43.5	-17.91	Peak	168.00	200	Vertical	Pass
4	311.979	28.81	-21.30	46.0	-17.19	Peak	159.60	200	Vertical	Pass
5	455.975	32.32	-17.94	46.0	-13.68	Peak	358.20	100	Vertical	Pass
6	927.250	78.89	-9.44	46.0	32.89	Peak	212.00	100	Vertical	N/A

Test Data and Plots

125KHz

LOW CHANNEL, 1 GHz to 12.75 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	1452.000	41.68	-10.97	74.0	-32.32	Peak	268.00	150	Horizontal	Pass
1**	1452.000	30.50	-10.97	54.0	-23.50	AV	268.00	150	Horizontal	Pass
2	2999.400	49.32	-2.41	74.0	-24.68	Peak	276.00	150	Horizontal	Pass
2**	2999.400	38.35	-2.41	54.0	-15.65	AV	276.00	150	Horizontal	Pass
3	4889.200	48.32	-1.04	74.0	-25.68	Peak	228.00	150	Horizontal	Pass
3**	4889.200	39.17	-1.04	54.0	-14.83	AV	228.00	150	Horizontal	Pass
4	6931.600	52.75	4.38	74.0	-21.25	Peak	212.00	150	Horizontal	Pass
4**	6931.600	42.41	4.38	54.0	-11.59	AV	212.00	150	Horizontal	Pass
5	9138.713	49.01	17.63	74.0	-24.99	Peak	105.00	150	Horizontal	Pass
5**	9138.713	38.37	17.63	54.0	-15.63	AV	105.00	150	Horizontal	Pass
6	12283.388	50.11	20.19	74.0	-23.89	Peak	210.00	150	Horizontal	Pass
6**	12283.388	39.85	20.19	54.0	-14.15	AV	210.00	150	Horizontal	Pass

LOW CHANNEL, 1 GHz to 12.75 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	1805.000	42.40	-10.69	74.0	-31.60	Peak	54.00	150	Vertical	Pass
1**	1805.000	42.26	-10.69	54.0	-11.74	AV	54.00	150	Vertical	Pass
2	2999.900	49.14	-2.38	74.0	-24.86	Peak	97.00	150	Vertical	Pass
2**	2999.900	37.98	-2.38	54.0	-16.02	AV	97.00	150	Vertical	Pass
3	5323.200	49.68	0.01	74.0	-24.32	Peak	277.00	150	Vertical	Pass
3**	5323.200	39.56	0.01	54.0	-14.44	AV	277.00	150	Vertical	Pass
4	6997.800	52.45	4.06	74.0	-21.55	Peak	0.00	150	Vertical	Pass
4**	6997.800	43.79	4.06	54.0	-10.21	AV	0.00	150	Vertical	Pass
5	8595.049	49.34	18.28	74.0	-24.66	Peak	349.00	150	Vertical	Pass
5**	8595.049	37.86	18.28	54.0	-16.14	AV	349.00	150	Vertical	Pass
6	12337.438	51.01	19.80	74.0	-22.99	Peak	44.00	150	Vertical	Pass
6**	12337.438	38.36	19.80	54.0	-15.64	AV	44.00	150	Vertical	Pass

MIDDLE CHANNEL, 1 GHz to 12.75 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	1802.900	42.08	-10.80	74.0	-31.92	Peak	223.00	150	Horizontal	Pass
1**	1802.900	29.85	-10.80	54.0	-24.15	AV	223.00	150	Horizontal	Pass
2	2670.900	48.32	-4.49	74.0	-25.68	Peak	321.00	150	Horizontal	Pass
2**	2670.900	37.03	-4.49	54.0	-16.97	AV	321.00	150	Horizontal	Pass
3	4547.000	47.59	-2.63	74.0	-26.41	Peak	328.00	150	Horizontal	Pass
3**	4547.000	38.00	-2.63	54.0	-16.00	AV	328.00	150	Horizontal	Pass
4	6975.400	53.32	5.17	74.0	-20.68	Peak	286.00	150	Horizontal	Pass
4**	6975.400	42.76	5.17	54.0	-11.24	AV	286.00	150	Horizontal	Pass
5	9692.438	49.52	18.49	74.0	-24.48	Peak	95.00	150	Horizontal	Pass
5**	9692.438	37.64	18.49	54.0	-16.36	AV	95.00	150	Horizontal	Pass
6	12346.637	51.04	19.73	74.0	-22.96	Peak	260.00	150	Horizontal	Pass
6**	12346.637	38.53	19.73	54.0	-15.47	AV	260.00	150	Horizontal	Pass

MIDDLE CHANNEL, 1 GHz to 12.75 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	1829.500	43.10	-10.65	74.0	-30.90	Peak	360.00	150	Vertical	Pass
1**	1829.500	40.83	-10.65	54.0	-13.17	AV	360.00	150	Vertical	Pass
2	2841.000	48.36	-3.38	74.0	-25.64	Peak	213.00	150	Vertical	Pass
2**	2841.000	37.00	-3.38	54.0	-17.00	AV	213.00	150	Vertical	Pass
3	5006.000	49.16	-0.78	74.0	-24.84	Peak	350.00	150	Vertical	Pass
3**	5006.000	40.28	-0.78	54.0	-13.72	AV	350.00	150	Vertical	Pass
4	6970.000	52.75	5.14	74.0	-21.25	Peak	192.00	150	Vertical	Pass
4**	6970.000	42.82	5.14	54.0	-11.18	AV	192.00	150	Vertical	Pass
5	8881.401	48.49	17.45	74.0	-25.51	Peak	0.00	150	Vertical	Pass
5**	8881.401	37.38	17.45	54.0	-16.62	AV	0.00	150	Vertical	Pass
6	12332.550	51.00	19.83	74.0	-23.00	Peak	40.00	150	Vertical	Pass
6**	12332.550	38.43	19.83	54.0	-15.57	AV	40.00	150	Vertical	Pass

HIGH CHANNEL, 1 GHz to 12.75 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	1293.000	41.41	-11.42	74.0	-32.59	Peak	109.00	150	Horizontal	Pass
1**	1293.000	28.68	-11.42	54.0	-25.32	AV	109.00	150	Horizontal	Pass
2	2708.300	48.55	-4.40	74.0	-25.45	Peak	11.00	150	Horizontal	Pass
2**	2708.300	36.92	-4.40	54.0	-17.08	AV	11.00	150	Horizontal	Pass
3	4772.400	48.96	-2.21	74.0	-25.04	Peak	174.00	150	Horizontal	Pass
3**	4772.400	39.36	-2.21	54.0	-14.64	AV	174.00	150	Horizontal	Pass
4	6908.200	52.50	4.76	74.0	-21.50	Peak	247.00	150	Horizontal	Pass
4**	6908.200	42.79	4.76	54.0	-11.21	AV	247.00	150	Horizontal	Pass
5	9629.475	49.14	18.87	74.0	-24.86	Peak	314.00	150	Horizontal	Pass
5**	9629.475	36.66	18.87	54.0	-17.34	AV	314.00	150	Horizontal	Pass
6	12337.438	49.93	19.80	74.0	-24.07	Peak	336.00	150	Horizontal	Pass
6**	12337.438	38.74	19.80	54.0	-15.26	AV	336.00	150	Horizontal	Pass

HIGH CHANNEL, 1 GHz to 12.75 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	1855.400	41.81	-10.18	74.0	-32.19	Peak	263.00	150	Vertical	Pass
1**	1855.400	39.62	-10.18	54.0	-14.38	AV	263.00	150	Vertical	Pass
2	2995.600	48.40	-2.57	74.0	-25.60	Peak	235.00	150	Vertical	Pass
2**	2995.600	38.41	-2.57	54.0	-15.59	AV	235.00	150	Vertical	Pass
3	4902.600	48.73	-0.78	74.0	-25.27	Peak	99.00	150	Vertical	Pass
3**	4902.600	38.71	-0.78	54.0	-15.29	AV	99.00	150	Vertical	Pass
4	6225.200	52.27	3.55	74.0	-21.73	Peak	158.00	150	Vertical	Pass
4**	6225.200	42.34	3.55	54.0	-11.66	AV	158.00	150	Vertical	Pass
5	9038.088	48.94	18.16	74.0	-25.06	Peak	42.00	150	Vertical	Pass
5**	9038.088	38.43	18.16	54.0	-15.57	AV	42.00	150	Vertical	Pass
6	11622.425	49.86	20.25	74.0	-24.14	Peak	42.00	150	Vertical	Pass
6**	11622.425	39.73	20.25	54.0	-14.27	AV	42.00	150	Vertical	Pass

HOPPING MODE, 1 GHz to 12.75 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	1460.100	41.49	-11.60	74.0	-32.51	Peak	41.00	150	Horizontal	Pass
1**	1460.100	29.86	-11.60	54.0	-24.14	AV	41.00	150	Horizontal	Pass
2	2545.100	47.12	-5.38	74.0	-26.88	Peak	299.00	150	Horizontal	Pass
2**	2545.100	35.17	-5.38	54.0	-18.83	AV	299.00	150	Horizontal	Pass
3	4445.400	47.46	-2.13	74.0	-26.54	Peak	21.00	150	Horizontal	Pass
3**	4445.400	37.54	-2.13	54.0	-16.46	AV	21.00	150	Horizontal	Pass
4	6414.200	50.67	3.99	74.0	-23.33	Peak	248.00	150	Horizontal	Pass
4**	6414.200	42.00	3.99	54.0	-12.00	AV	248.00	150	Horizontal	Pass
5	8649.099	47.69	18.05	74.0	-26.31	Peak	270.00	150	Horizontal	Pass
5**	8649.099	36.94	18.05	54.0	-17.06	AV	270.00	150	Horizontal	Pass
6	12396.375	50.15	19.23	74.0	-23.85	Peak	310.00	150	Horizontal	Pass
6**	12396.375	37.63	19.23	54.0	-16.37	AV	310.00	150	Horizontal	Pass

HOPPING MODE, 1 GHz to 12.75 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	1020.800	50.67	-10.28	74.0	-23.33	Peak	360.00	150	Vertical	Pass
1**	1020.800	36.88	-10.28	54.0	-17.12	AV	360.00	150	Vertical	Pass
2	1829.300	46.65	-10.63	74.0	-27.35	Peak	331.00	150	Vertical	Pass
2**	1829.300	43.00	-10.63	54.0	-11.00	AV	331.00	150	Vertical	Pass
3	2549.000	47.85	-5.01	74.0	-26.15	Peak	316.00	150	Vertical	Pass
3**	2549.000	35.80	-5.01	54.0	-18.20	AV	316.00	150	Vertical	Pass
4	3946.400	45.48	-4.88	74.0	-28.52	Peak	35.00	150	Vertical	Pass
4**	3946.400	35.38	-4.88	54.0	-18.62	AV	35.00	150	Vertical	Pass
5	6916.000	51.59	4.74	74.0	-22.41	Peak	62.00	150	Vertical	Pass
5**	6916.000	42.09	4.74	54.0	-11.91	AV	62.00	150	Vertical	Pass
6	10628.825	48.98	18.39	74.0	-25.02	Peak	299.00	150	Vertical	Pass
6**	10628.825	35.74	18.39	54.0	-18.26	AV	299.00	150	Vertical	Pass

250KHz

LOW CHANNEL, 1 GHz to 12.75 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	1618.100	41.26	-11.92	74.0	-32.74	Peak	38.00	150	Horizontal	Pass
1**	1618.100	29.36	-11.92	54.0	-24.64	AV	38.00	150	Horizontal	Pass
2	2941.200	48.87	-3.61	74.0	-25.13	Peak	52.00	150	Horizontal	Pass
2**	2941.200	37.04	-3.61	54.0	-16.96	AV	52.00	150	Horizontal	Pass
3	4920.400	49.17	-1.05	74.0	-24.83	Peak	297.00	150	Horizontal	Pass
3**	4920.400	39.94	-1.05	54.0	-14.06	AV	297.00	150	Horizontal	Pass
4	6979.400	52.56	4.93	74.0	-21.44	Peak	73.00	150	Horizontal	Pass
4**	6979.400	43.00	4.93	54.0	-11.00	AV	73.00	150	Horizontal	Pass
5	9070.862	48.61	18.17	74.0	-25.39	Peak	319.00	150	Horizontal	Pass
5**	9070.862	38.00	18.17	54.0	-16.00	AV	319.00	150	Horizontal	Pass
6	11720.175	49.96	19.45	74.0	-24.04	Peak	224.00	150	Horizontal	Pass
6**	11720.175	39.93	19.45	54.0	-14.07	AV	224.00	150	Horizontal	Pass

LOW CHANNEL, 1 GHz to 12.75 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	1786.400	41.46	-11.50	74.0	-32.54	Peak	61.00	150	Vertical	Pass
1**	1786.400	29.02	-11.50	54.0	-24.98	AV	61.00	150	Vertical	Pass
2	2557.100	48.84	-5.22	74.0	-25.16	Peak	0.00	150	Vertical	Pass
2**	2557.100	35.35	-5.22	54.0	-18.65	AV	0.00	150	Vertical	Pass
3	4705.200	48.14	-2.25	74.0	-25.86	Peak	360.00	150	Vertical	Pass
3**	4705.200	38.85	-2.25	54.0	-15.15	AV	360.00	150	Vertical	Pass
4	6935.000	53.10	4.31	74.0	-20.90	Peak	228.00	150	Vertical	Pass
4**	6935.000	42.51	4.31	54.0	-11.49	AV	228.00	150	Vertical	Pass
5	9661.963	48.95	18.81	74.0	-25.05	Peak	324.00	150	Vertical	Pass
5**	9661.963	37.94	18.81	54.0	-16.06	AV	324.00	150	Vertical	Pass
6	12343.187	50.19	19.76	74.0	-23.81	Peak	363.00	150	Vertical	Pass
6**	12343.187	40.10	19.76	54.0	-13.90	AV	363.00	150	Vertical	Pass

MIDDLE CHANNEL, 1 GHz to 12.75 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	1691.000	41.39	-11.80	74.0	-32.61	Peak	13.00	150	Horizontal	Pass
1**	1691.000	30.02	-11.80	54.0	-23.98	AV	13.00	150	Horizontal	Pass
2	2997.900	49.12	-2.48	74.0	-24.88	Peak	49.00	150	Horizontal	Pass
2**	2997.900	38.04	-2.48	54.0	-15.96	AV	49.00	150	Horizontal	Pass
3	5304.600	50.51	0.32	74.0	-23.49	Peak	350.00	150	Horizontal	Pass
3**	5304.600	39.94	0.32	54.0	-14.06	AV	350.00	150	Horizontal	Pass
4	6919.600	52.97	4.51	74.0	-21.03	Peak	212.00	150	Horizontal	Pass
4**	6919.600	42.84	4.51	54.0	-11.16	AV	212.00	150	Horizontal	Pass
5	9954.925	49.89	17.82	74.0	-24.11	Peak	187.00	150	Horizontal	Pass
5**	9954.925	38.54	17.82	54.0	-15.46	AV	187.00	150	Horizontal	Pass
6	12233.362	49.76	20.43	74.0	-24.24	Peak	283.00	150	Horizontal	Pass
6**	12233.362	38.23	20.43	54.0	-15.77	AV	283.00	150	Horizontal	Pass

MIDDLE CHANNEL, 1 GHz to 12.75 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	1830.300	42.52	-10.68	74.0	-31.48	Peak	360.00	150	Vertical	Pass
1**	1830.300	39.78	-10.68	54.0	-14.22	AV	360.00	150	Vertical	Pass
2	2997.200	49.24	-2.48	74.0	-24.76	Peak	18.00	150	Vertical	Pass
2**	2997.200	37.73	-2.48	54.0	-16.27	AV	18.00	150	Vertical	Pass
3	4873.800	49.33	-1.53	74.0	-24.67	Peak	0.00	150	Vertical	Pass
3**	4873.800	39.10	-1.53	54.0	-14.90	AV	0.00	150	Vertical	Pass
4	6918.400	52.39	4.56	74.0	-21.61	Peak	136.00	150	Vertical	Pass
4**	6918.400	42.98	4.56	54.0	-11.02	AV	136.00	150	Vertical	Pass
5	9904.326	49.47	17.73	74.0	-24.53	Peak	-3.00	150	Vertical	Pass
5**	9904.326	37.39	17.73	54.0	-16.61	AV	-3.00	150	Vertical	Pass
6	11757.838	51.40	18.87	74.0	-22.60	Peak	293.00	150	Vertical	Pass
6**	11757.838	39.02	18.87	54.0	-14.98	AV	293.00	150	Vertical	Pass

HIGH CHANNEL, 1 GHz to 12.75 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	1859.300	42.24	-9.83	74.0	-31.76	Peak	330.00	150	Horizontal	Pass
1**	1859.300	32.99	-9.83	54.0	-21.01	AV	330.00	150	Horizontal	Pass
2	2918.000	48.12	-4.47	74.0	-25.88	Peak	36.00	150	Horizontal	Pass
2**	2918.000	36.59	-4.47	54.0	-17.41	AV	36.00	150	Horizontal	Pass
3	4801.600	48.70	-1.33	74.0	-25.30	Peak	312.00	150	Horizontal	Pass
3**	4801.600	38.76	-1.33	54.0	-15.24	AV	312.00	150	Horizontal	Pass
4	6986.800	52.55	4.41	74.0	-21.45	Peak	297.00	150	Horizontal	Pass
4**	6986.800	43.13	4.41	54.0	-10.87	AV	297.00	150	Horizontal	Pass
5	9342.838	49.13	17.06	74.0	-24.87	Peak	99.00	150	Horizontal	Pass
5**	9342.838	37.76	17.06	54.0	-16.24	AV	99.00	150	Horizontal	Pass
6	12355.550	50.33	19.67	74.0	-23.67	Peak	199.00	150	Horizontal	Pass
6**	12355.550	38.10	19.67	54.0	-15.90	AV	199.00	150	Horizontal	Pass

HIGH CHANNEL, 1 GHz to 12.75 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	1855.100	42.46	-10.22	74.0	-31.54	Peak	268.00	150	Vertical	Pass
1**	1855.100	39.73	-10.22	54.0	-14.27	AV	268.00	150	Vertical	Pass
2	2998.100	48.98	-2.48	74.0	-25.02	Peak	117.00	150	Vertical	Pass
2**	2998.100	37.53	-2.48	54.0	-16.47	AV	117.00	150	Vertical	Pass
3	5504.400	49.64	0.47	74.0	-24.36	Peak	177.00	150	Vertical	Pass
3**	5504.400	39.96	0.47	54.0	-14.04	AV	177.00	150	Vertical	Pass
4	6987.600	52.47	4.44	74.0	-21.53	Peak	317.00	150	Vertical	Pass
4**	6987.600	42.84	4.44	54.0	-11.16	AV	317.00	150	Vertical	Pass
5	9025.724	49.11	18.14	74.0	-24.89	Peak	342.00	150	Vertical	Pass
5**	9025.724	36.21	18.14	54.0	-17.79	AV	342.00	150	Vertical	Pass
6	12646.213	50.30	19.00	74.0	-23.70	Peak	143.00	150	Vertical	Pass
6**	12646.213	38.30	19.00	54.0	-15.70	AV	143.00	150	Vertical	Pass

HOPPING MODE, 1 GHz to 12.75 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	1129.700	41.55	-11.63	74.0	-32.45	Peak	76.00	150	Horizontal	Pass
1**	1129.700	29.38	-11.63	54.0	-24.62	AV	76.00	150	Horizontal	Pass
2	1807.400	43.62	-10.77	74.0	-30.38	Peak	103.00	150	Horizontal	Pass
2**	1807.400	36.05	-10.77	54.0	-17.95	AV	103.00	150	Horizontal	Pass
3	2940.000	48.46	-3.54	74.0	-25.54	Peak	117.00	150	Horizontal	Pass
3**	2940.000	36.86	-3.54	54.0	-17.14	AV	117.00	150	Horizontal	Pass
4	3971.600	45.80	-4.21	74.0	-28.20	Peak	54.00	150	Horizontal	Pass
4**	3971.600	36.54	-4.21	54.0	-17.46	AV	54.00	150	Horizontal	Pass
5	6768.800	52.03	3.64	74.0	-21.97	Peak	91.00	150	Horizontal	Pass
5**	6768.800	40.50	3.64	54.0	-13.50	AV	91.00	150	Horizontal	Pass
6	9896.563	49.54	17.70	74.0	-24.46	Peak	362.00	150	Horizontal	Pass
6**	9896.563	36.85	17.70	54.0	-17.15	AV	362.00	150	Horizontal	Pass

HOPPING MODE, 1 GHz to 12.75 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	1026.800	54.69	-10.53	74.0	-19.31	Peak	146.00	150	Vertical	Pass
1**	1026.800	43.51	-10.53	54.0	-10.49	AV	146.00	150	Vertical	Pass
2	1853.900	45.72	-10.30	74.0	-28.28	Peak	120.00	150	Vertical	Pass
2**	1853.900	40.03	-10.30	54.0	-13.97	AV	120.00	150	Vertical	Pass
3	2995.300	48.76	-2.61	74.0	-25.24	Peak	185.00	150	Vertical	Pass
3**	2995.300	37.64	-2.61	54.0	-16.36	AV	185.00	150	Vertical	Pass
4	4441.000	47.04	-2.13	74.0	-26.96	Peak	105.00	150	Vertical	Pass
4**	4441.000	39.08	-2.13	54.0	-14.92	AV	105.00	150	Vertical	Pass
5	6915.600	52.22	4.77	74.0	-21.78	Peak	125.00	150	Vertical	Pass
5**	6915.600	42.26	4.77	54.0	-11.74	AV	125.00	150	Vertical	Pass
6	12333.125	50.32	19.83	74.0	-23.68	Peak	284.00	150	Vertical	Pass
6**	12333.125	37.48	19.83	54.0	-16.52	AV	284.00	150	Vertical	Pass

500KHz

LOW CHANNEL, 1 GHz to 12.75 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	1704.200	41.43	-11.22	74.0	-32.57	Peak	271.00	150	Horizontal	Pass
1**	1704.200	29.36	-11.22	54.0	-24.64	AV	271.00	150	Horizontal	Pass
2	2941.100	48.56	-3.60	74.0	-25.44	Peak	360.00	150	Horizontal	Pass
2**	2941.100	36.37	-3.60	54.0	-17.63	AV	360.00	150	Horizontal	Pass
3	4260.400	47.29	-3.39	74.0	-26.71	Peak	238.00	150	Horizontal	Pass
3**	4260.400	36.85	-3.39	54.0	-17.15	AV	238.00	150	Horizontal	Pass
4	6969.000	52.45	5.13	74.0	-21.55	Peak	254.00	150	Horizontal	Pass
4**	6969.000	43.91	5.13	54.0	-10.09	AV	254.00	150	Horizontal	Pass
5	10021.913	49.57	17.54	74.0	-24.43	Peak	70.00	150	Horizontal	Pass
5**	10021.913	36.75	17.54	54.0	-17.25	AV	70.00	150	Horizontal	Pass
6	12119.224	50.62	19.63	74.0	-23.38	Peak	272.00	150	Horizontal	Pass
6**	12119.224	37.57	19.63	54.0	-16.43	AV	272.00	150	Horizontal	Pass

LOW CHANNEL, 1 GHz to 12.75 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	1806.400	43.99	-10.76	74.0	-30.01	Peak	47.00	150	Vertical	Pass
1**	1806.400	42.86	-10.76	54.0	-11.14	AV	47.00	150	Vertical	Pass
2	2999.400	49.35	-2.41	74.0	-24.65	Peak	78.00	150	Vertical	Pass
2**	2999.400	39.02	-2.41	54.0	-14.98	AV	78.00	150	Vertical	Pass
3	5293.400	49.50	-0.07	74.0	-24.50	Peak	77.00	150	Vertical	Pass
3**	5293.400	40.13	-0.07	54.0	-13.87	AV	77.00	150	Vertical	Pass
4	6984.200	52.98	4.68	74.0	-21.02	Peak	191.00	150	Vertical	Pass
4**	6984.200	43.06	4.68	54.0	-10.94	AV	191.00	150	Vertical	Pass
5	9513.900	48.74	17.79	74.0	-25.26	Peak	37.00	150	Vertical	Pass
5**	9513.900	36.10	17.79	54.0	-17.90	AV	37.00	150	Vertical	Pass
6	12368.487	50.31	19.53	74.0	-23.69	Peak	343.00	150	Vertical	Pass
6**	12368.487	37.99	19.53	54.0	-16.01	AV	343.00	150	Vertical	Pass

MIDDLE CHANNEL, 1 GHz to 12.75 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	2188.400	46.33	-6.80	74.0	-27.67	Peak	348.00	150	Horizontal	Pass
1**	2188.400	36.16	-6.80	54.0	-17.84	AV	348.00	150	Horizontal	Pass
2	2997.300	49.04	-2.48	74.0	-24.96	Peak	125.00	150	Horizontal	Pass
2**	2997.300	38.59	-2.48	54.0	-15.41	AV	125.00	150	Horizontal	Pass
3	5065.600	49.13	-0.42	74.0	-24.87	Peak	212.00	150	Horizontal	Pass
3**	5065.600	40.89	-0.42	54.0	-13.11	AV	212.00	150	Horizontal	Pass
4	6659.800	52.63	4.37	74.0	-21.37	Peak	245.00	150	Horizontal	Pass
4**	6659.800	41.67	4.37	54.0	-12.33	AV	245.00	150	Horizontal	Pass
5	10444.250	49.44	18.78	74.0	-24.56	Peak	-1.00	150	Horizontal	Pass
5**	10444.250	36.77	18.78	54.0	-17.23	AV	-1.00	150	Horizontal	Pass
6	12276.775	51.45	20.26	74.0	-22.55	Peak	316.00	150	Horizontal	Pass
6**	12276.775	38.64	20.26	54.0	-15.36	AV	316.00	150	Horizontal	Pass

MIDDLE CHANNEL, 1 GHz to 12.75 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	1961.300	43.31	-9.33	74.0	-30.69	Peak	360.00	150	Vertical	Pass
1**	1961.300	31.40	-9.33	54.0	-22.60	AV	360.00	150	Vertical	Pass
2	2976.200	48.69	-4.06	74.0	-25.31	Peak	79.00	150	Vertical	Pass
2**	2976.200	36.52	-4.06	54.0	-17.48	AV	79.00	150	Vertical	Pass
3	5298.000	49.46	0.26	74.0	-24.54	Peak	314.00	150	Vertical	Pass
3**	5298.000	39.08	0.26	54.0	-14.92	AV	314.00	150	Vertical	Pass
4	6972.800	52.78	5.10	74.0	-21.22	Peak	298.00	150	Vertical	Pass
4**	6972.800	43.49	5.10	54.0	-10.51	AV	298.00	150	Vertical	Pass
5	9914.963	49.14	17.76	74.0	-24.86	Peak	146.00	150	Vertical	Pass
5**	9914.963	37.24	17.76	54.0	-16.76	AV	146.00	150	Vertical	Pass
6	12359.576	50.61	19.64	74.0	-23.39	Peak	363.00	150	Vertical	Pass
6**	12359.576	38.43	19.64	54.0	-15.57	AV	363.00	150	Vertical	Pass

HIGH CHANNEL, 1 GHz to 12.75 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	1316.500	41.36	-11.11	74.0	-32.64	Peak	252.00	150	Horizontal	Pass
1**	1316.500	29.47	-11.11	54.0	-24.53	AV	252.00	150	Horizontal	Pass
2	2997.600	49.38	-2.48	74.0	-24.62	Peak	28.00	150	Horizontal	Pass
2**	2997.600	37.40	-2.48	54.0	-16.60	AV	28.00	150	Horizontal	Pass
3	5348.800	50.20	-0.06	74.0	-23.80	Peak	106.00	150	Horizontal	Pass
3**	5348.800	39.49	-0.06	54.0	-14.51	AV	106.00	150	Horizontal	Pass
4	6938.800	52.59	4.47	74.0	-21.41	Peak	89.00	150	Horizontal	Pass
4**	6938.800	42.25	4.47	54.0	-11.75	AV	89.00	150	Horizontal	Pass
5	9638.100	49.11	18.93	74.0	-24.89	Peak	96.00	150	Horizontal	Pass
5**	9638.100	36.67	18.93	54.0	-17.33	AV	96.00	150	Horizontal	Pass
6	12236.237	50.26	20.43	74.0	-23.74	Peak	96.00	150	Horizontal	Pass
6**	12236.237	38.24	20.43	54.0	-15.76	AV	96.00	150	Horizontal	Pass

HIGH CHANNEL, 1 GHz to 12.75 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	1831.200	43.41	-10.71	74.0	-30.59	Peak	297.00	150	Vertical	Pass
1**	1831.200	29.86	-10.71	54.0	-24.14	AV	297.00	150	Vertical	Pass
2	2997.500	48.90	-2.48	74.0	-25.10	Peak	350.00	150	Vertical	Pass
2**	2997.500	38.14	-2.48	54.0	-15.86	AV	350.00	150	Vertical	Pass
3	5286.200	49.63	-0.44	74.0	-24.37	Peak	346.00	150	Vertical	Pass
3**	5286.200	40.15	-0.44	54.0	-13.85	AV	346.00	150	Vertical	Pass
4	6634.200	52.25	3.75	74.0	-21.75	Peak	12.00	150	Vertical	Pass
4**	6634.200	41.89	3.75	54.0	-12.11	AV	12.00	150	Vertical	Pass
5	9891.100	49.23	17.68	74.0	-24.77	Peak	77.00	150	Vertical	Pass
5**	9891.100	37.29	17.68	54.0	-16.71	AV	77.00	150	Vertical	Pass
6	12247.162	50.01	20.45	74.0	-23.99	Peak	360.00	150	Vertical	Pass
6**	12247.162	38.19	20.45	54.0	-15.81	AV	360.00	150	Vertical	Pass

A.8 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.

125KHz

Test Mode	Test Channel	Frequency (MHz)	Level (dBuV/m)	Factor (dB)	Limit Line (dBuV/m)	Margin (dB)	Remark	Verdict
LoRa	Low	614	40.921	3.16	74	33.079	PEAK	Pass
		614	N/A	N/A	54	N/A	AVERAGE	Pass
LoRa	HIGH	960	48.208	28.00	74	25.792	PEAK	Pass
		960	N/A	N/A	54	N/A	AVERAGE	Pass
LoRa	Hopping Low	614	41.227	3.16	74	32.773	PEAK	Pass
		614	N/A	N/A	54	N/A	AVERAGE	Pass
LoRa	Hopping High	960	47.854	28.00	74	26.146	PEAK	Pass
		960	N/A	N/A	54	N/A	AVERAGE	Pass

250KHz

Test Mode	Test Channel	Frequency (MHz)	Level (dBuV/m)	Factor (dB)	Limit Line (dBuV/m)	Margin (dB)	Remark	Verdict
LoRa	Low	614	42.118	3.16	74	31.882	PEAK	Pass
		614	N/A	N/A	54	N/A	AVERAGE	Pass
LoRa	HIGH	960	47.477	28.00	74	26.523	PEAK	Pass
		960	N/A	N/A	54	N/A	AVERAGE	Pass
LoRa	Hopping Low	614	40.743	3.16	74	33.257	PEAK	Pass
		614	N/A	N/A	54	N/A	AVERAGE	Pass
LoRa	Hopping High	960	47.344	28.00	74	26.656	PEAK	Pass
		960	N/A	N/A	54	N/A	AVERAGE	Pass

500KHz

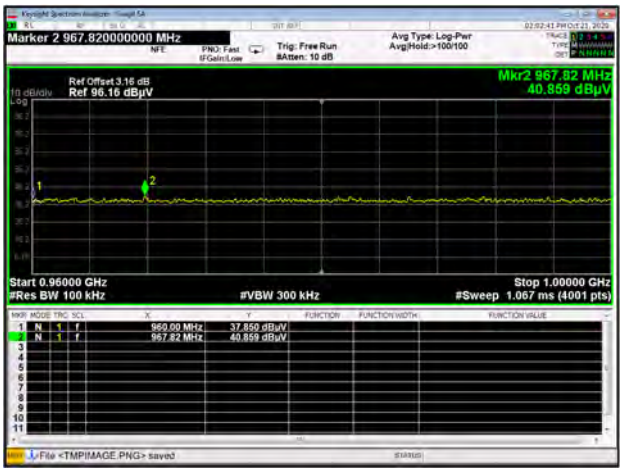
Test Mode	Test Channel	Frequency (MHz)	Level (dBuV/m)	Factor (dB)	Limit Line (dBuV/m)	Margin (dB)	Remark	Verdict
LoRa	Low	614	40.654	3.16	74	33.346	PEAK	Pass
		614	N/A	N/A	54	N/A	AVERAGE	Pass
LoRa	High	960	47.709	28.00	74	26.291	PEAK	Pass
		960	N/A	N/A	54	N/A	AVERAGE	Pass

Test Plots

125KHz

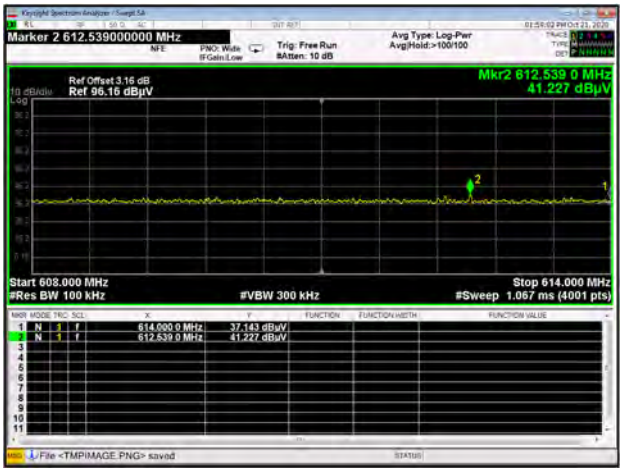
LOW CHANNEL, PEAK

HIGH CHANNEL, PEAK

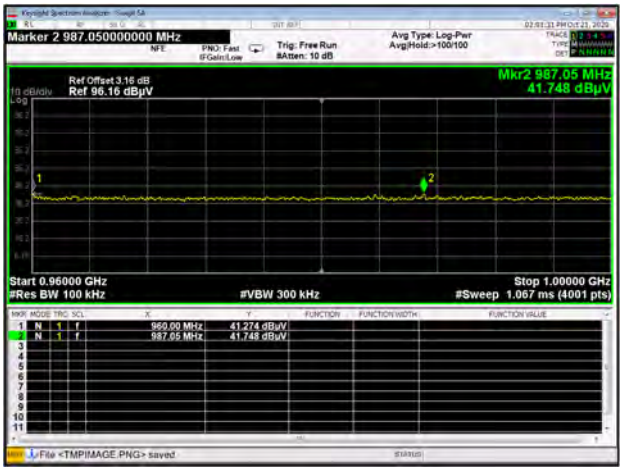


HIGH CHANNEL, AV

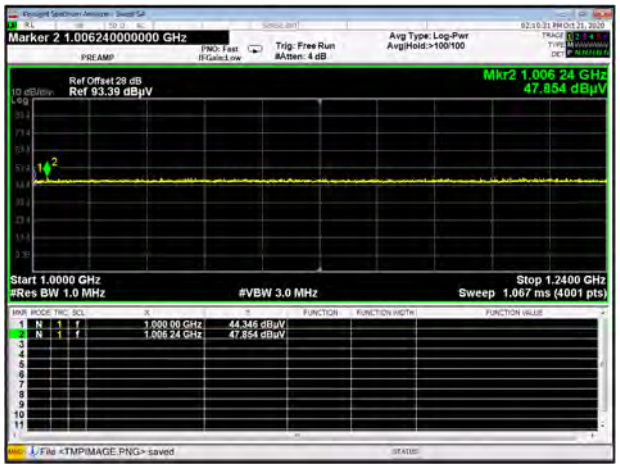
HOPPING LOW CHANNEL, PEAK



HOPPING HIGH CHANNEL, PEAK

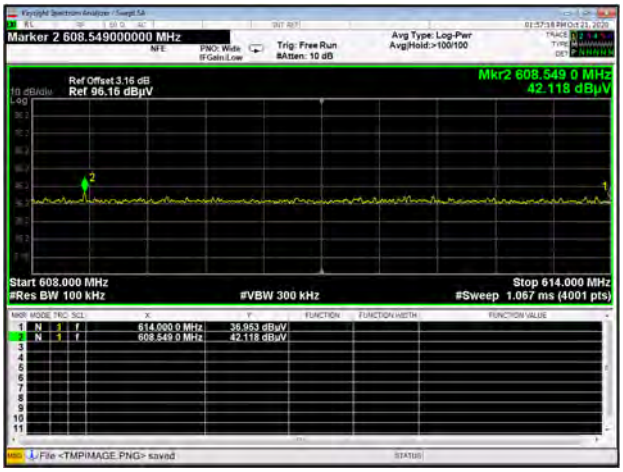


HOPPING HIGH CHANNEL, AV

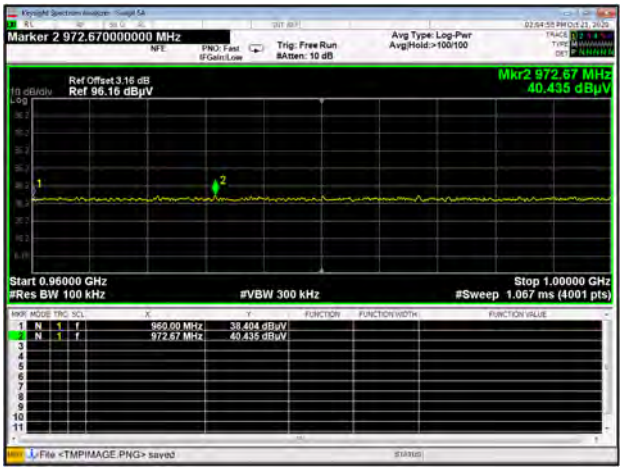


250KHz

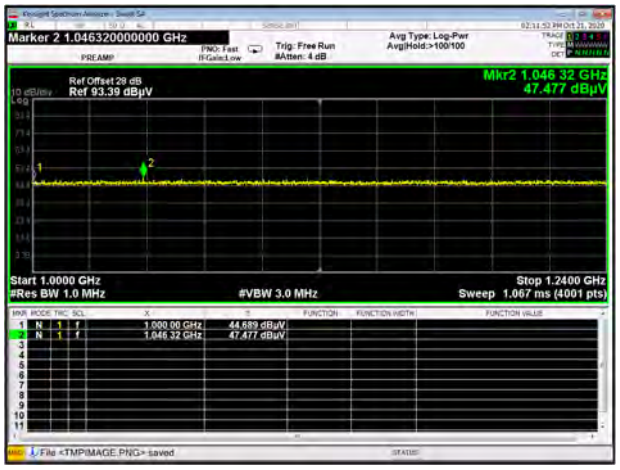
LOW CHANNEL, PEAK



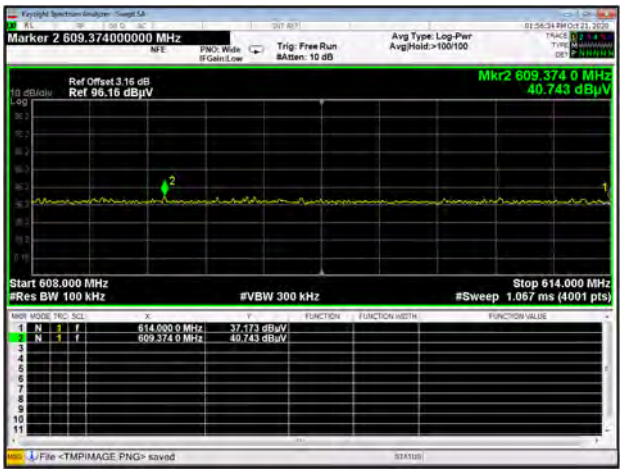
HIGH CHANNEL, PEAK



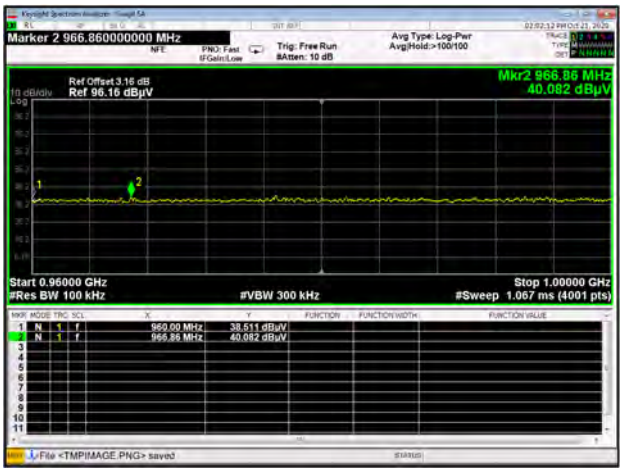
HIGH CHANNEL, AV



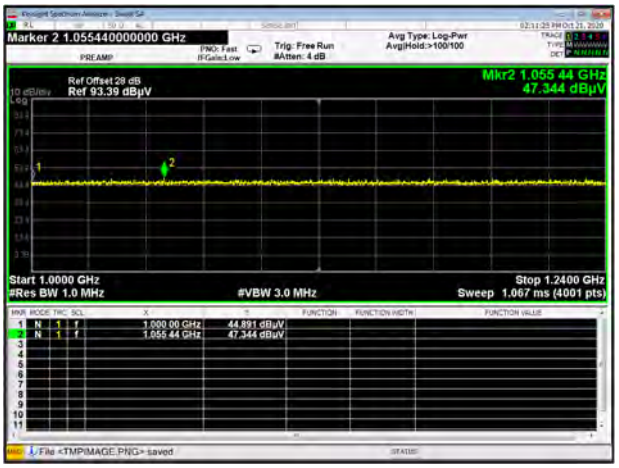
HOPPING LOW CHANNEL, PEAK



HOPPING HIGH CHANNEL, PEAK

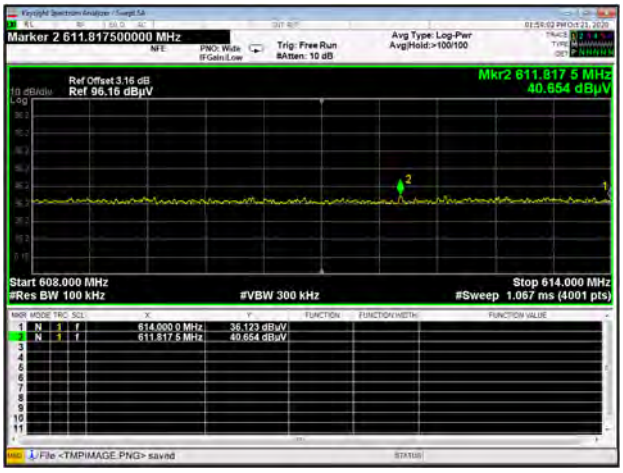


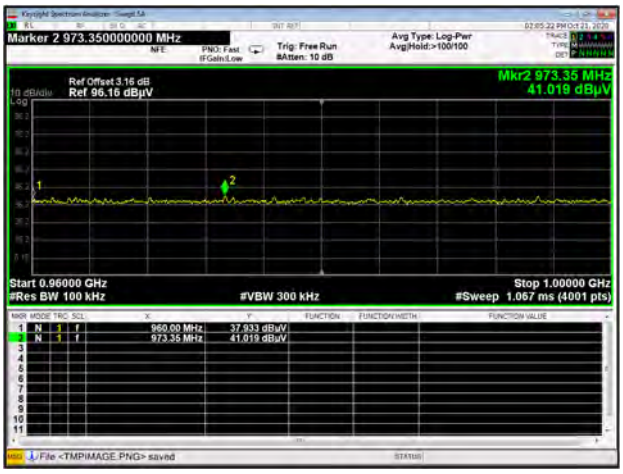
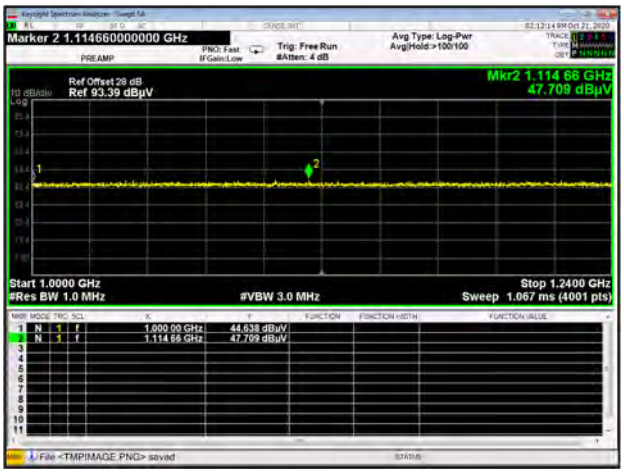
HOPPING HIGH CHANNEL, AV



500KHz

LOW CHANNEL, PEAK



HIGH CHANNEL, PEAK	HIGH CHANNEL, AV
	

A.9 Power Spectral Density (PSD)

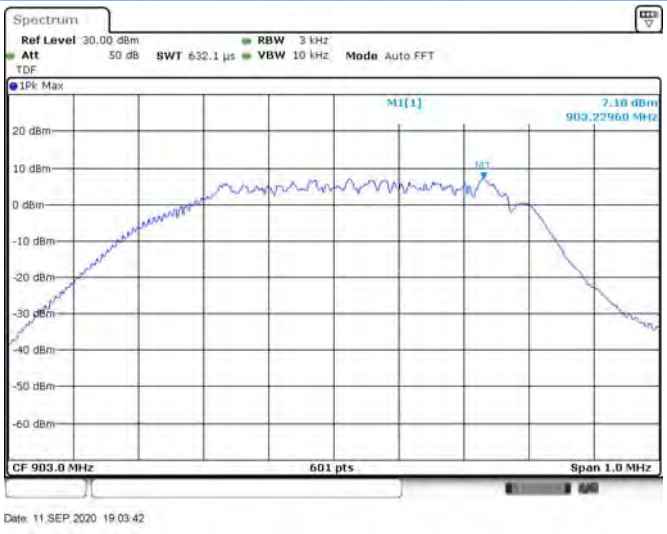
Test Data

500KHz

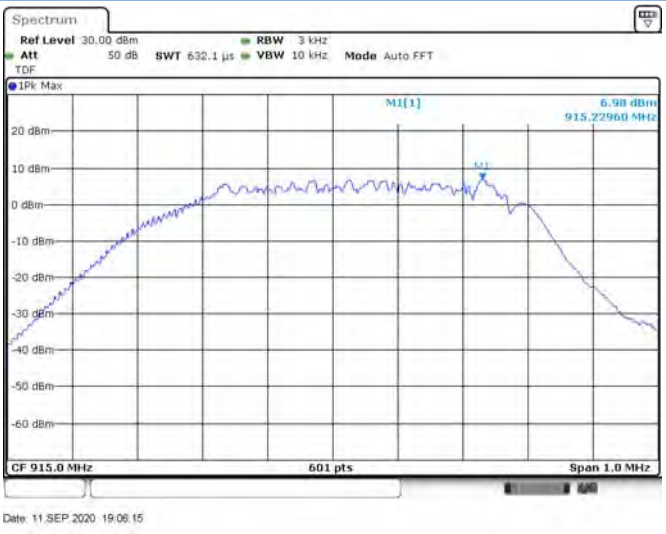
Channel	Spectral power density (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
Low Channel	7.10	8	Pass
Middle Channel	6.98	8	Pass
High Channel	6.88	8	Pass

Test plots

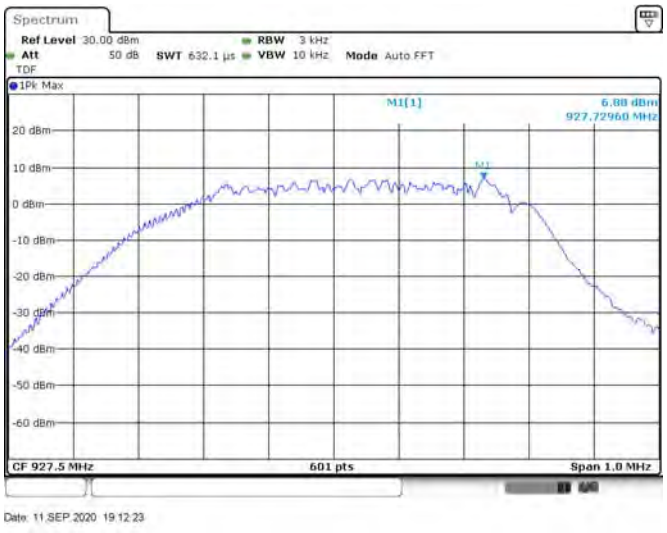
LOW CHANNEL



MIDDLE CHANNEL



HIGH CHANNEL



ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-SZ2080617-AR.PDF”.

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ2080617-AW.PDF”.

ANNEX D EUT INTERNAL PHOTOS

Please refer the document “BL-SZ2080617-AI.PDF”.

--END OF REPORT--