

MEASUREMENT REPORT

FCC PART 15.247 Bluetooth-LE

FCC ID: 2ALJ3AP32X

APPLICANT: HAN Networks Co., Ltd.

Application Type: Certification

Product: HAN Access Point

Model No.: AP321, AP321e

Brand Name: HAN NETWORKS; HANNETWORKS

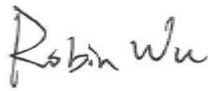
FCC Classification: Digital Transmission System (DTS)

FCC Rule Part(s): Part 15 Subpart C (Section 15.247)

Test Procedure(s): ANSI C63.10-2013, KDB 558074 D01v05r02;

Test Date: September 30 ~ December 02, 2019

Reviewed By: 
(Sunny Sun)

Approved By: 
(Robin Wu)



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
1909RSU036-U1	Rev. 01	Initial Report	01-10-2020	Valid

CONTENTS

Description	Page
1. INTRODUCTION	6
1.1. Scope	6
1.2. MRT Test Location	6
2. PRODUCT INFORMATION	7
2.1. Feature of Equipment under Test	7
2.2. Product Specification Subjective to this Report.....	7
2.3. Working Frequencies for this report	8
2.4. Description of Available Antennas	9
2.5. Description of Antenna RF Port	11
2.6. Device Capabilities	12
2.7. Test Configuration	12
2.8. EMI Suppression Device(s)/Modifications.....	12
2.9. Labeling Requirements.....	13
2.10. Test Software	13
3. DESCRIPTION OF TEST	14
3.1. Evaluation Procedure	14
3.2. AC Line Conducted Emissions	14
3.3. Radiated Emissions	15
4. ANTENNA REQUIREMENTS.....	16
5. TEST EQUIPMENT CALIBRATION DATE.....	17
6. MEASUREMENT UNCERTAINTY.....	19
7. TEST RESULT	20
7.1. Summary	20
7.2. 6dB Bandwidth Measurement.....	21
7.2.1. Test Limit	21
7.2.2. Test Procedure used.....	21
7.2.3. Test Setting.....	21
7.2.4. Test Setup.....	21
7.2.5. Test Result.....	22
7.3. Output Power Measurement.....	24
7.3.1. Test Limit	24
7.3.2. Test Procedure Used	24
7.3.3. Test Setting.....	24

7.3.4.	Test Setup.....	24
7.3.5.	Test Result of Output Power	25
7.4.	Power Spectral Density Measurement	26
7.4.1.	Test Limit	26
7.4.2.	Test Procedure Used	26
7.4.3.	Test Setting.....	26
7.4.4.	Test Setup.....	26
7.4.5.	Test Result.....	27
7.5.	Conducted Band Edge and Out-of-Band Emissions.....	29
7.5.1.	Test Limit	29
7.5.2.	Test Procedure Used	29
7.5.3.	Test Setting.....	29
7.5.4.	Test Setup.....	30
7.5.5.	Test Result.....	31
7.6.	Radiated Spurious Emission Measurement	36
7.6.1.	Test Limit	36
7.6.2.	Test Procedure Used	36
7.6.3.	Test Setting.....	36
7.6.4.	Test Setup.....	38
7.6.5.	Test Result.....	39
7.7.	Radiated Restricted Band Edge Measurement	47
7.7.1.	Test Limit	47
7.7.2.	Test Procedure Used	48
7.7.3.	Test Setting.....	48
7.7.4.	Test Setup.....	49
7.7.5.	Test Result.....	50
7.8.	AC Conducted Emissions Measurement.....	66
7.8.1.	Test Limit	66
7.8.2.	Test Setup.....	66
7.8.3.	Test Result.....	67
8.	CONCLUSION.....	69
	Appendix A – Test Setup Photograph.....	70
	Appendix B – EUT Photograph	71

General Information

Applicant:	HAN Networks Co., Ltd.
Applicant Address:	101-A16, 1 st Floor, Building 3, No.9 compound, Yongfeng Road, Haidian District, Beijing, P.R. China
Manufacturer:	HAN Networks Co., Ltd.
Manufacturer Address:	101-A16, 1 st Floor, Building 3, No.9 compound, Yongfeng Road, Haidian District, Beijing, P.R. China
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
Test Device Serial No.:	N/A ☐ Production ☒ Pre-Production ☐ Engineering

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- MRT facility is a FCC accredited (MRT Designation No. CN1166) test facility with the site description report on file and has met all the requirements specified in ANSI C63.4-2014.
- MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.
- MRT facility is a VCCI registered (R-20025, G-20034, C-20020, T-20020) test laboratory with the site description on file at VCCI Council.
- MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications, Radio and SAR testing.



1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The measurement facility compliant with the test site requirements specified in ANSI C63.4-2014.



2. PRODUCT INFORMATION

2.1. Feature of Equipment under Test

Product Name:	HAN Access Point
Model No.:	AP321, AP321e
Brand Name:	HAN NETWORKS; HANNETWORKS
Wi-Fi Specification:	802.11a/b/g/n/ac/ax
Bluetooth Specification:	v5.1
Operating Temperature:	0 ~ 50 °C
Power Type:	PoE input or AC adapter input
Operating Environment:	Indoor Use
Accessories	
Adapter 1#:	Model No.: ADP-30HR B Input Power: 100 - 240V ~ 50/60Hz, 1.0A Output Power: 48VDC/0.66A
Adapter 2#:	Model No.: PD-9001 25GR/AC Input Power: 100 - 240V ~ 50/60Hz, 1.5A Output Power: 55VDC/0.63A

Note: The difference between models is that EUT use different Wi-Fi antenna and appearance, other hardware and software are the same.

2.2. Product Specification Subjective to this Report

Frequency Range:	2400MHz ~ 2483.5MHz
Number of Channels:	40
Data Rate:	1MHz & 2MHz
Type of Modulation:	GFSK
Antenna Gain:	3.2dBi

Note: For other features of this EUT, test report will be issued separately.

2.3. Working Frequencies for this report

Channel	Frequency	Channel	Frequency	Channel	Frequency
00	2402 MHz	01	2404 MHz	02	2406 MHz
03	2408 MHz	04	2410 MHz	05	2412 MHz
06	2414 MHz	07	2416 MHz	08	2418 MHz
09	2420 MHz	10	2422 MHz	11	2424 MHz
12	2426 MHz	13	2428 MHz	14	2430 MHz
15	2432 MHz	16	2434 MHz	17	2436 MHz
18	2438 MHz	19	2440 MHz	20	2442 MHz
21	2444 MHz	22	2446 MHz	23	2448 MHz
24	2450 MHz	25	2452 MHz	26	2454 MHz
27	2456 MHz	28	2458 MHz	29	2460 MHz
30	2462 MHz	31	2464 MHz	32	2466 MHz
33	2468 MHz	34	2470 MHz	35	2472 MHz
36	2474 MHz	37	2476 MHz	38	2478 MHz
39	2480 MHz	--	--	--	--

2.4. Description of Available Antennas

Model No.: AP321

Antenna Type	Frequency Band (GHz)	T _x Paths	Bandwidth (MHz)	Max Peak Gain (dBi)				Directional Gain (dBi)	
				Ant 0	Ant 1	Ant 2	Ant 3	CDD	Beamforming
Wi-Fi Internal Antenna List (2.4GHz 2*2 MIMO, 5GHz 4*4 MIMO)									
Omni Antenna	2400 ~ 2483.5	2	20, 40	3.5	3.5	--	--	3.5	6.51
	5150 ~ 5850	4	20	3.2	3.6	3.7	3.5	3.7	9.52
			40						
			80						
Bluetooth Internal Antenna									
Antenna Type		Frequency Band (GHz)				Max Peak Gain (dBi)			
Omni Antenna		2400 ~ 2483.5				3.2			
Scan Internal Antenna									
Antenna Type		Frequency Band (GHz)				Max Peak Gain (dBi)			
Omni Antenna		2400 ~ 2483.5				3.5			
		5150 ~ 5850				3.5			

Model No.: AP321e

Antenna Type	Frequency Band (GHz)	T _x Paths	Bandwidth (MHz)	Max Peak Gain (dBi)	Directional Gain (dBi)	
					CDD	Beamforming
Wi-Fi Internal Antenna List (2.4GHz 2*2 MIMO, 5GHz 4*4 MIMO)						
Dipole	2400 ~ 2483.5	2	20, 40	3.5	3.5	6.51
	5150 ~ 5850	4	20	6	6	12.02
			40			
			80			
Bluetooth Internal Antenna						
Antenna Type		Frequency Band (GHz)			Max Peak Gain (dBi)	
Omni Antenna		2400 ~ 2483.5			3.2	
Scan Internal Antenna						
Antenna Type		Frequency Band (GHz)			Max Peak Gain (dBi)	
Omni Antenna		2400 ~ 2483.5			3.5	
		5150 ~ 5850			3.5	

Note 1: The EUT supports Cyclic Delay Diversity (CDD) technology for 802.11a/b/g/n/ac/ax mode.

Note 2: The EUT also supports Beam Forming technology for 802.11n/ac/ax.

Note 3: The EUT supports Cyclic Delay Diversity (CDD) mode, and CDD signals are correlated.

If all antennas have the same gain, G_{ANT} , Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

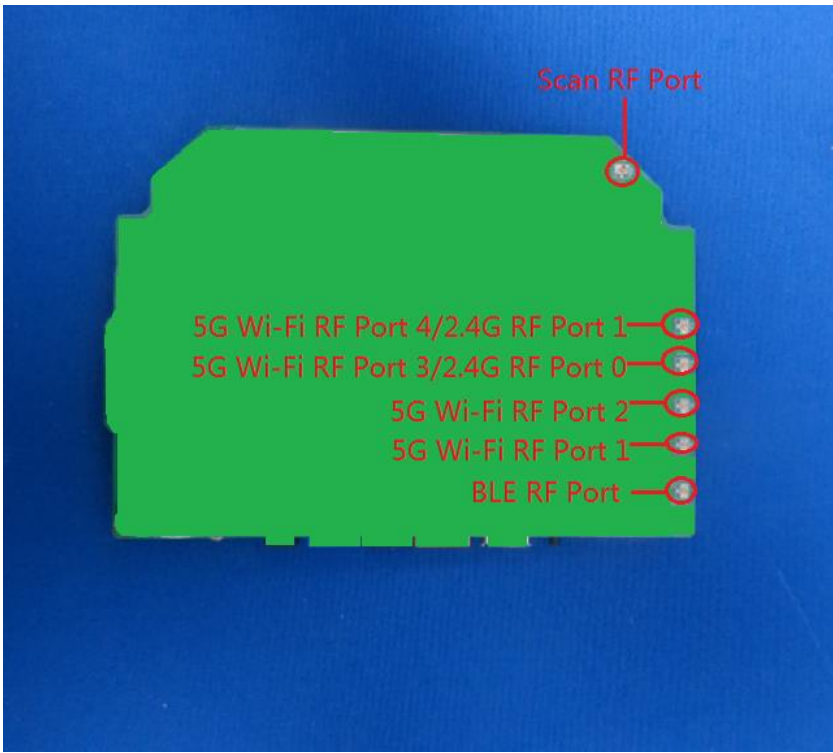
- For power spectral density (PSD) measurements on all devices,
Array Gain = $10 \log (N_{ANT} / N_{SS})$ dB = 3.01;
- For power measurements on IEEE 802.11 devices,
Array Gain = 0 dB for $N_{ANT} \leq 4$;

If antenna gains are not equal, Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain.

Note 4: The EUT also supports Beam Forming mode, and the Beam Forming support 802.11n/ac/ax, not include 802.11a/b/g. The directional gain = $10 \cdot \log [(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}]$ dBi.

2.5. Description of Antenna RF Port

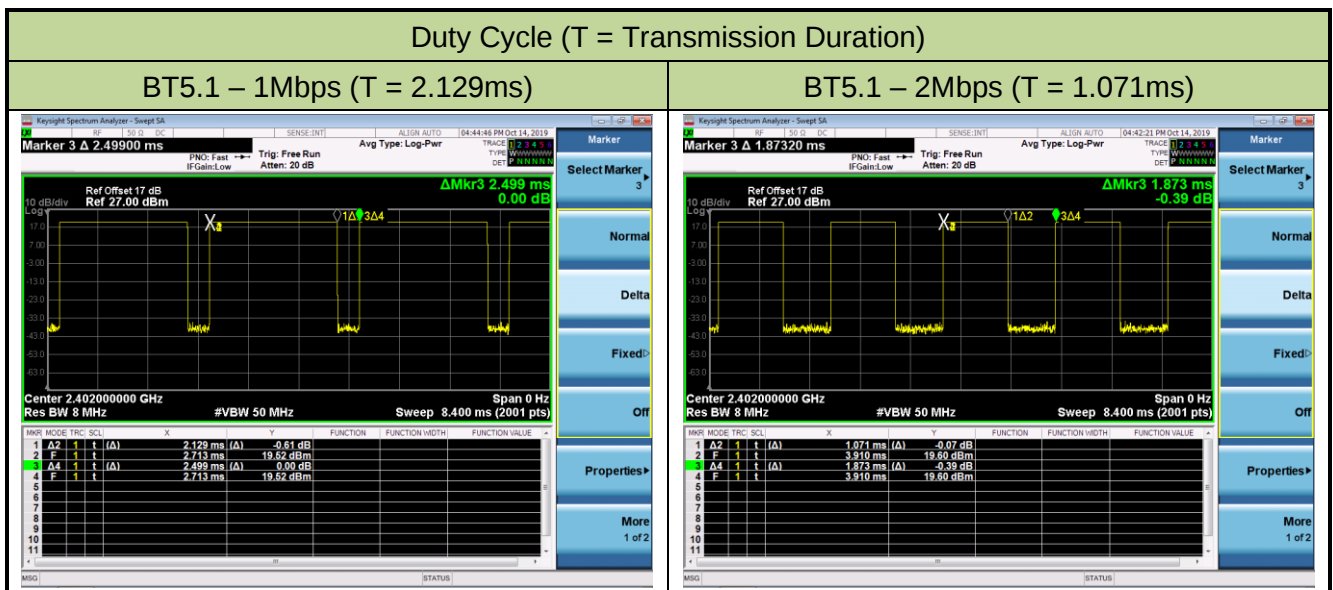
Antenna RF Port								
--	2.4GHz RF Port		5GHz RF Port				Scan RF Port	BLE RF Port
Software Control Port	Ant 0	Ant 1	Ant 1	Ant 2	Ant 3	Ant 4	Ant 0	Ant 0



2.6. Duty Cycle

The maximum achievable duty cycle was determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Test Mode	Duty Cycle
BT5.1 – 1Mbps	85.19%
BT5.1 – 2Mbps	57.18%



2.7. Test Configuration

The unit was tested per the guidance of ANSI C63.10-2013. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

2.8. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.9. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase.

However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

2.10. Test Software

The test utility software used during testing was “Console”.

3. DESCRIPTION OF TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013), and the guidance provided in ANSI C63.10-2013 were used in the measurement.

Deviation from measurement procedure.....None

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions were used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the Antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable. For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive Antenna height using a broadband Antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn Antennas were used. For frequencies below 30MHz, a calibrated loop Antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband Antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-40GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive Antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn Antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive Antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive Antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn Antenna, the horn Antenna should be always directed to the EUT when rising height.

4. ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 antenna is **permanently attached**.
- There are no provisions for connection to an external antenna.

Conclusion:

The unit complies with the requirement of §15.203.

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions - SR2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR3	MRTSUE06185	1 year	2020/04/15
Two-Line V-Network	R&S	ENV 216	MRTSUE06002	1 year	2020/06/13
Two-Line V-Network	R&S	ENV 216	MRTSUE06003	1 year	2020/06/13
Thermohygrometer	Testo	608-H1	MRTSUE06404	1 year	2020/08/08
Shielding Room	MIX-BEP	Chamber-SR2	MRTSUE06215	N/A	N/A

Radiated Emissions - AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2020/08/01
PXA Signal Analyzer	Keysight	9030B	MRTSUE06395	1 year	2020/09/03
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2020/11/10
Bilog Period Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2020/03/31
Broad Band Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2020/10/13
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06024	1 year	2020/12/17
Microwave System Amplifier	Agilent	83017A	MRTSUE06076	1 year	2020/11/15
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2020/06/11
Thermohygrometer	Testo	608-H1	MRTSUE06403	1 year	2020/08/08
Anechoic Chamber	TDK	Chamber-AC1	MRTSUE06212	1 year	2020/04/30

Radiated Emission - AC2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Keysight	N9038A	MRTSUE06125	1 year	2020/08/01
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2020/11/10
Bilog Period Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2020/10/13
Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06171	1 year	2020/10/27
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06024	1 year	2020/12/17
Broadband Coaxial Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2020/11/15
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2020/06/11
Temperature/Humidity Meter	Minggao	ETH529	MRTSUE06170	1 year	2020/12/13
Anechoic Chamber	RIKEN	Chamber-AC2	MRTSUE06213	1 year	2020/04/30

Conducted Test Equipment - TR3

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2020/04/15
EXA Signal Analyzer	Keysight	N9010B	MRTSUE06452	1 year	2020/07/11
Signal Analyzer	R&S	FSV40	MRTSUE06218	1 year	2020/04/15
Power Meter	Agilent	U2021XA	MRTSUE06030	1 year	2020/11/18
USB wideband power sensor	Keysight	U2021XA	MRTSUE06446	1 year	2020/06/30
USB wideband power sensor	Keysight	U2021XA	MRTSUE06447	1 year	2020/06/30
Bluetooth Test Set	Anritsu	MT8852B-042	MRTSUE06389	1 year	2020/06/13
Audio Analyzer	Agilent	U8903B	MRTSUE06143	1 year	2020/06/13
Modulation Analyzer	HP	8901A	MRTSUE06098	1 year	2020/10/10
Wideband Radio Communication Tester	R&S	CMW 500	MRTSUE06243	1 year	2020/11/07
DC Power Supply	GWINSTEK	DPS-3303C	MRTSUE06064	N/A	N/A
Temperature & Humidity Chamber	BAOYT	BYH-150CL	MRTSUE06051	1 year	2020/11/07
Thermohygrometer	testo	608-H1	MRTSUE06401	1 year	2020/08/08

Software	Version	Function
EMI Software	V3	EMI Test Software

6. MEASUREMENT UNCERTAINTY

Where relevant, the following test 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 $k = 2$.

Conducted Emission Measurement - SR2

The maximum measurement uncertainty is evaluated as:

9kHz~150kHz: 3.84dB

150kHz~30MHz: 3.46dB

Radiated Emission Measurement - AC1

The maximum measurement uncertainty is evaluated as:

Horizontal: 30MHz~300MHz: 4.07dB

300MHz~1GHz: 3.63dB

1GHz~18GHz: 4.16dB

Vertical: 30MHz~300MHz: 4.18dB

300MHz~1GHz: 3.60dB

1GHz~18GHz: 4.76dB

Radiated Emission Measurement - AC2

The maximum measurement uncertainty is evaluated as:

Horizontal: 30MHz~300MHz: 3.75dB

300MHz~1GHz: 3.53dB

1GHz~18GHz: 4.28dB

Vertical: 30MHz~300MHz: 3.86dB

300MHz~1GHz: 3.53dB

1GHz~18GHz: 4.33dB

7. TEST RESULT

7.1. Summary

FCC Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(2)	6dB Bandwidth	$\geq 500\text{kHz}$	Conducted	Pass	Section 7.2
15.247(b)(3)	Output Power	$\leq 30\text{dBm}$		Pass	Section 7.3
15.247(e)	Power Spectral Density	$\leq 8\text{dBm}/3\text{kHz}$		Pass	Section 7.4
15.247(d)	Band Edge / Out-of-Band Emissions	$\leq 20\text{dBc}$ (Peak)		Pass	Section 7.5
15.205 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209	Radiated	Pass	Section 7.6 & 7.7
15.207	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits	Line Conducted	Pass	Section 7.8

Notes:

- 1) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- 2) All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst case emissions.
- 3) This report is supplemented to MRT Original "1912RSU023-U1" Report, FCC ID: 2AI9TOAW-AP132X updating applicant, product name and model number.

7.2. 6dB Bandwidth Measurement

7.2.1. Test Limit

The minimum 6dB bandwidth shall be at least 500 kHz.

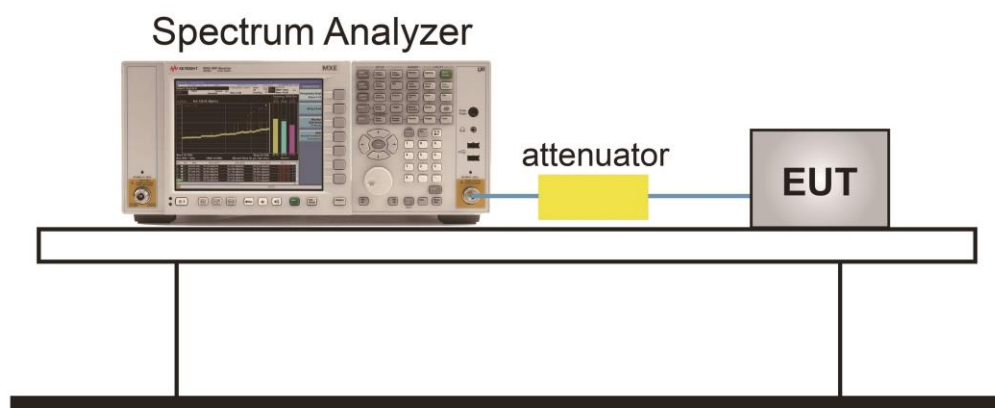
7.2.2. Test Procedure used

ANSI C63.10-2013 - Section 11.8.2 Option 2

7.2.3. Test Setting

1. The Spectrum's automatic bandwidth measurement capability was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to $X = 6$. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. Set RBW = 100 kHz
3. $VBW \geq 3 \times RBW$
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. Allow the trace was allowed to stabilize

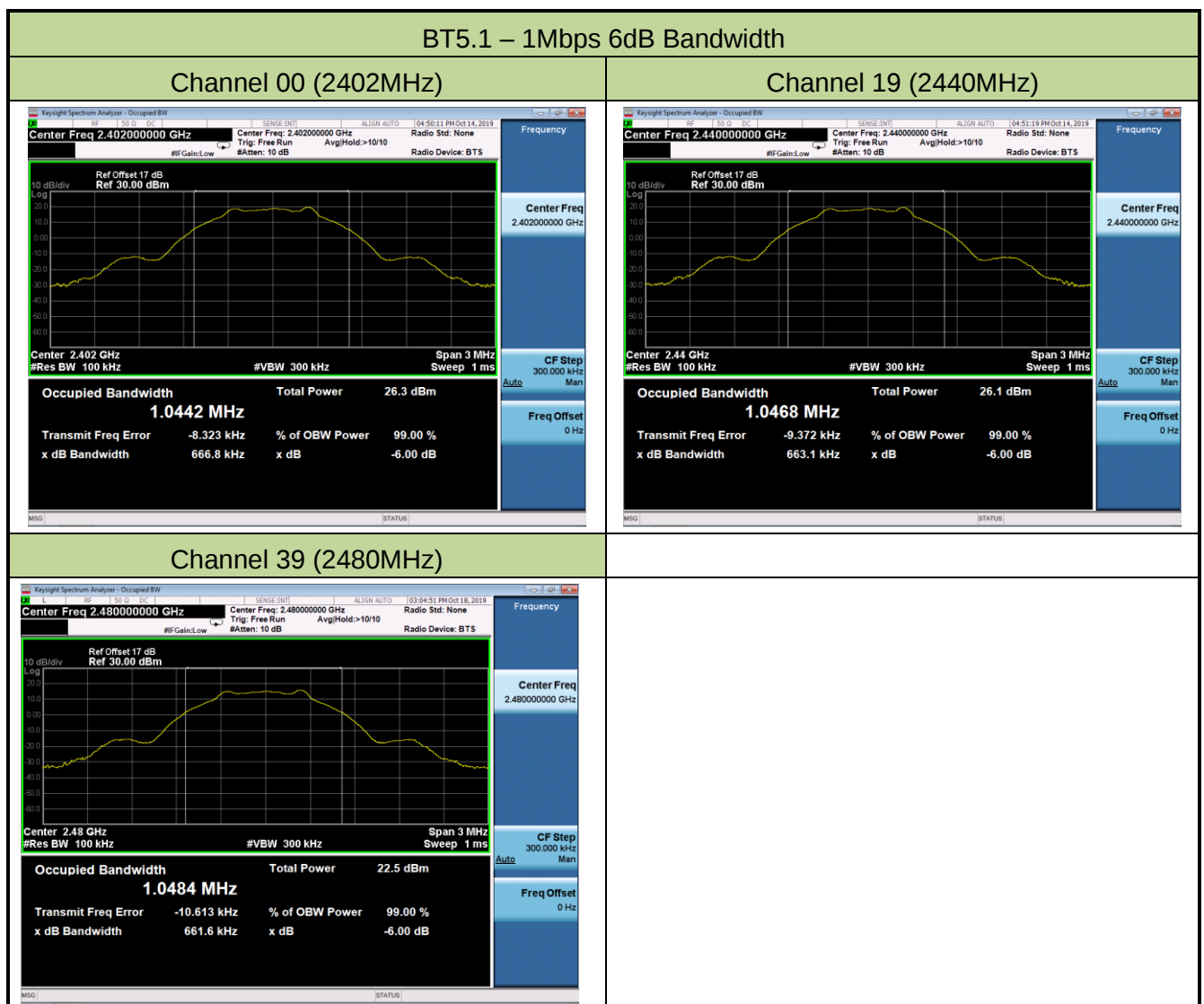
7.2.4. Test Setup



7.2.5. Test Result

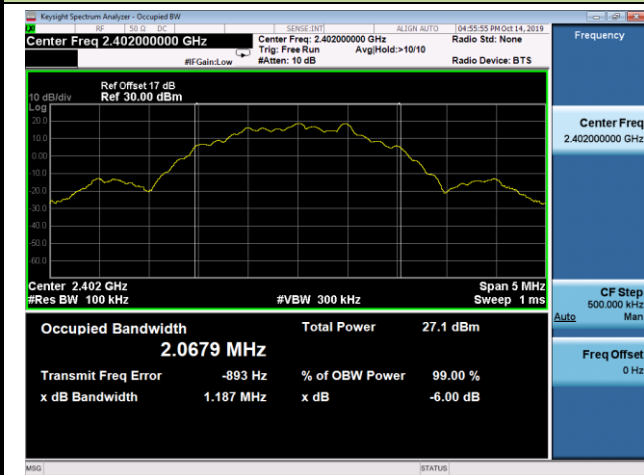
Product	HAN Access Point	Temperature	25°C
Test Engineer	Amy Zhang	Relative Humidity	52%
Test Site	TR3	Test Date	2019/10/14

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
BT5.1	1	00	2402	0.67	≥ 0.5	Pass
		19	2440	0.66	≥ 0.5	Pass
		39	2480	0.66	≥ 0.5	Pass
	2	00	2402	1.19	≥ 0.5	Pass
		19	2440	1.18	≥ 0.5	Pass
		39	2480	1.19	≥ 0.5	Pass

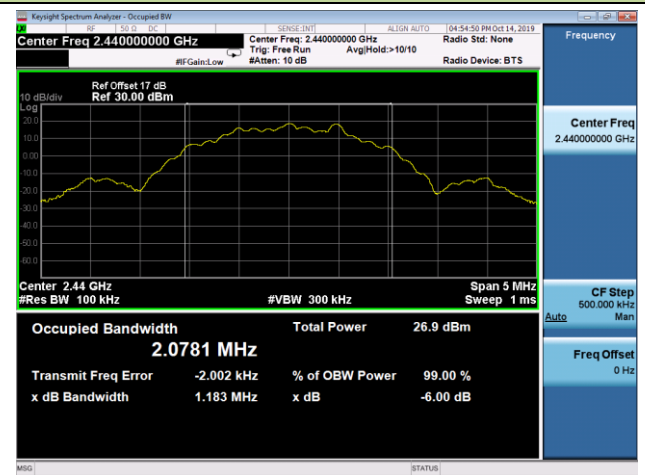


BT5.1 – 2Mbps 6dB Bandwidth

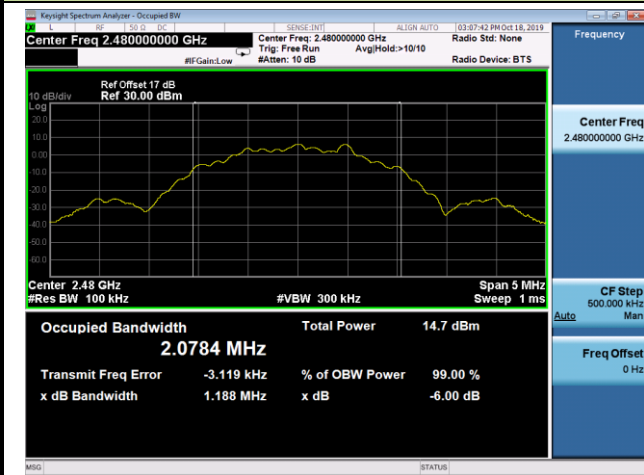
Channel 00 (2402MHz)



Channel 19 (2440MHz)



Channel 39 (2480MHz)



7.3. Output Power Measurement

7.3.1. Test Limit

The maximum out power shall be less 1 Watt (30dBm).

7.3.2. Test Procedure Used

ANSI C63.10-2013 - Section 11.9.2.3

7.3.3. Test Setting

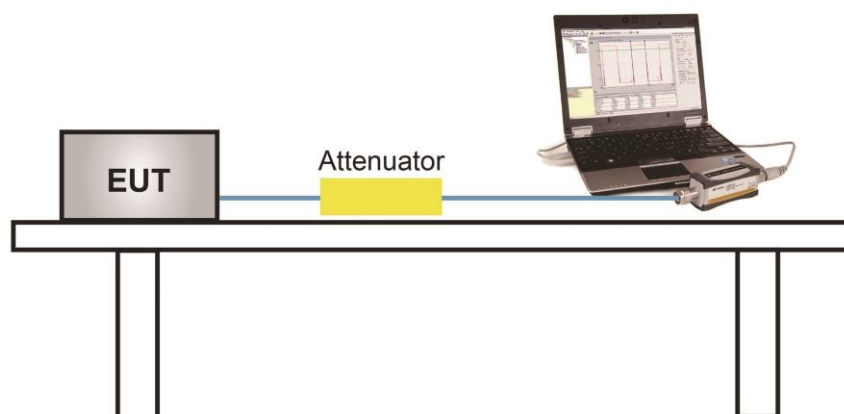
Method PKPM1 (Peak Power Measurement of Signals with DTS BW $\leq$ 50MHz)

Peak power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The pulse sensor employs a VBW = 50MHz so this method was only used for signals whose DTS bandwidth was less than or equal to 50MHz.

Method AVGPM-G (Measurement using a gated RF average-reading power meter)

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.

7.3.4. Test Setup



7.3.5. Test Result of Output Power

Product	HAN Access Point	Temperature	25°C
Test Engineer	Amy Zhang	Relative Humidity	52%
Test Site	TR3	Test Date	2019/10/14

Test Result of Peak Output Power

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Result
BT5.1	1	00	2402	19.31	≤ 30.00	Pass
		19	2440	19.24	≤ 30.00	Pass
		39	2480	15.88	≤ 30.00	Pass
	2	00	2402	19.21	≤ 30.00	Pass
		19	2440	19.25	≤ 30.00	Pass
		39	2480	7.30	≤ 30.00	Pass

Test Result of Average Output Power (Reporting Only)

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	Average Power (dBm)	Limit (dBm)	Result
BT5.1	1	00	2402	19.20	≤ 30.00	Pass
		19	2440	19.09	≤ 30.00	Pass
		39	2480	15.74	≤ 30.00	Pass
	2	00	2402	19.33	≤ 30.00	Pass
		19	2440	19.10	≤ 30.00	Pass
		39	2480	7.07	≤ 30.00	Pass

7.4. Power Spectral Density Measurement

7.4.1. Test Limit

The maximum permissible power spectral density is 8dBm in any 3 kHz band.

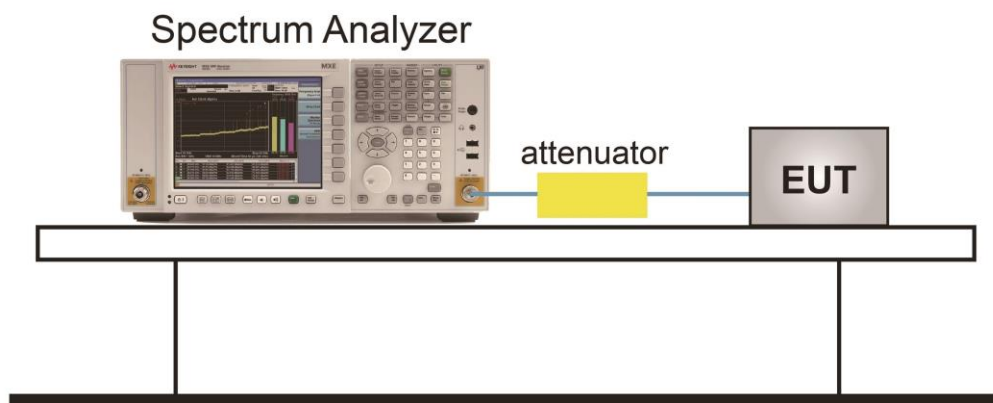
7.4.2. Test Procedure Used

ANSI C63.10 Section 11.10.2

7.4.3. Test Setting

1. Analyzer was set to the center frequency of the DTS channel under investigation
2. Span = 1.5 times the DTS channel bandwidth
3. RBW = 3kHz
4. VBW = 10kHz
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Trace was allowed to stabilize

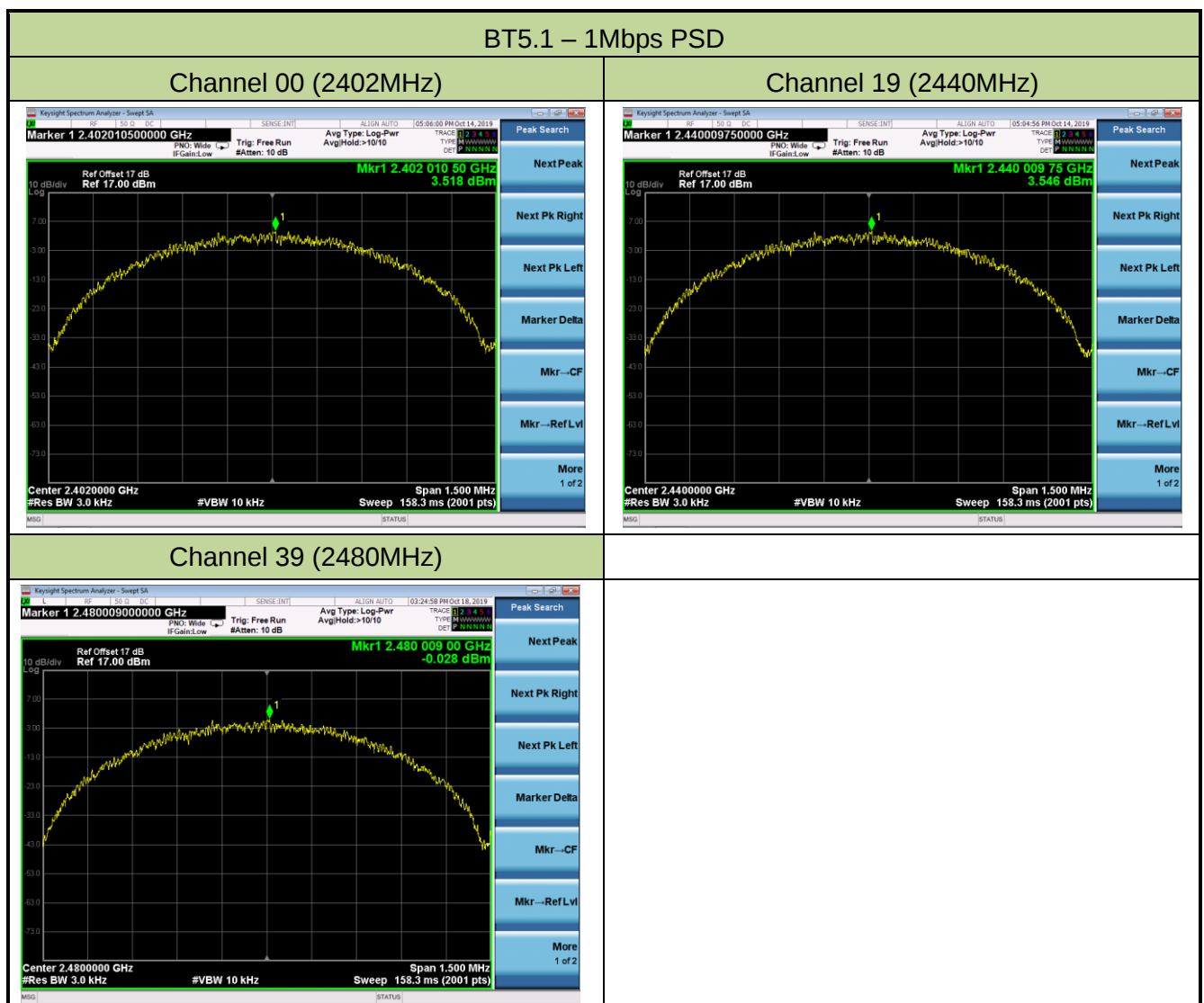
7.4.4. Test Setup



7.4.5. Test Result

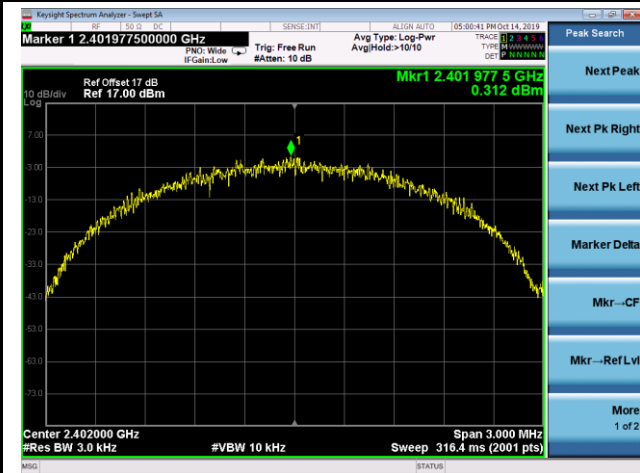
Product	HAN Access Point	Temperature	25°C
Test Engineer	Amy Zhang	Relative Humidity	52%
Test Site	TR3	Test Date	2019/10/14

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	PSD Result (dBm / 3kHz)	Limit (dBm / 3kHz)	Result
BT5.1	1	00	2402	3.52	≤ 8.00	Pass
		19	2440	3.55	≤ 8.00	Pass
		39	2480	-0.03	≤ 8.00	Pass
	2	00	2402	0.31	≤ 8.00	Pass
		19	2440	0.29	≤ 8.00	Pass
		39	2480	-11.91	≤ 8.00	Pass



BT5.1 – 2Mbps PSD

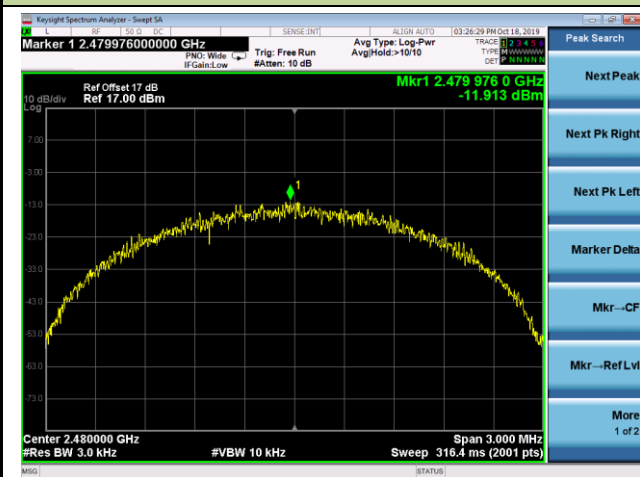
Channel 00 (2402MHz)



Channel 19 (2440MHz)



Channel 39 (2480MHz)



7.5. Conducted Band Edge and Out-of-Band Emissions

7.5.1. Test Limit

The limit for out-of-band spurious emissions at the band edge is 20dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100kHz bandwidth per the PSD procedure.

7.5.2. Test Procedure Used

ANSI C63.10 Section 11.11

7.5.3. Test Setting

Reference level measurement

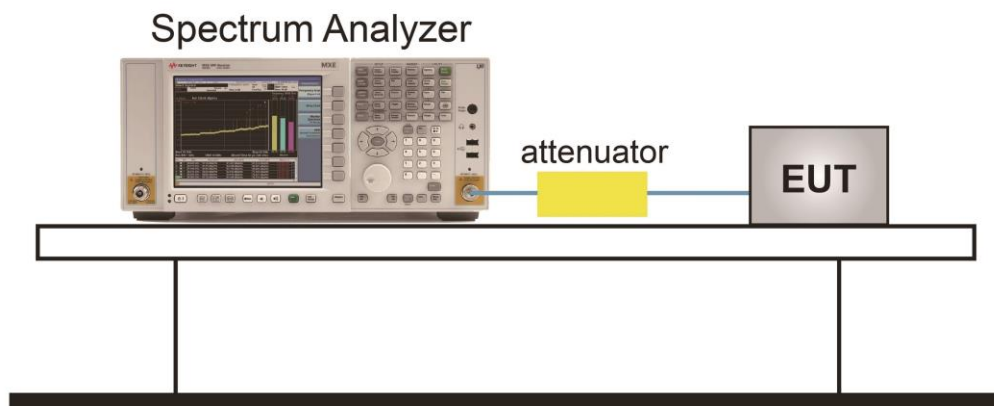
1. Set instrument center frequency to DTS channel center frequency
2. Set the span to ≥ 1.5 times the DTS bandwidth
3. Set the RBW = 100 kHz
4. Set the VBW $\geq 3 \times$ RBW
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Allow trace to fully stabilize

Emission level measurement

1. Set the center frequency and span to encompass frequency range to be measured
2. RBW = 100kHz
3. VBW = 300kHz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Notes

1. RBW was set to 1.3MHz rather than 100KHz in order to increase the measurement speed.
2. The display line shown in the following plots denotes the limit at 20dB below the fundamental emission level measured in a 100KHz bandwidth. However, since the traces in the following plots are measured with a 1.3MHz RBW, the display line may not necessarily appear to be 20dB below the level of the fundamental in a 1.3MHz bandwidth.
3. For plots showing conducted spurious emissions near the limit, the frequencies were investigated with a reduced RBW to ensure that no emissions were present.

7.5.4.Test Setup

7.5.5. Test Result

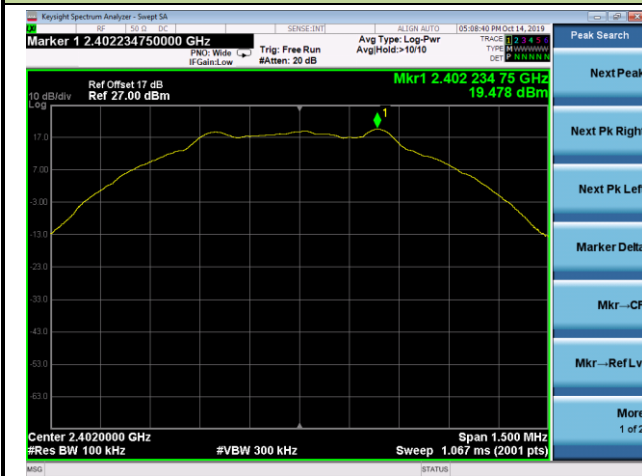
Product	HAN Access Point	Temperature	25°C
Test Engineer	Amy Zhang	Relative Humidity	52%
Test Site	TR3	Test Date	2019/10/14

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	Limit	Result
BT5.1	1	00	2402	20dBc	Pass
		19	2440	20dBc	Pass
		39	2480	20dBc	Pass
	2	00	2402	20dBc	Pass
		19	2440	20dBc	Pass
		39	2480	20dBc	Pass

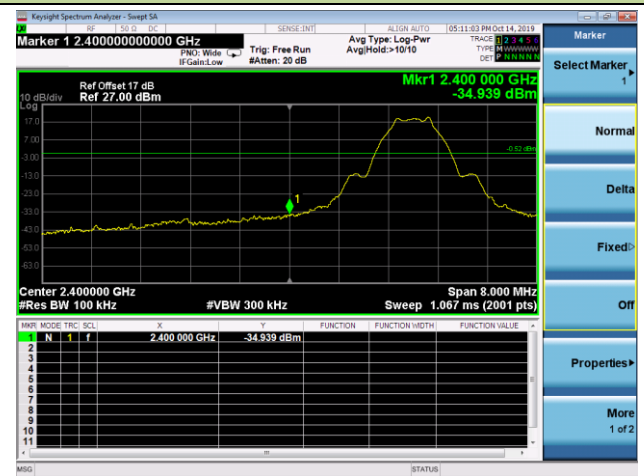
BT5.1 – 1Mbps Out-of-Band Emissions

Channel 00 (2402MHz)

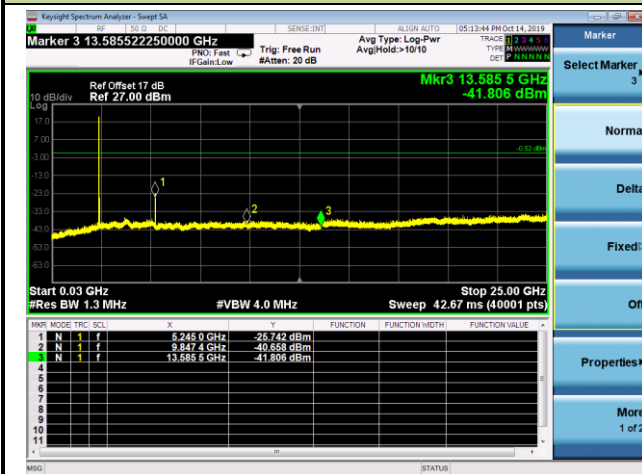
100kHz PSD reference Level



Low Band Edge

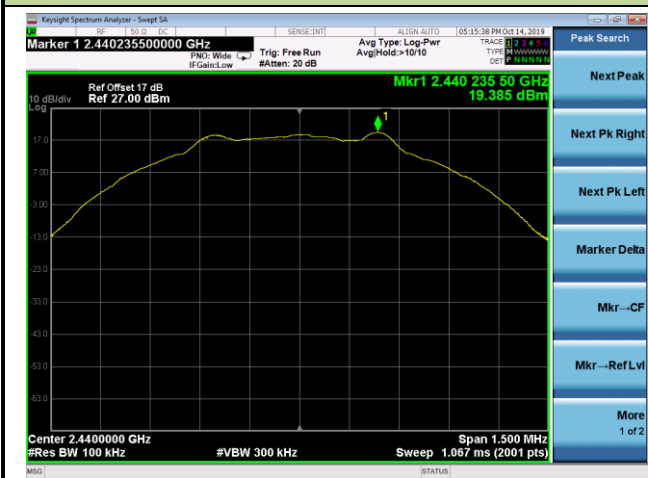


Spurious Emission 30MHz ~ 25GHz

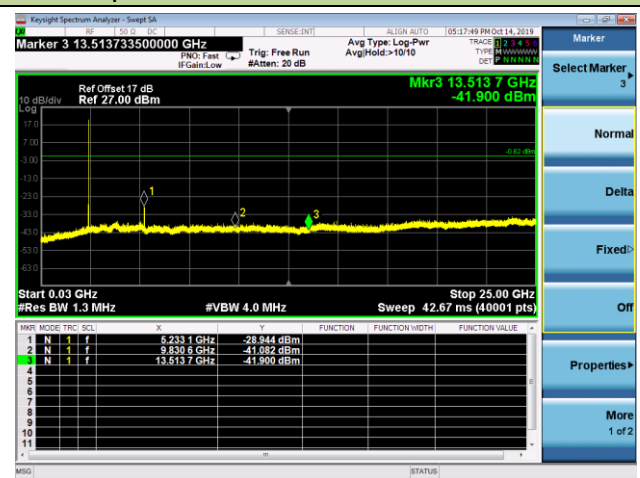


Channel 19 (2440MHz)

100kHz PSD reference Level

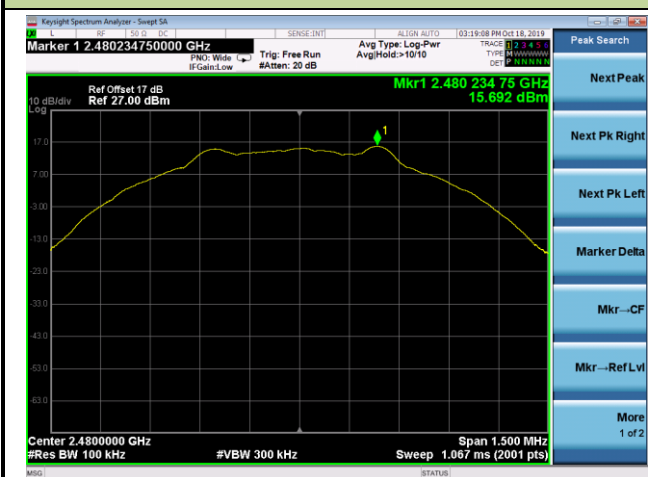


Spurious Emission 30MHz ~ 25GHz

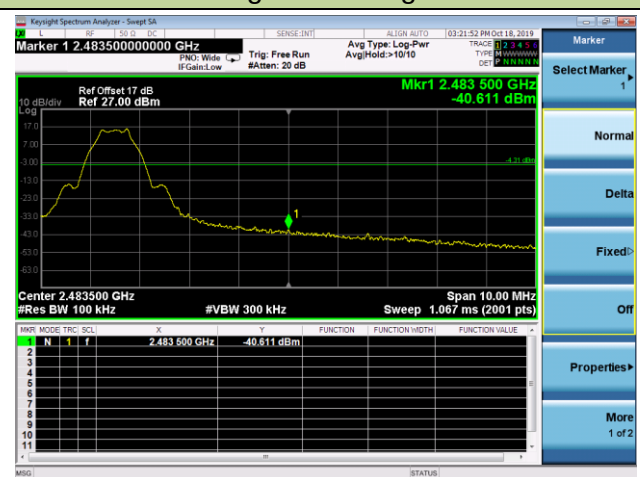


Channel 39 (2480MHz)

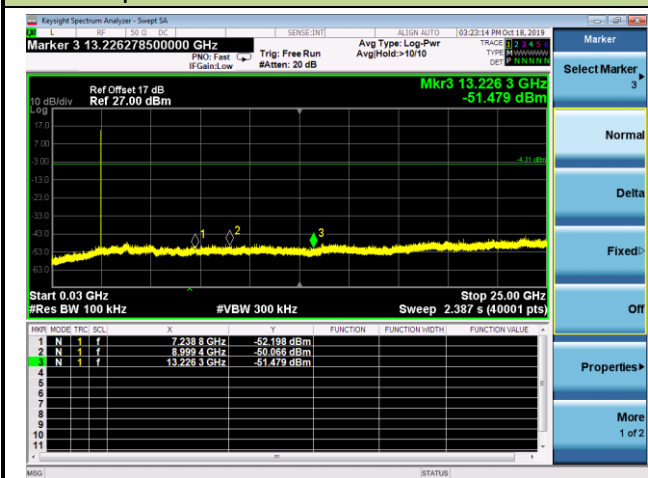
100kHz PSD reference Level



High Band Edge



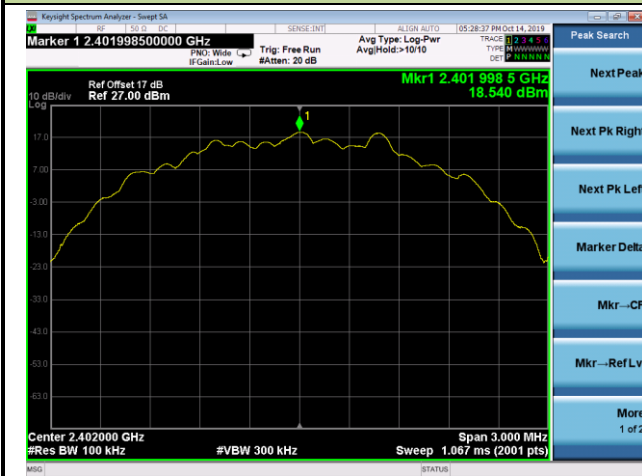
Spurious Emission 30MHz ~ 25GHz



BT5.1 – 2Mbps Out-of-Band Emissions

Channel 00 (2402MHz)

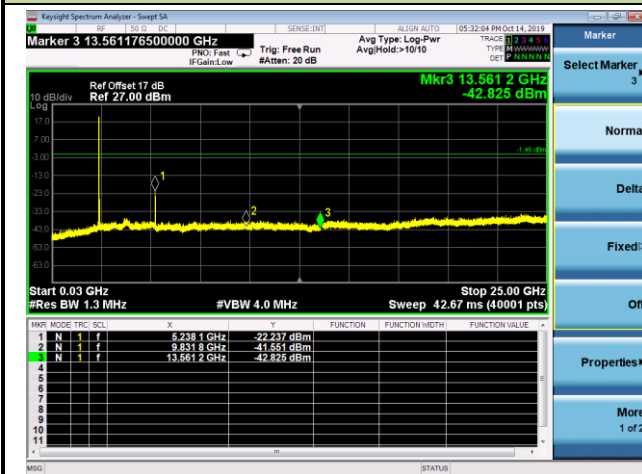
100kHz PSD reference Level



Low Band Edge

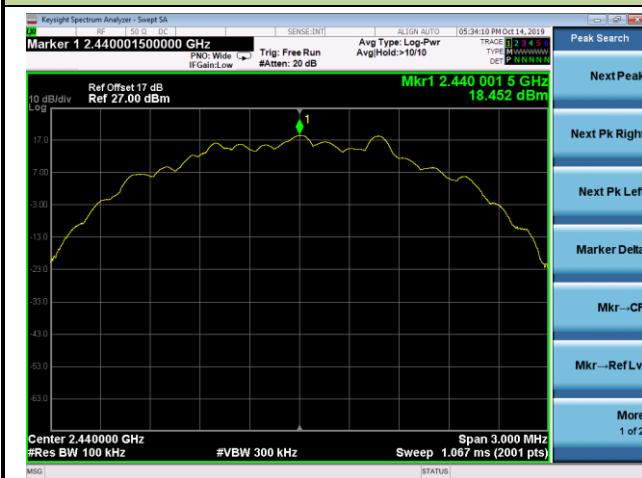


Spurious Emission 30MHz ~ 25GHz

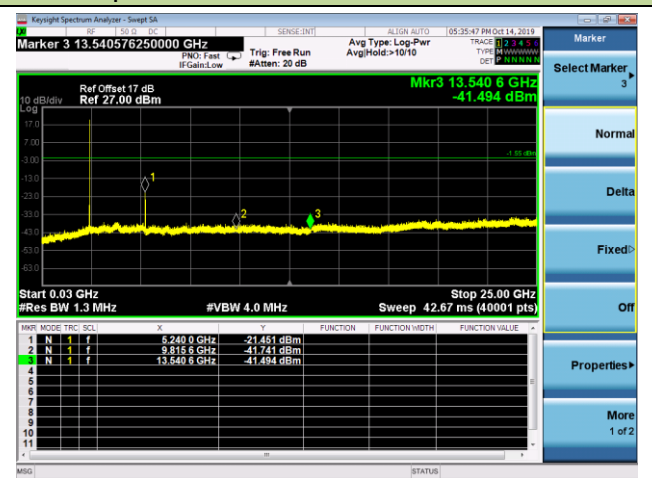


Channel 19 (2440MHz)

100kHz PSD reference Level

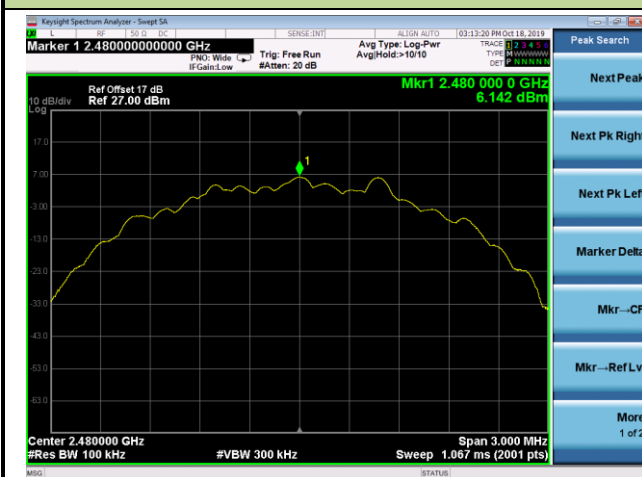


Spurious Emission 30MHz ~ 25GHz



Channel 39 (2480MHz)

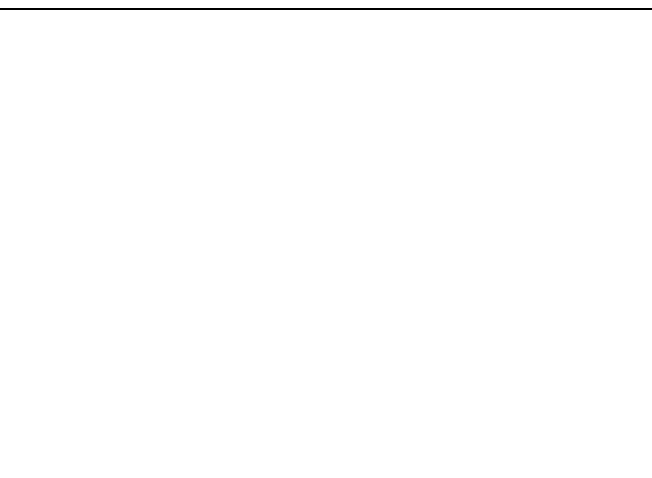
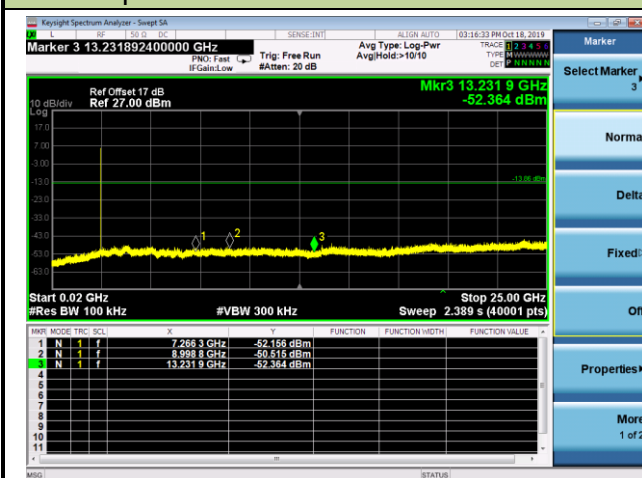
100kHz PSD reference Level



High Band Edge



Spurious Emission 30MHz ~ 25GHz



7.6. Radiated Spurious Emission Measurement

7.6.1. Test Limit

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency (MHz)	Field Strength (uV/m)	Measured Distance (Meters)
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

7.6.2. Test Procedure Used

ANSI C63.10 Section 6.3 (General Requirements)

ANSI C63.10 Section 6.4 (Standard test method below 30MHz)

ANSI C63.10 Section 6.5 (Standard test method above 30MHz to 1GHz)

ANSI C63.10 Section 6.6 (Standard test method above 1GHz)

7.6.3. Test Setting

Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = as specified in Table 1
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Table 1 - RBW as a function of frequency

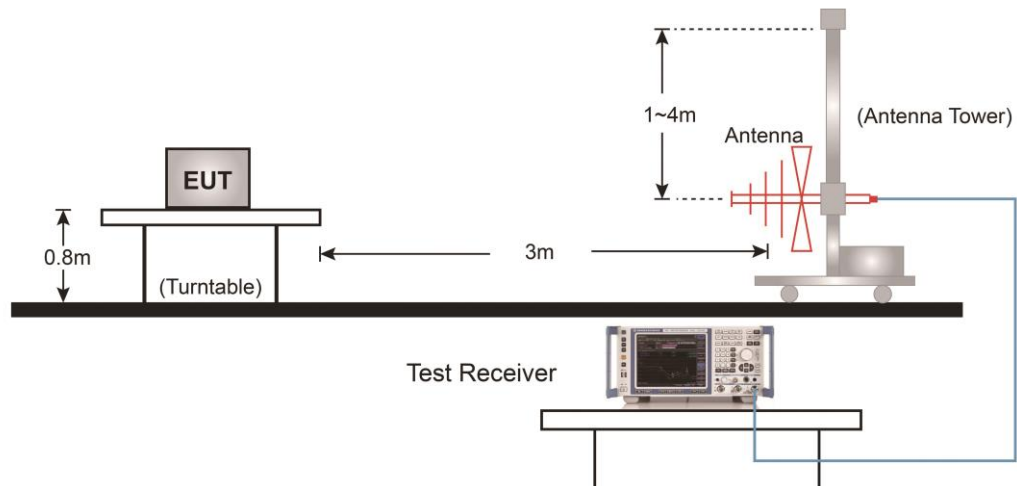
Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000 MHz	1 MHz

Average Field Strength Measurements

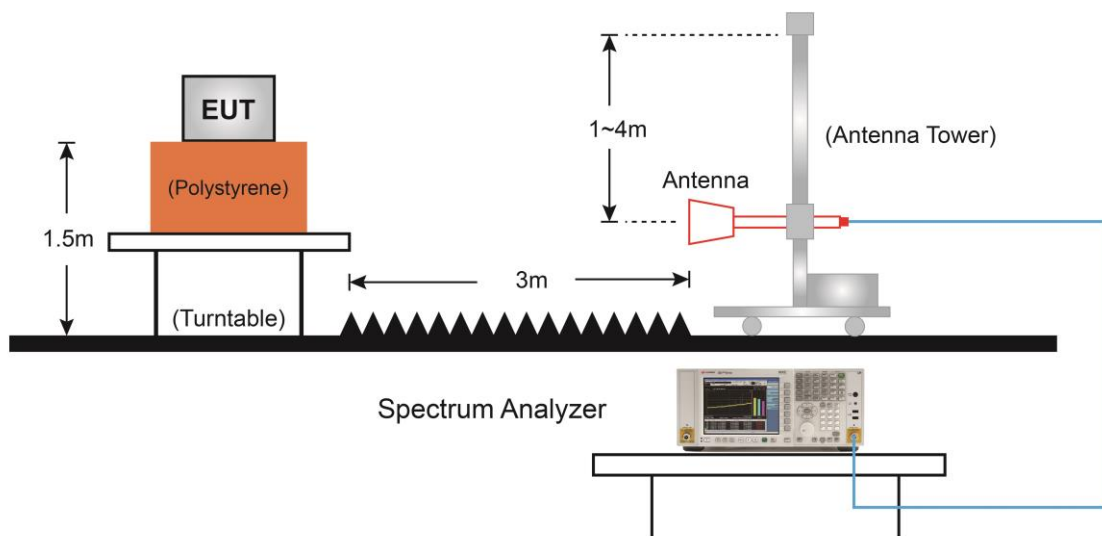
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW $\geq 1/T$
4. De As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to "Voltage" regardless of the display mode
5. Detector = Peak
6. Sweep time = auto
7. Trace mode = max hold
8. Allow max hold to run for at least 50 times (1/duty cycle) traces

7.6.4. Test Setup

Below 1GHz Test Setup:



Above 1GHz Test Setup:



7.6.5.Test Result

Test Mode:	BT5.1 – 1Mbps	Test Site:	AC1
Test Channel:	00	Test Engineer:	Cloud Guo
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	3966.5	37.4	2.4	39.7	74.0	-34.3	Peak	Horizontal
	4859.0	35.4	5.7	41.1	74.0	-32.9	Peak	Horizontal
*	6270.0	35.6	8.4	44.0	94.3	-50.3	Peak	Horizontal
*	8633.0	34.9	13.1	48.0	94.3	-46.3	Peak	Horizontal
	3839.0	37.8	2.1	39.9	74.0	-34.1	Peak	Vertical
	5003.5	38.1	6.1	44.2	74.0	-29.8	Peak	Vertical
*	6567.5	35.6	9.5	45.2	94.3	-49.1	Peak	Vertical
*	7970.0	35.1	12.5	47.6	94.3	-46.7	Peak	Vertical

Note 1: “*” is not in restricted band, its limit is 20dBc of the fundamental emission level (114.3dBμV/m) or 15.209 which is higher.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Test Mode:	BT5.1 – 1Mbps	Test Site:	AC1
Test Channel:	19	Test Engineer:	Cloud Guo
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	3805.0	37.8	1.9	39.6	74.0	-34.4	Peak	Horizontal
	5054.5	36.2	6.3	42.5	74.0	-31.5	Peak	Horizontal
*	6066.0	36.3	7.6	43.9	94.2	-50.3	Peak	Horizontal
*	8573.5	34.9	12.8	47.7	94.2	-46.5	Peak	Horizontal
	3958.0	37.2	2.4	39.5	74.0	-34.5	Peak	Vertical
	4646.5	38.2	4.8	43.0	74.0	-31.0	Peak	Vertical
*	6142.5	35.7	7.9	43.5	94.2	-50.7	Peak	Vertical
*	7910.5	35.9	12.4	48.2	94.2	-46.0	Peak	Vertical

Note 1: “*” is not in restricted band, its limit is 20dBc of the fundamental emission level (114.2dBμV/m) or 15.209 which is higher.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Test Mode:	BT5.1 – 1Mbps	Test Site:	AC1
Test Channel:	39	Test Engineer:	Cloud Guo
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4085.5	37.8	2.7	40.6	74.0	-33.4	Peak	Horizontal
	4706.0	36.9	5.1	42.0	74.0	-32.0	Peak	Horizontal
*	6618.5	36.3	9.6	45.9	92.0	-46.1	Peak	Horizontal
*	7978.5	35.5	12.6	48.1	92.0	-43.9	Peak	Horizontal
	4077.0	37.8	2.7	40.4	74.0	-33.6	Peak	Vertical
	5012.0	34.7	6.1	40.8	74.0	-33.2	Peak	Vertical
*	6644.0	35.8	9.6	45.4	92.0	-46.6	Peak	Vertical
*	8786.0	35.2	13.3	48.5	92.0	-43.5	Peak	Vertical

Note 1: “*” is not in restricted band, its limit is 20dBc of the fundamental emission level (112.0dBμV/m) or 15.209 which is higher.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Test Mode:	BT5.1 – 2Mbps	Test Site:	AC1
Test Channel:	00	Test Engineer:	Cloud Guo
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4281.0	36.4	3.5	39.9	74.0	-34.1	Peak	Horizontal
	4969.5	36.4	5.9	42.3	74.0	-31.7	Peak	Horizontal
*	6703.5	35.7	9.5	45.2	94.4	-49.2	Peak	Horizontal
*	7978.5	35.7	12.6	48.3	94.4	-46.1	Peak	Horizontal
	3830.5	37.7	2.0	39.7	74.0	-34.3	Peak	Vertical
	5080.0	37.7	6.4	44.1	74.0	-29.9	Peak	Vertical
*	5734.5	34.5	6.9	41.5	94.4	-52.9	Peak	Vertical
*	8012.5	35.7	12.7	48.4	94.4	-46.0	Peak	Vertical

Note 1: “*” is not in restricted band, its limit is 20dBc of the fundamental emission level (114.4dBμV/m) or 15.209 which is higher.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Test Mode:	BT5.1 – 2Mbps	Test Site:	AC1
Test Channel:	19	Test Engineer:	Cloud Guo
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4017.5	36.8	2.5	39.3	74.0	-34.7	Peak	Horizontal
	5105.5	35.7	6.4	42.1	74.0	-31.9	Peak	Horizontal
*	6431.5	35.4	8.9	44.3	94.5	-50.2	Peak	Horizontal
*	8633.0	35.1	13.1	48.2	94.5	-46.3	Peak	Horizontal
	4187.5	37.5	3.1	40.6	74.0	-33.4	Peak	Vertical
	5003.5	37.1	6.1	43.2	74.0	-30.8	Peak	Vertical
*	6423.0	35.8	8.9	44.7	94.5	-49.8	Peak	Vertical
*	8004.0	34.9	12.8	47.6	94.5	-46.9	Peak	Vertical

Note 1: “*” is not in restricted band, its limit is 20dBc of the fundamental emission level (114.5dBμV/m) or 15.209 which is higher.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Test Mode:	BT5.1 – 2Mbps	Test Site:	AC1
Test Channel:	39	Test Engineer:	Cloud Guo
Remark:	1. Average measurement was not performed if peak level lower than average limit. 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	4060.0	37.7	2.7	40.4	74.0	-33.6	Peak	Horizontal
	5063.0	35.4	6.4	41.8	74.0	-32.2	Peak	Horizontal
*	6151.0	35.4	7.9	43.3	83.4	-40.1	Peak	Horizontal
*	8709.5	36.2	13.2	49.4	83.4	-34.0	Peak	Horizontal
	3958.0	37.4	2.4	39.7	74.0	-34.3	Peak	Vertical
	5003.5	36.9	6.1	43.0	74.0	-31.0	Peak	Vertical
*	6618.5	36.7	9.6	46.3	83.4	-37.1	Peak	Vertical
*	7987.0	34.4	12.6	47.1	83.4	-36.3	Peak	Vertical

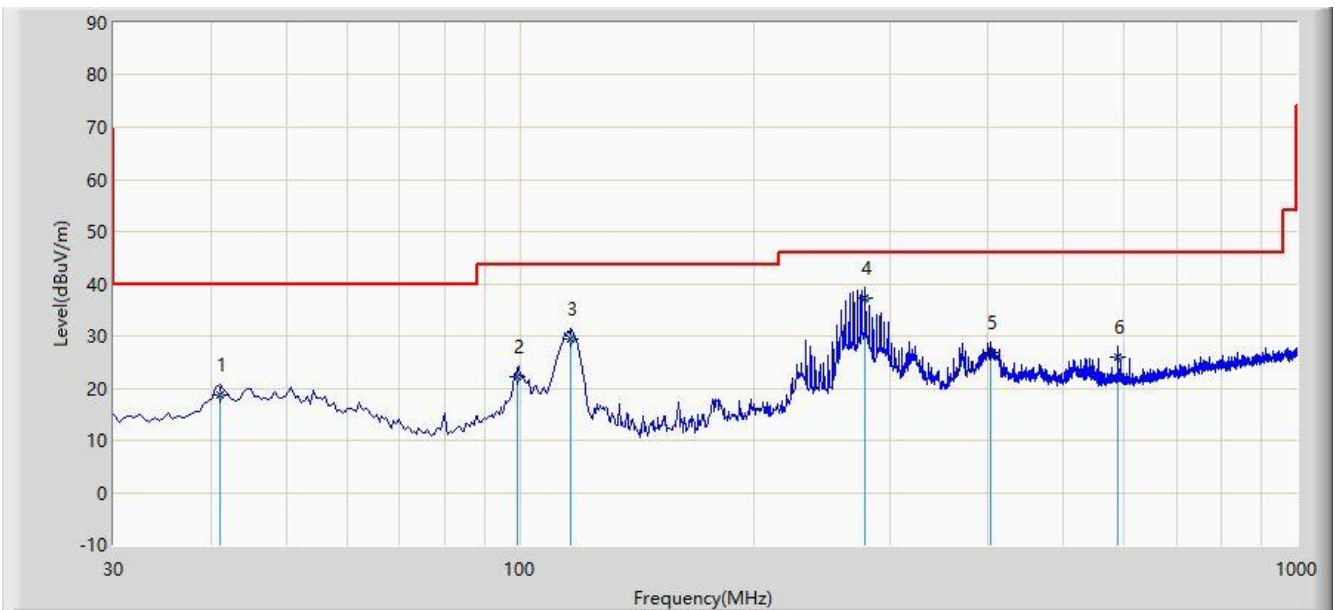
Note 1: “*” is not in restricted band, its limit is 20dBc of the fundamental emission level (103.4dBμV/m) or 15.209 which is higher.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

The worst case of Radiated Emission below 1GHz:

Site: AC2	Time: 2019/10/09 - 21:03
Limit: FCC_Part15.209_RSE(3m)	Engineer: David Lv
Probe: VULB9162_0.03-8GHz	Polarity: Horizontal
EUT: HAN Access Point	Power: AC 120V/60Hz
Worse Case Mode: Transmit by BLE at channel 2402MHz	



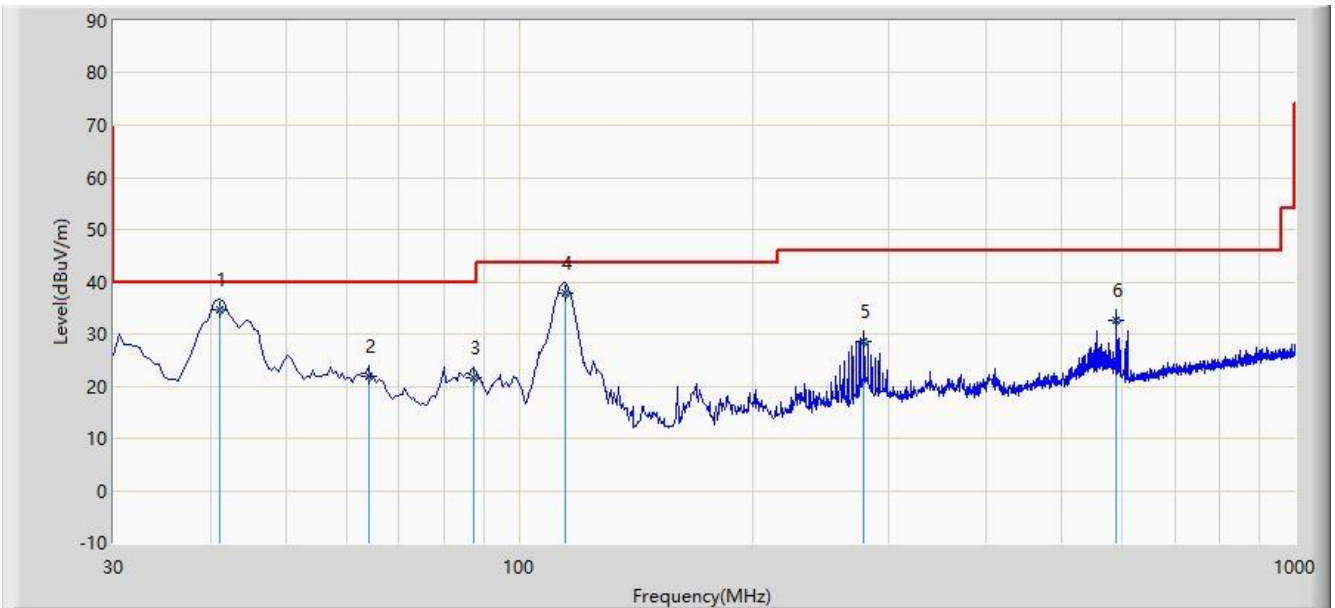
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			41.155	18.701	4.698	-21.299	40.000	14.002	QP
2			99.362	22.058	9.289	-21.442	43.500	12.769	QP
3			116.330	29.416	17.701	-14.084	43.500	11.715	QP
4		*	278.320	37.389	23.452	-8.611	46.000	13.936	QP
5			402.965	26.748	10.272	-19.252	46.000	16.476	QP
6			588.720	26.053	6.537	-19.947	46.000	19.517	QP

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

Site: AC2	Time: 2019/10/09 - 21:12
Limit: FCC_Part15.209_RSE(3m)	Engineer: David Lv
Probe: VULB9162_0.03-8GHz	Polarity: Vertical
EUT: HAN Access Point	Power: AC 120V/60Hz
Worse Case Mode: Transmit by BLE at channel 2402MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	41.155	34.535	20.532	-5.465	40.000	14.002	QP
2			63.950	22.019	9.233	-17.981	40.000	12.787	QP
3			87.230	21.736	11.304	-18.264	40.000	10.432	QP
4			114.875	37.917	25.957	-5.583	43.500	11.960	QP
5			278.320	28.446	14.509	-17.554	46.000	13.936	QP
6			589.205	32.561	13.039	-13.439	46.000	19.523	QP

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

7.7. Radiated Restricted Band Edge Measurement

7.7.1. Test Limit

For 15.205 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a).

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41	--	--	--

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency (MHz]	Field Strength (uV/m]	Measured Distance (Meters)
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

7.7.2.Test Procedure Used

ANSI C63.10 Section 6.3 (General Requirements)

ANSI C63.10 Section 6.6 (Standard test method above 1GHz)

7.7.3.Test Setting

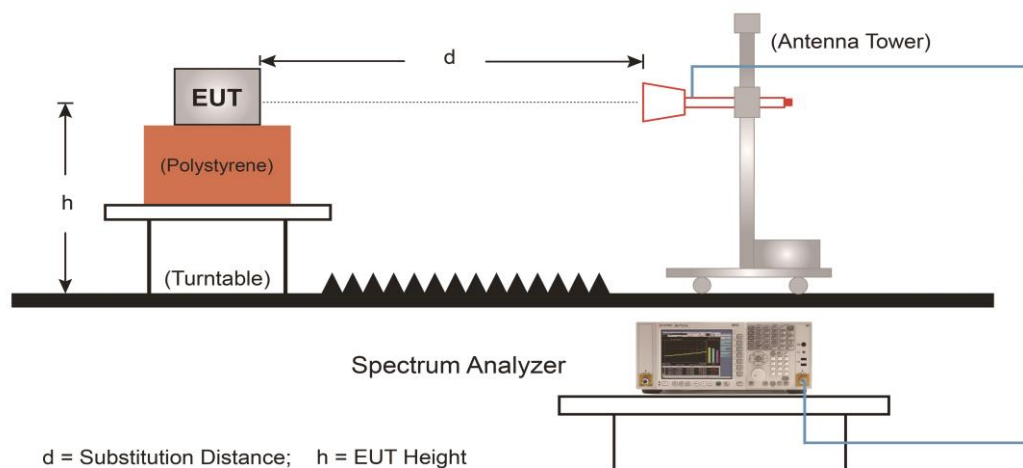
Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Average Field Strength Measurements

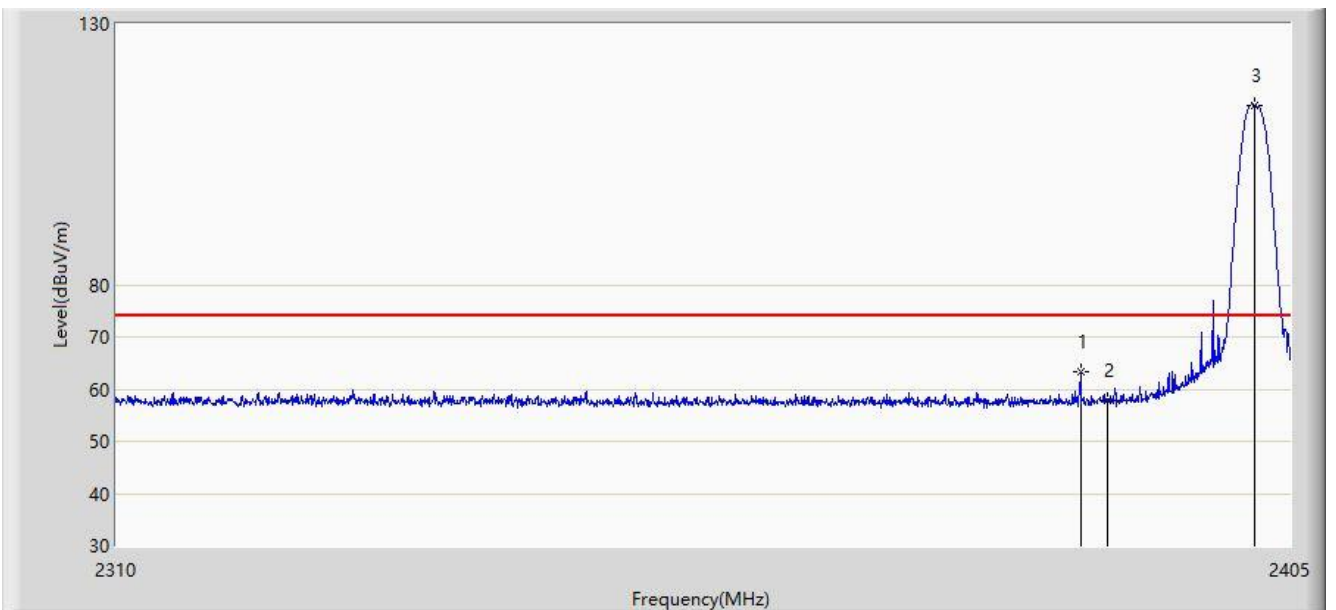
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW $\geq 1/T$
4. De As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to "Voltage" regardless of the display mode
5. Detector = Peak
6. Sweep time = auto
7. Trace mode = max hold
8. Allow max hold to run for at least 50 times (1/duty cycle) traces

7.7.4.Test Setup



7.7.5.Test Result

Site: AC2	Time: 2019/10/15 - 21:28
Limit: FCC_Part15.209(3m)	Engineer: Yeto Yin
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: HAN Access Point	Power: AC 120V/60Hz
Test Mode: Transmit by BT5.1 – 1Mbps at Channel 2402MHz	

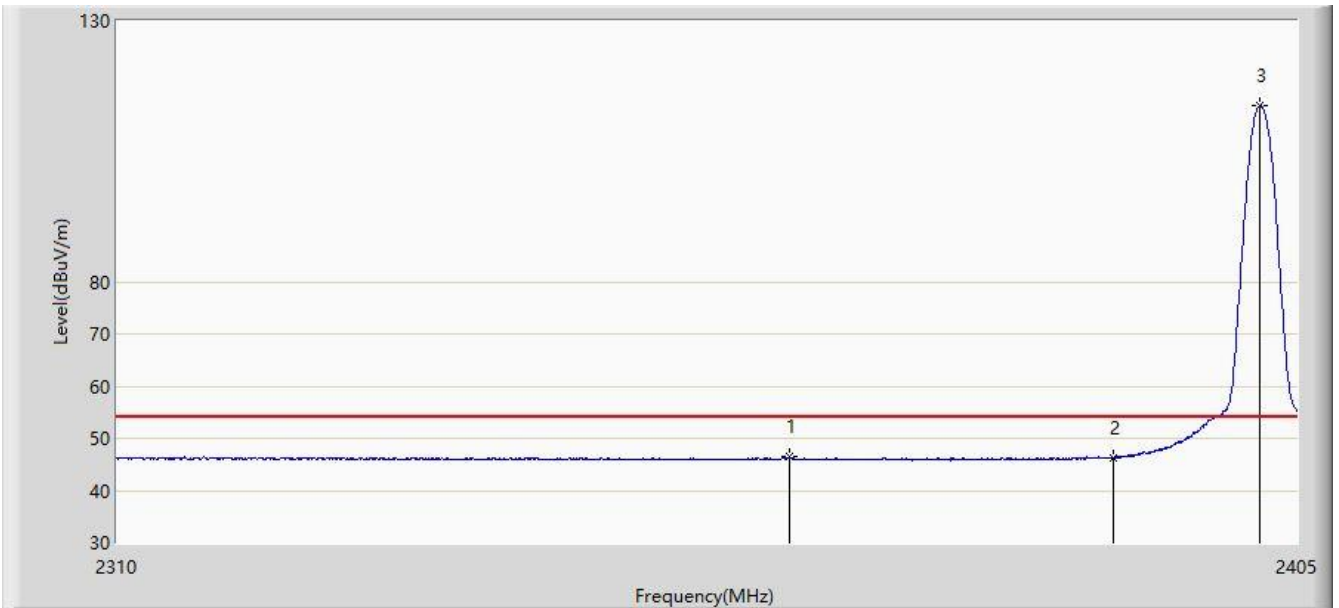


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2387.758	63.300	31.852	-10.700	74.000	31.449	PK
2			2390.000	57.967	26.518	-16.033	74.000	31.449	PK
3		*	2402.103	114.349	82.928	N/A	N/A	31.421	PK

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Site: AC2	Time: 2019/10/15 - 21:53
Limit: FCC_Part15.209(3m)	Engineer: Yeto Yin
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: HAN Access Point	Power: AC 120V/60Hz
Test Mode: Transmit by BT5.1 – 1Mbps at Channel 2402MHz	

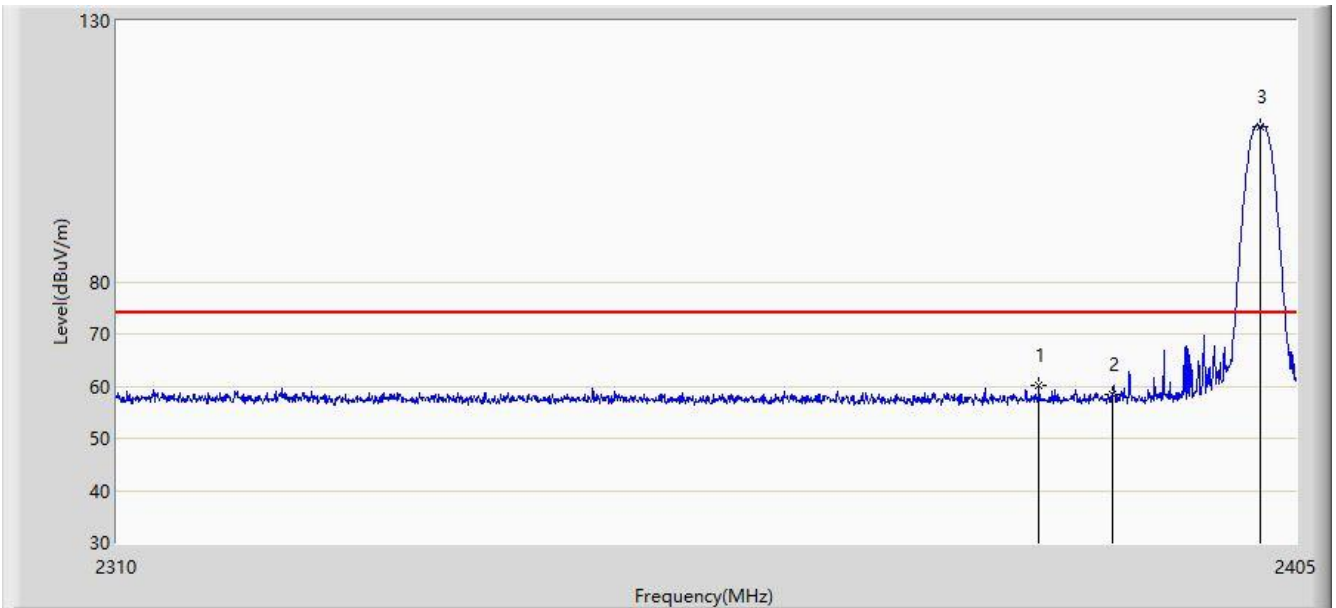


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2363.722	46.425	14.957	-7.575	54.000	31.468	AV
2			2390.000	46.346	14.897	-7.654	54.000	31.449	AV
3	X	*	2401.960	113.749	82.327	N/A	N/A	31.422	AV

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Site: AC2	Time: 2019/10/15 - 21:59
Limit: FCC_Part15.209(3m)	Engineer: Yeto Yin
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: HAN Access Point	Power: AC 120V/60Hz
Test Mode: Transmit by BT5.1 – 1Mbps at Channel 2402MHz	

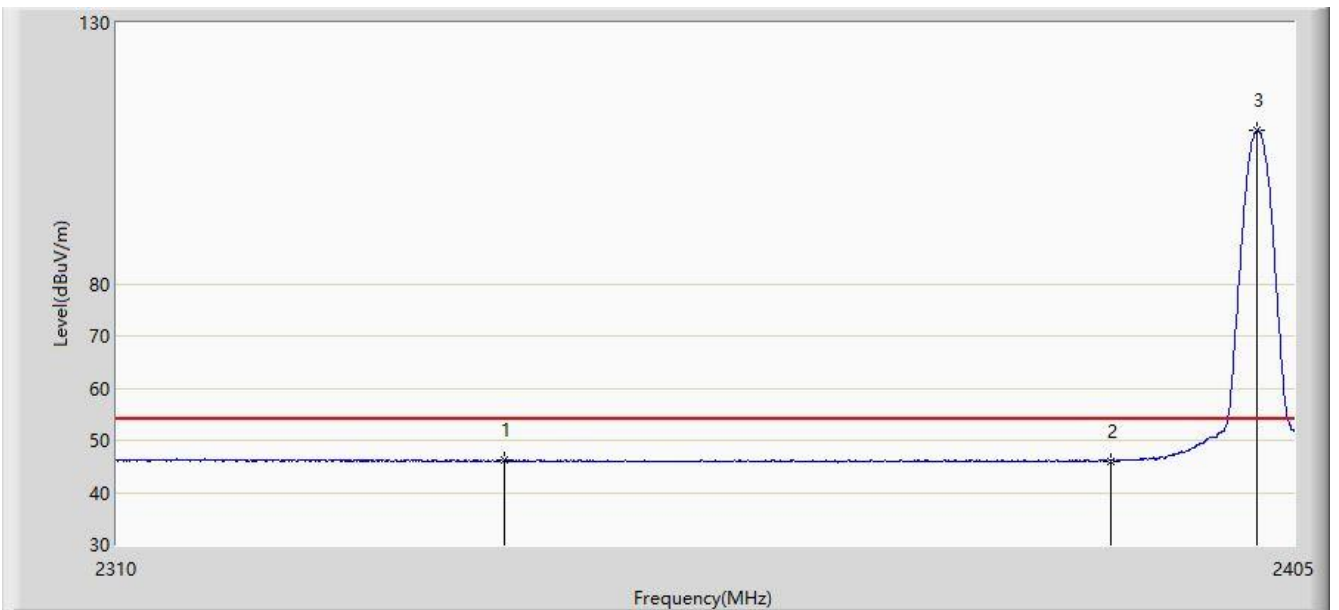


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2384.005	60.107	28.659	-13.893	74.000	31.447	PK
2			2390.000	58.443	26.994	-15.557	74.000	31.449	PK
3		*	2402.103	109.781	78.360	N/A	N/A	31.421	PK

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Site: AC2	Time: 2019/10/15 - 22:00
Limit: FCC_Part15.209(3m)	Engineer: Yeto Yin
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: HAN Access Point	Power: AC 120V/60Hz
Test Mode: Transmit by BT5.1 – 1Mbps at Channel 2402MHz	

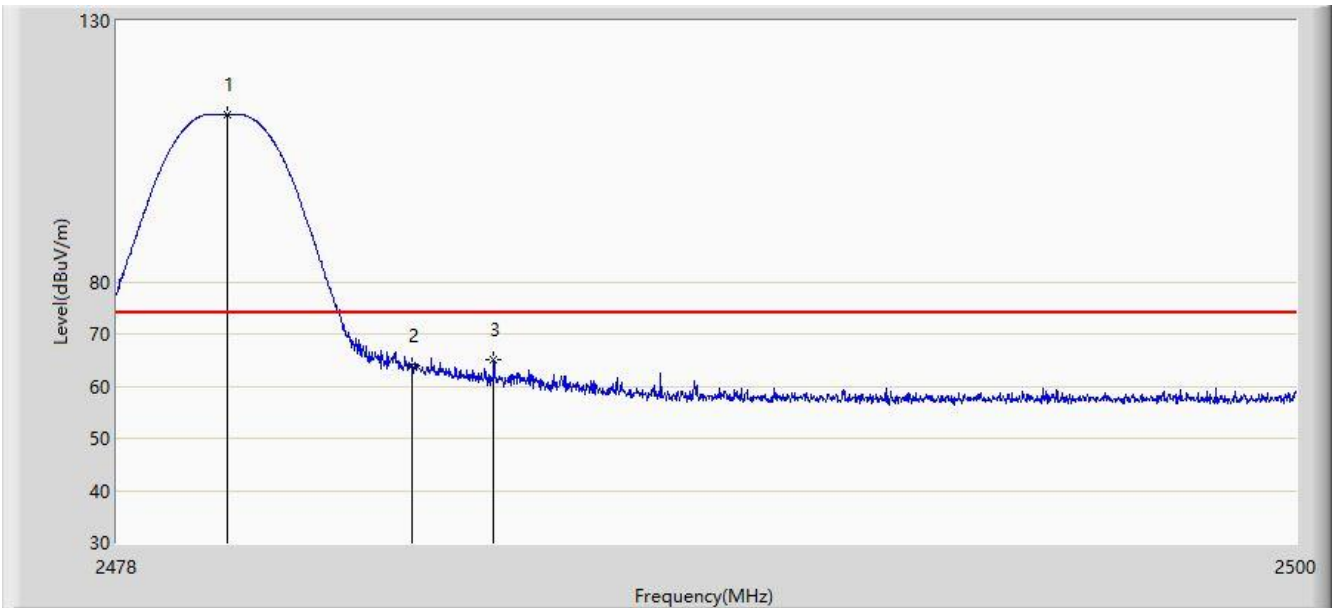


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2340.923	46.334	14.791	-7.666	54.000	31.543	AV
2			2390.000	46.066	14.617	-7.934	54.000	31.449	AV
3	X	*	2402.008	109.364	77.942	N/A	N/A	31.422	AV

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Site: AC2	Time: 2019/10/15 - 22:02
Limit: FCC_Part15.209(3m)	Engineer: Yeto Yin
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: HAN Access Point	Power: AC 120V/60Hz
Test Mode: Transmit by BT5.1 – 1Mbps at Channel 2480MHz	

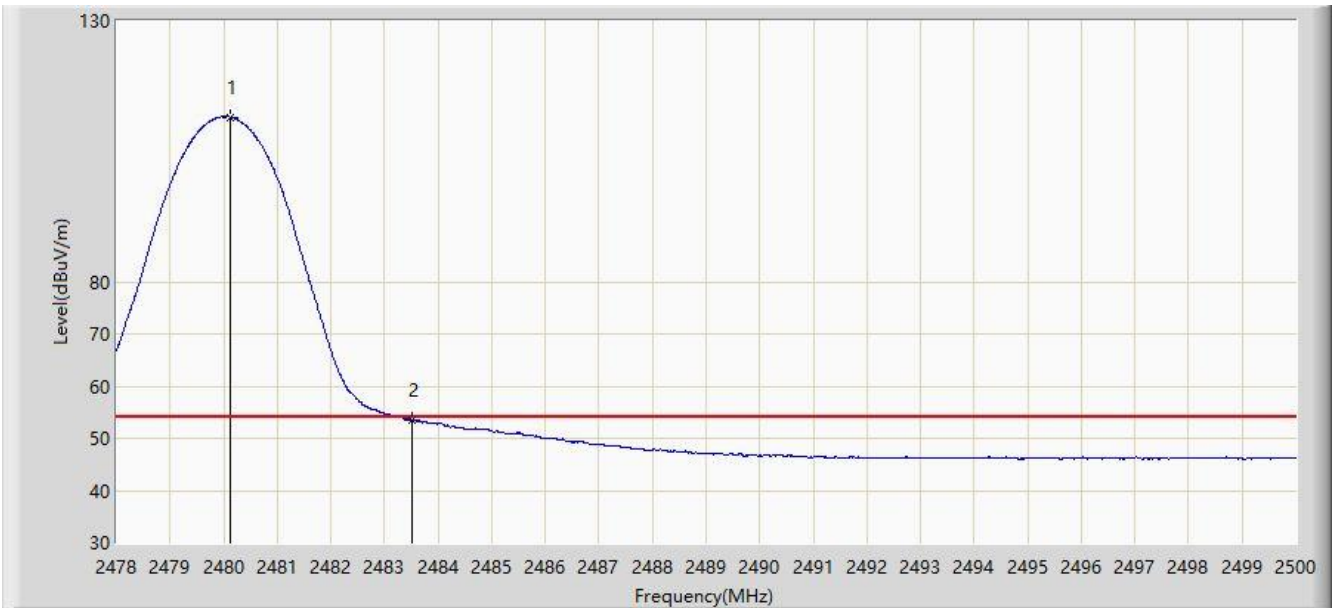


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2480.068	112.013	80.622	N/A	N/A	31.391	PK
2			2483.500	63.831	32.428	-10.169	74.000	31.403	PK
3			2485.018	65.010	33.602	-8.990	74.000	31.408	PK

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Site: AC2	Time: 2019/10/15 - 22:11
Limit: FCC_Part15.209(3m)	Engineer: Yeto Yin
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: HAN Access Point	Power: AC 120V/60Hz
Test Mode: Transmit by BT5.1 – 1Mbps at Channel 2480MHz	

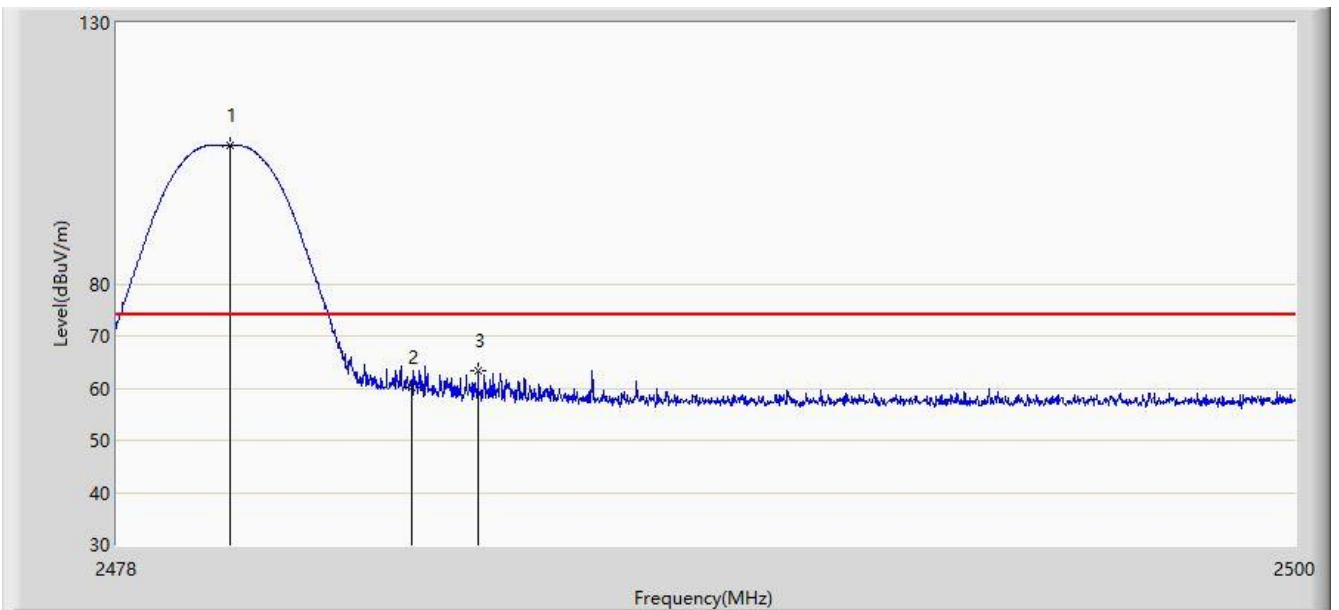


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	X	*	2480.112	111.577	80.186	N/A	N/A	31.391	AV
2			2483.500	53.600	22.197	-0.400	54.000	31.403	AV

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Site: AC2	Time: 2019/10/15 - 22:32
Limit: FCC_Part15.209(3m)	Engineer: Yeto Yin
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: HAN Access Point	Power: AC 120V/60Hz
Test Mode: Transmit by BT5.1 – 1Mbps at Channel 2480MHz	

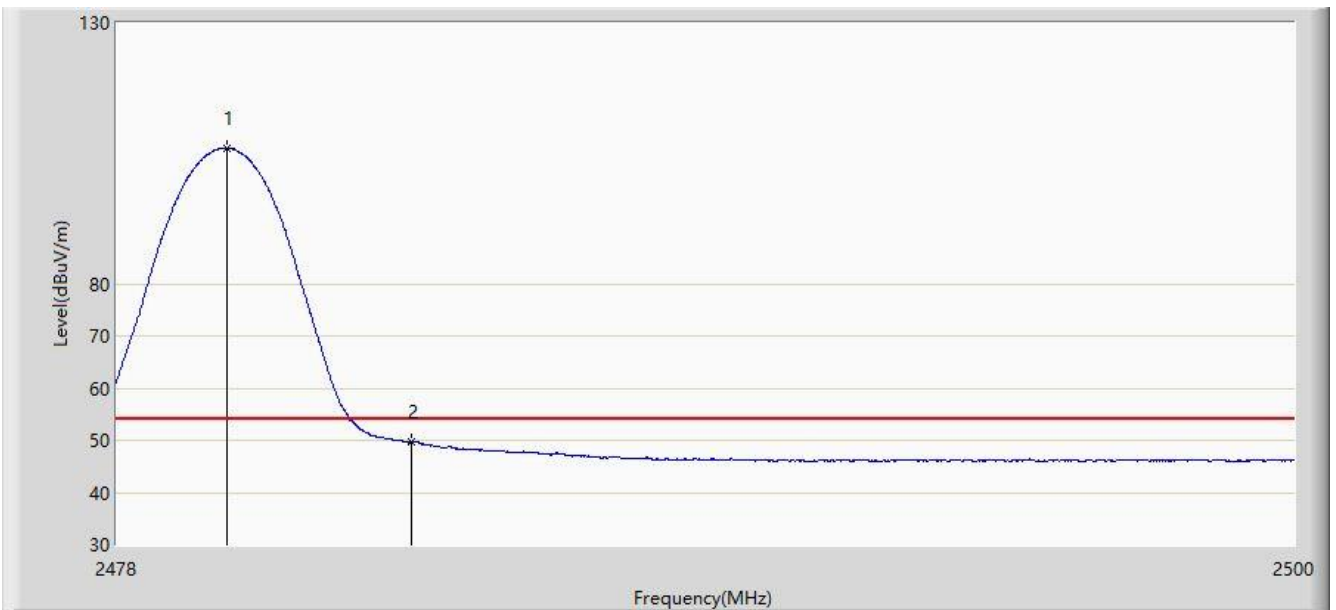


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2480.101	106.416	75.025	N/A	N/A	31.391	PK
2			2483.500	60.132	28.729	-13.868	74.000	31.403	PK
3			2484.732	63.380	31.973	-10.620	74.000	31.407	PK

Note: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Site: AC2	Time: 2019/10/15 - 22:33
Limit: FCC_Part15.209(3m)	Engineer: Yeto Yin
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: HAN Access Point	Power: AC 120V/60Hz
Test Mode: Transmit by BT5.1 – 1Mbps at Channel 2480MHz	

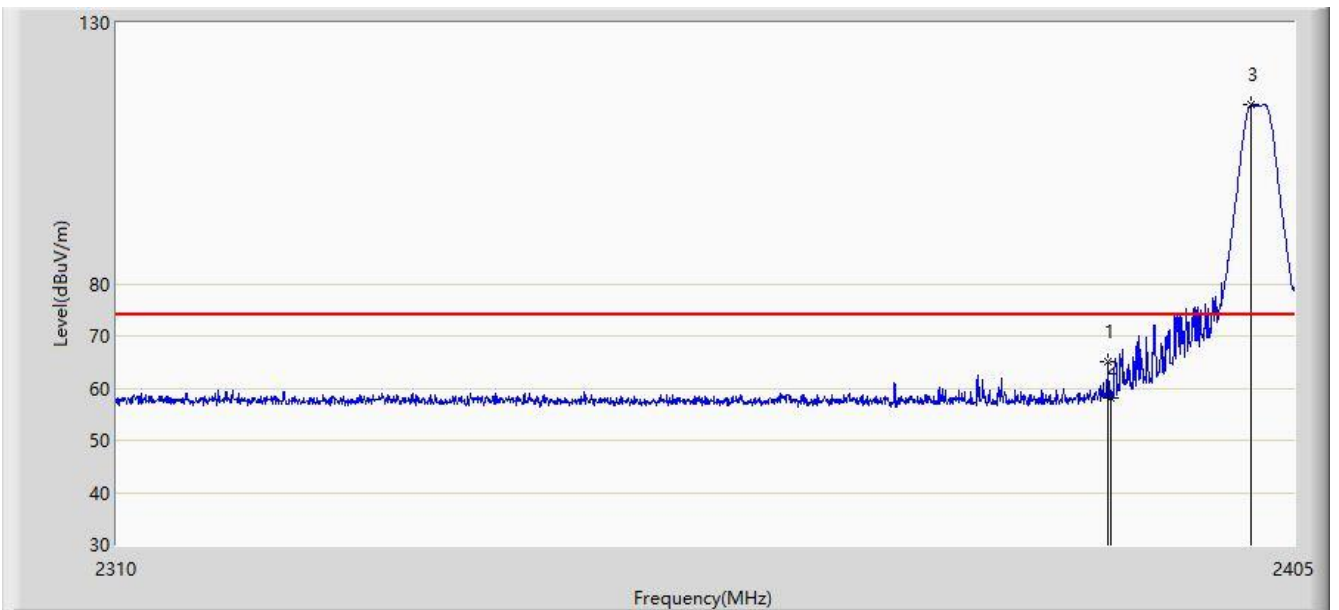


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2480.068	106.021	74.630	N/A	N/A	31.391	AV
2			2483.500	49.573	18.170	-4.427	54.000	31.403	AV

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Site: AC2	Time: 2019/10/15 - 22:35
Limit: FCC_Part15.209(3m)	Engineer: Yeto Yin
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: HAN Access Point	Power: AC 120V/60Hz
Test Mode: Transmit by BT5.1 – 2Mbps at Channel 2402MHz	

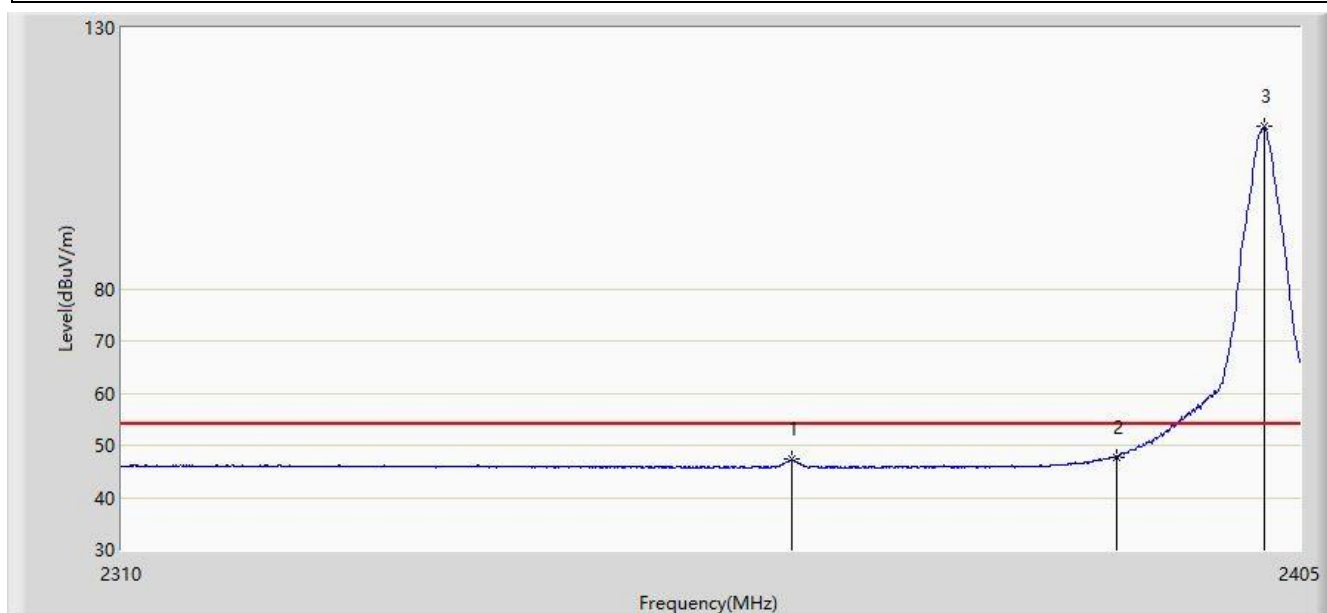


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2389.705	65.005	33.556	-8.995	74.000	31.449	PK
2			2390.000	58.235	26.786	-15.765	74.000	31.449	PK
3		*	2401.532	114.381	82.958	N/A	N/A	31.423	PK

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Site: AC2	Time: 2019/10/15 - 22:39
Limit: FCC_Part15.209(3m)	Engineer: Yeto Yin
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: HAN Access Point	Power: AC 120V/60Hz
Test Mode: Transmit by BT5.1 – 2Mbps at Channel 2402MHz	

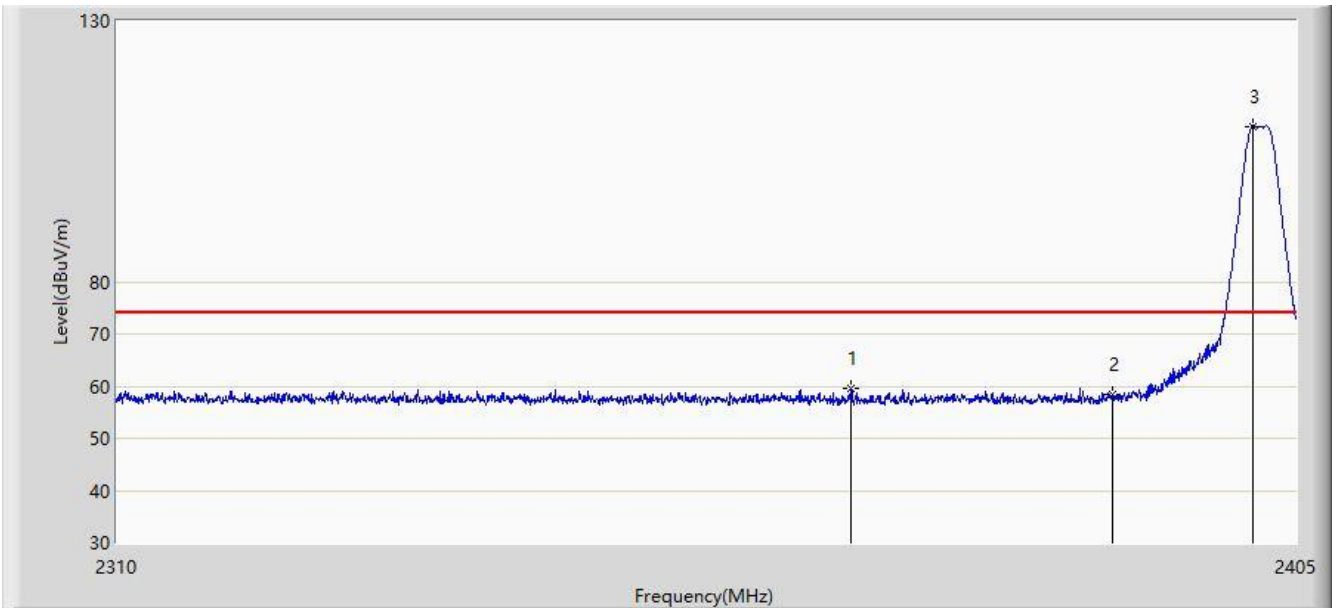


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2363.532	47.329	15.861	-6.671	54.000	31.469	AV
2			2390.000	47.796	16.347	-6.204	54.000	31.449	AV
3	X	*	2402.103	111.200	79.779	N/A	N/A	31.421	AV

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Site: AC2	Time: 2019/10/15 - 22:41
Limit: FCC_Part15.209(3m)	Engineer: Yeto Yin
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: HAN Access Point	Power: AC 120V/60Hz
Test Mode: Transmit by BT5.1 – 2Mbps at Channel 2402MHz	

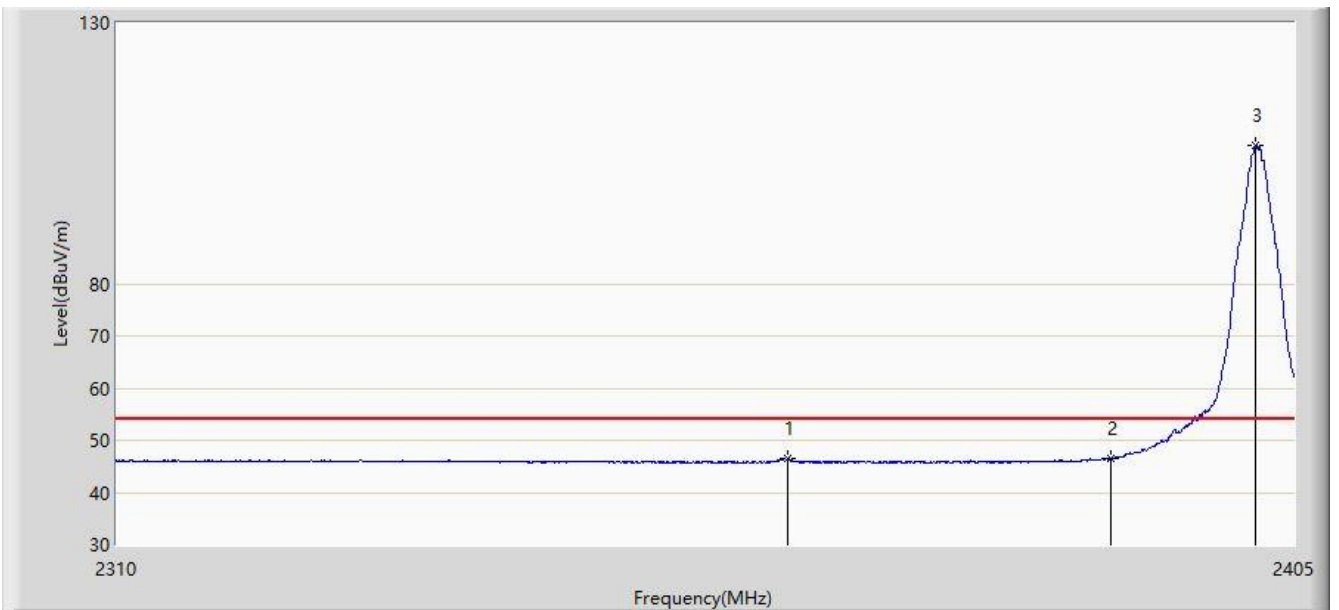


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2368.758	59.636	28.176	-14.364	74.000	31.460	PK
2			2390.000	58.283	26.834	-15.717	74.000	31.449	PK
3		*	2401.437	109.758	78.334	N/A	N/A	31.424	PK

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Site: AC2	Time: 2019/10/15 - 22:43
Limit: FCC_Part15.209(3m)	Engineer: Yeto Yin
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: HAN Access Point	Power: AC 120V/60Hz
Test Mode: Transmit by BT5.1 – 2Mbps at Channel 2402MHz	

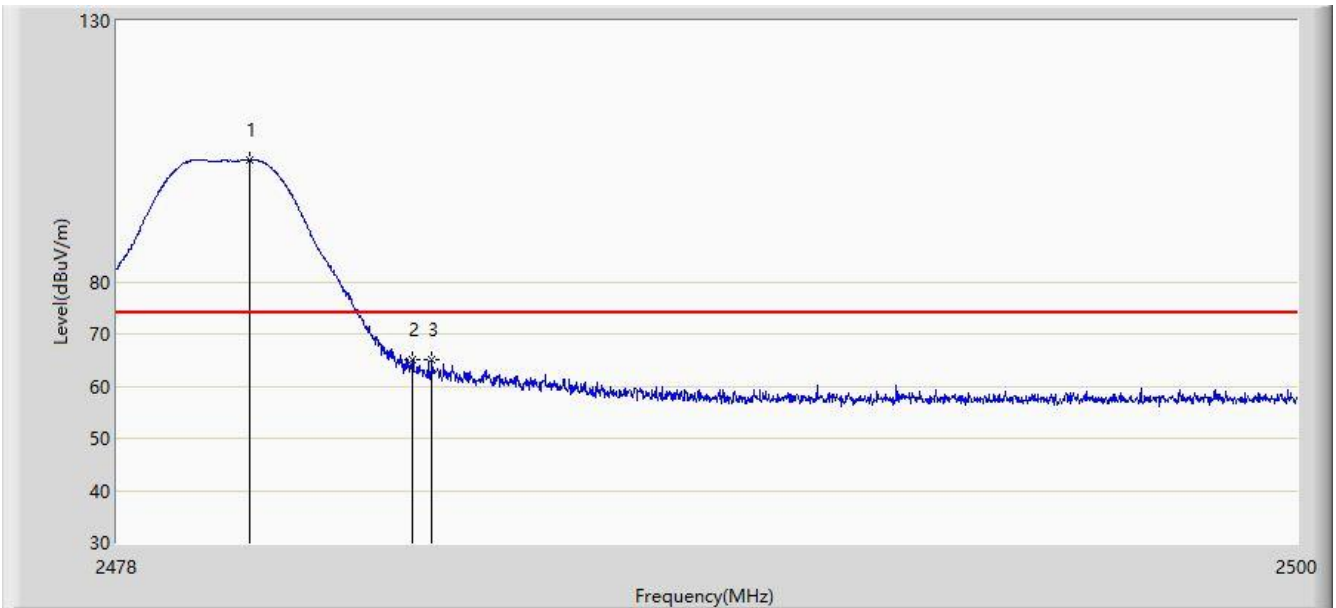


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2363.722	46.401	14.933	-7.599	54.000	31.468	AV
2			2390.000	46.459	15.010	-7.541	54.000	31.449	AV
3		*	2401.865	106.561	75.139	N/A	N/A	31.422	AV

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Site: AC2	Time: 2019/10/15 - 22:45
Limit: FCC_Part15.209(3m)	Engineer: Yeto Yin
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: HAN Access Point	Power: AC 120V/60Hz
Test Mode: Transmit by BT5.1 – 2Mbps at Channel 2480MHz	

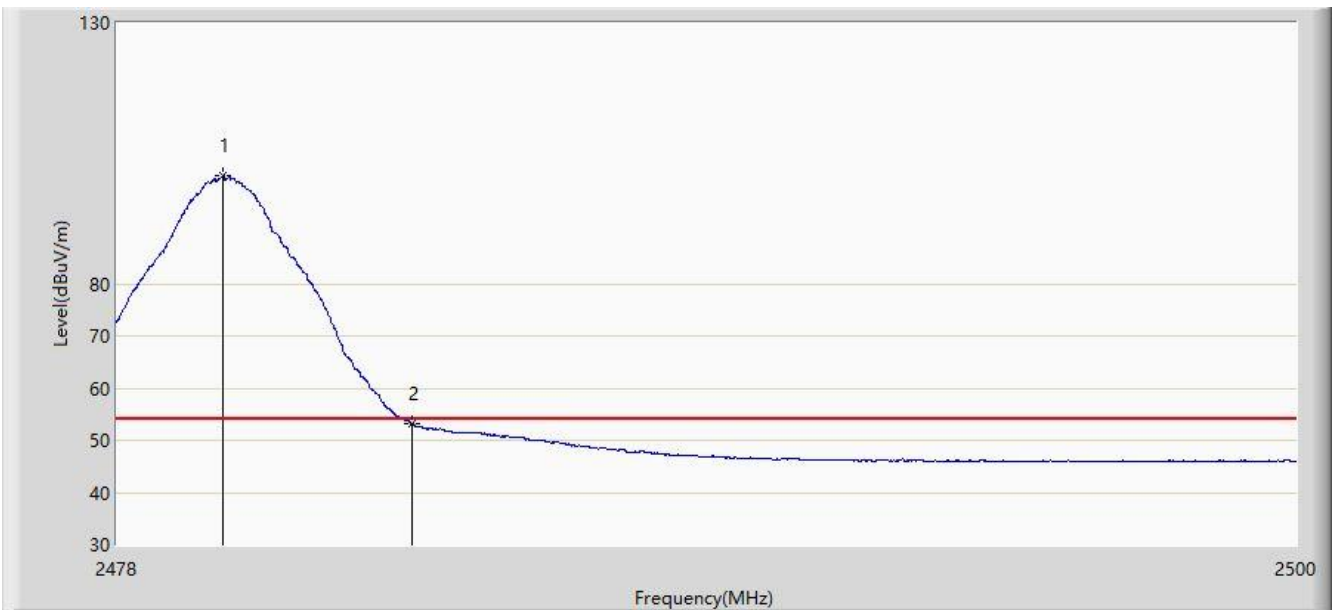


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2480.464	103.448	72.056	N/A	N/A	31.392	PK
2			2483.500	64.975	33.572	-9.025	74.000	31.403	PK
3			2483.852	65.133	33.729	-8.867	74.000	31.404	PK

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Site: AC2	Time: 2019/10/15 - 22:49
Limit: FCC_Part15.209(3m)	Engineer: Yeto Yin
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: HAN Access Point	Power: AC 120V/60Hz
Test Mode: Transmit by BT5.1 – 2Mbps at Channel 2480MHz	

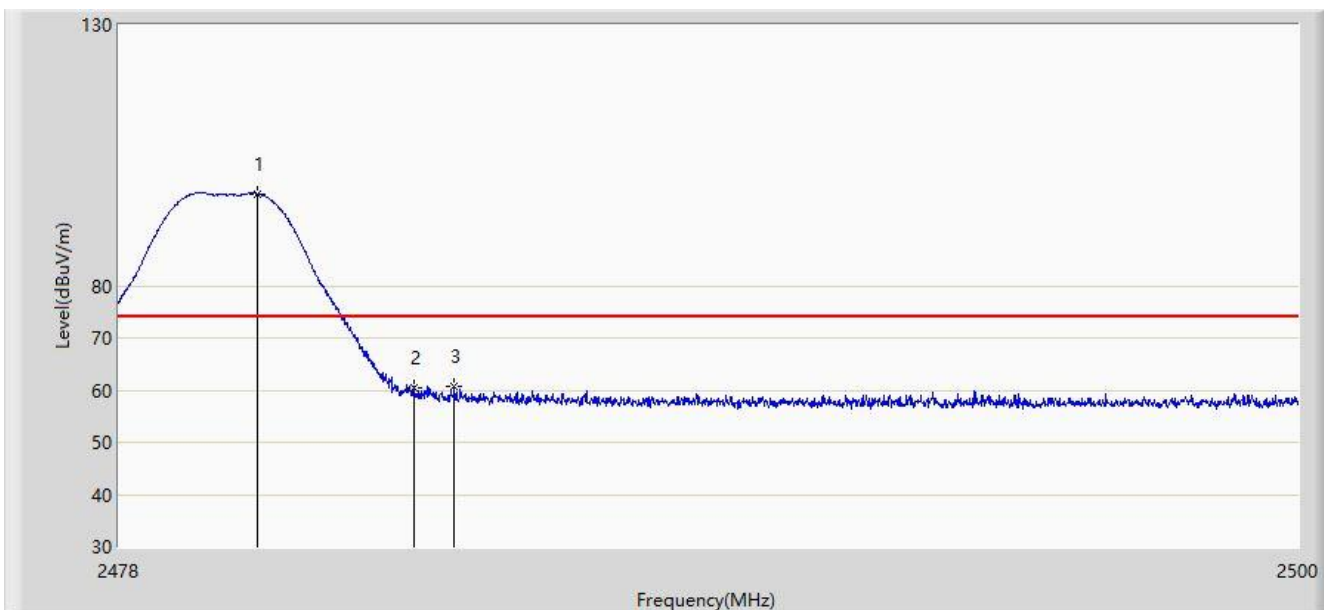


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2479.980	100.685	69.294	N/A	N/A	31.391	AV
2			2483.500	53.192	21.789	-0.808	54.000	31.403	AV

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Site: AC2	Time: 2019/10/15 - 22:59
Limit: FCC_Part15.209(3m)	Engineer: Yeto Yin
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: HAN Access Point	Power: AC 120V/60Hz
Test Mode: Transmit by BT5.1 – 2Mbps at Channel 2480MHz	

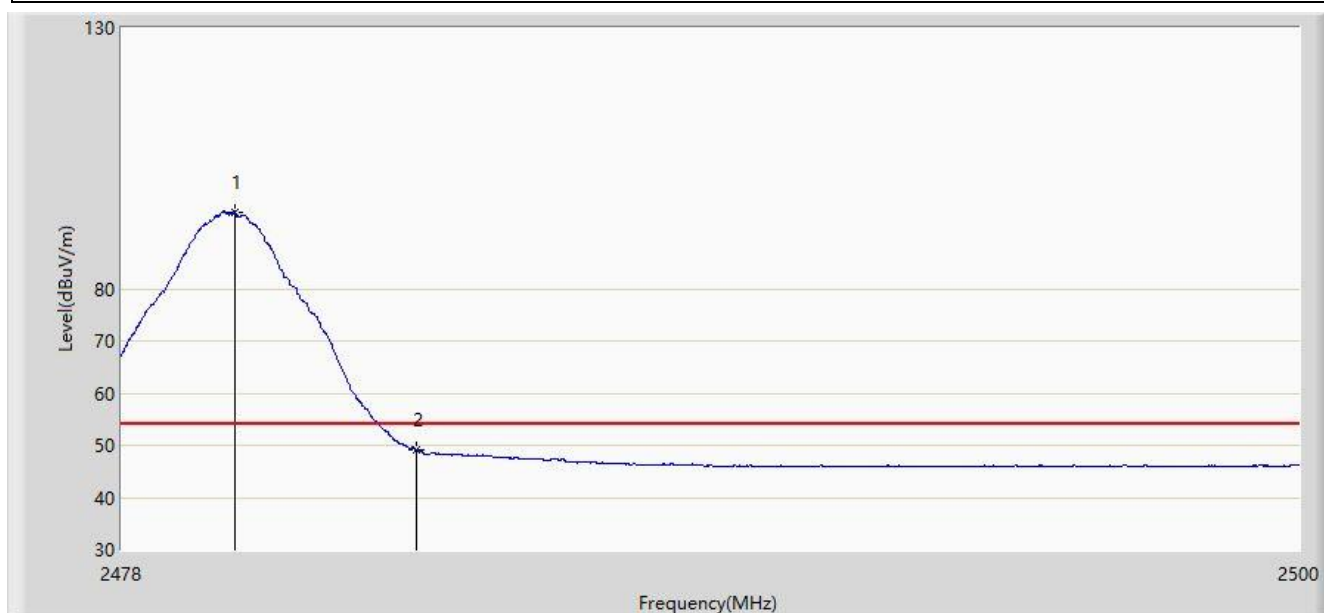


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2480.574	97.655	66.262	N/A	N/A	31.392	PK
2			2483.500	60.451	29.048	-13.549	74.000	31.403	PK
3			2484.248	60.847	29.442	-13.153	74.000	31.405	PK

Note: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Site: AC2	Time: 2019/10/15 - 23:00
Limit: FCC_Part15.209(3m)	Engineer: Yeto Yin
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: HAN Access Point	Power: AC 120V/60Hz
Test Mode: Transmit by BT5.1 – 2Mbps at Channel 2480MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	2480.112	94.757	63.366	N/A	N/A	31.391	AV
2			2483.500	49.191	17.788	-4.809	54.000	31.403	AV

Note: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

7.8. AC Conducted Emissions Measurement

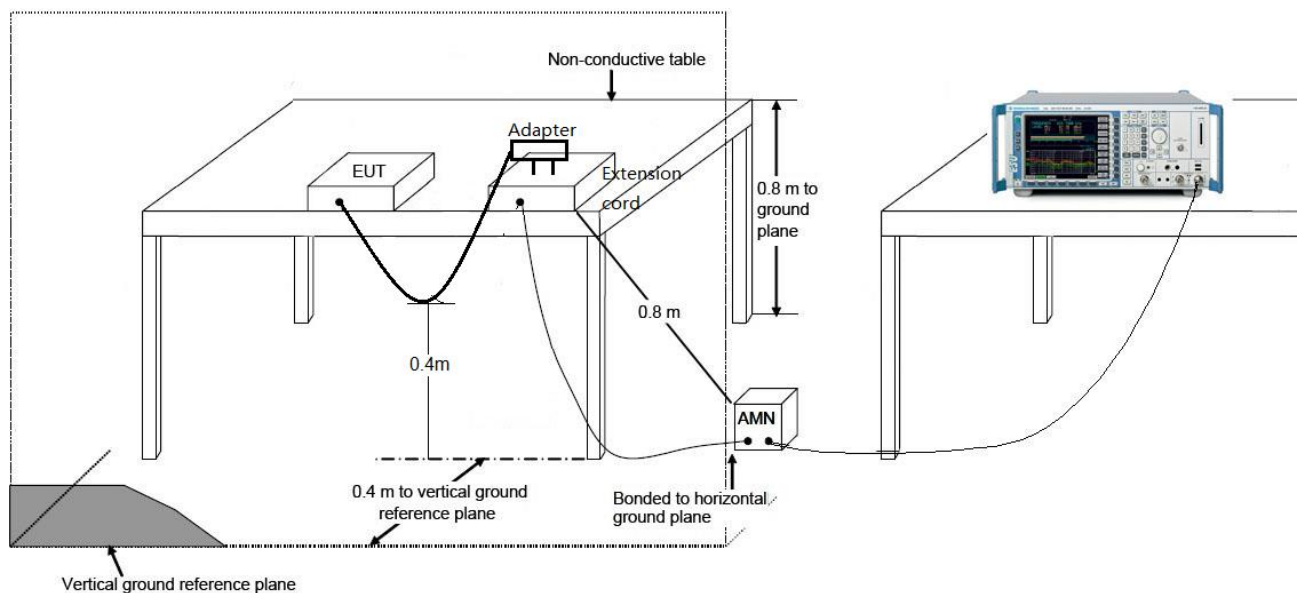
7.8.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dBuV)	AV (dBuV)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

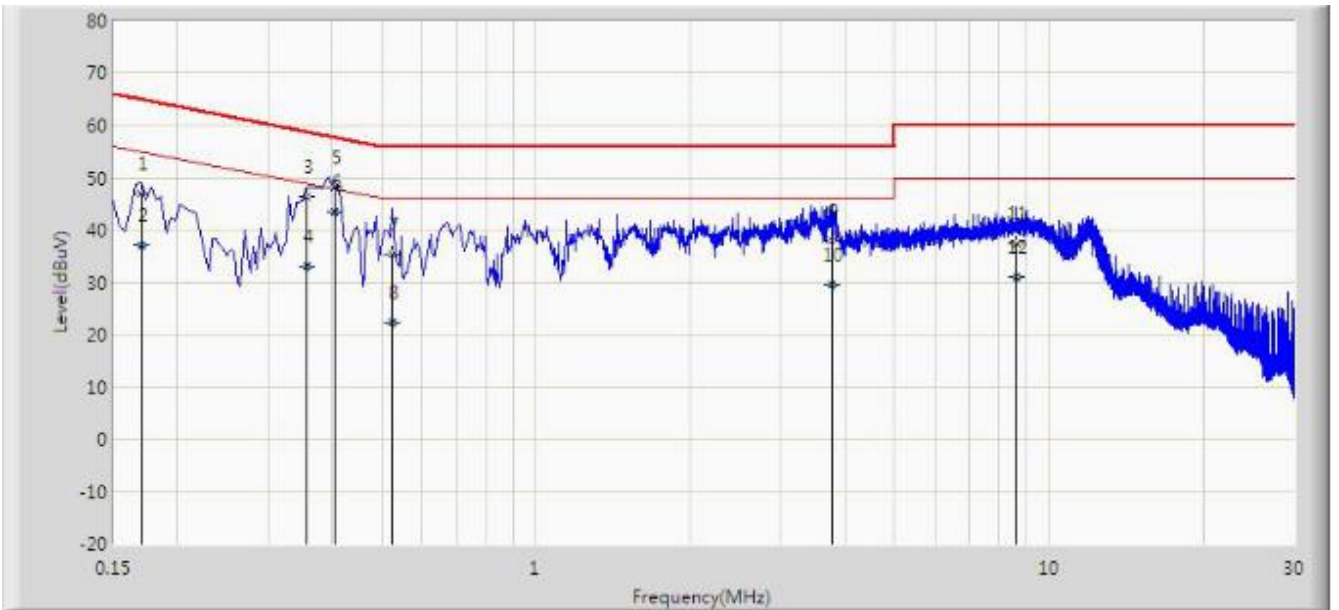
Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

7.8.2. Test Setup



7.8.3.Test Result

Site: SR2	Time: 2019/12/17 - 10:21
Limit: FCC_Part15.207_CE_AC Power	Engineer: Liz Yuan
Probe: ENV216_101683_Filter On	Polarity: Line
EUT: HAN Access Point	Power: AC 120V/60Hz
Test Mode: Transmit by BT5.1 at channel 2402MHz	

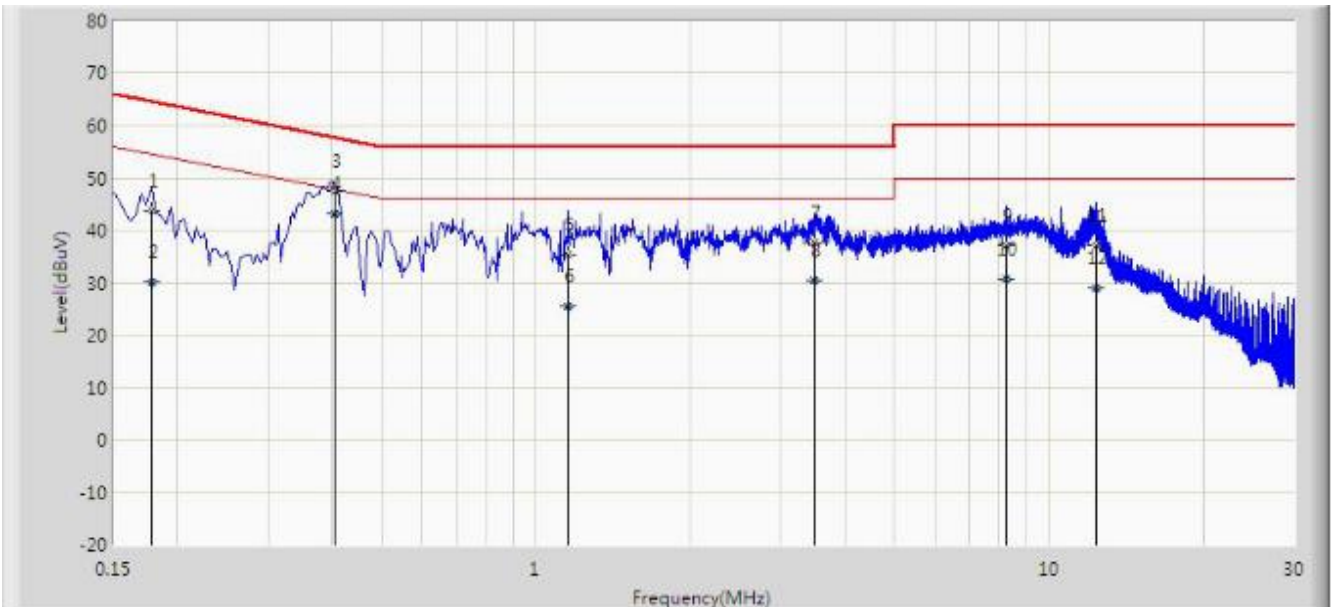


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV)	Factor (dB)	Type
1			0.170	47.069	36.991	-17.891	64.960	10.078	QP
2			0.170	37.149	27.072	-17.811	54.960	10.078	AV
3			0.358	46.242	36.190	-12.533	58.775	10.051	QP
4			0.358	32.918	22.867	-15.857	48.775	10.051	AV
5			0.406	47.990	37.900	-9.740	57.730	10.090	QP
6		*	0.406	43.590	33.500	-4.140	47.730	10.090	AV
7			0.526	35.371	25.218	-20.629	56.000	10.153	QP
8			0.526	22.439	12.286	-23.561	46.000	10.153	AV
9			3.762	38.098	28.139	-17.902	56.000	9.959	QP
10			3.762	29.498	19.539	-16.502	46.000	9.959	AV
11			8.622	37.414	27.232	-22.586	60.000	10.182	QP
12			8.622	31.040	20.858	-18.960	50.000	10.182	AV

Note: Measure Level (dBμV) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB)

Site: SR2	Time: 2019/12/17 - 10:28
Limit: FCC_Part15.207_CE_AC Power	Engineer: Liz Yuan
Probe: ENV216_101683_Filter On	Polarity: Neutral
EUT: HAN Access Point	Power: AC 120V/60Hz
Test Mode: Transmit by BT5.1 at channel 2402MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV)	Factor (dB)	Type
1			0.178	43.818	33.768	-20.761	64.578	10.049	QP
2			0.178	30.051	20.001	-24.528	54.578	10.049	AV
3			0.406	47.617	37.500	-10.113	57.730	10.116	QP
4		*	0.406	43.217	33.100	-4.513	47.730	10.116	AV
5			1.154	35.285	25.381	-20.715	56.000	9.904	QP
6			1.154	25.385	15.481	-20.615	46.000	9.904	AV
7			3.482	37.789	27.876	-18.211	56.000	9.912	QP
8			3.482	30.562	20.650	-15.438	46.000	9.912	AV
9			8.270	37.188	27.009	-22.812	60.000	10.179	QP
10			8.270	30.805	20.626	-19.195	50.000	10.179	AV
11			12.358	37.186	27.075	-22.814	60.000	10.111	QP
12			12.358	29.035	18.923	-20.965	50.000	10.111	AV

Note: Measure Level (dBμV) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB)

8. CONCLUSION

The data collected relate only the item(s) tested and show that the unit is compliance with Part 15C of the FCC rules.

The End

Appendix A – Test Setup Photograph

Refer to “1909RSU036-UT” file.

Appendix B – EUT Photograph

Refer to “1909RSU036-UE” file.