NCC RADIO TEST REPORT

Equipment	:	**Floodlight Cam Wired Pro**
Brand Name	:	**Ring**
Model Name	:	**5B28S4**
Applicant	:	環安智控股份有限公司 台北市內湖區堤頂大道二段 **179** 號 **4** 樓
Manufacturer	:	**Ring LLC** **1523 26th St Santa Monica, CA 90404 USA**
Standard	:	**NCC LP0002 (2020-07-01)**

The product was received on Feb. 09, 2021 and testing was started from Feb. 25, 2021 and completed on Mar. 22, 2021. We, Sporton International Inc. Wensan Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures NCC LP0002 (2020-07-01) and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. Wensan Laboratory
No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issued Date
TR120337B	01	Initial issue of report	May 12, 2021
TR120337B	02	1. Separate the receiver radiated emission test photo into Appendix D 2. Revise Connection Diagram of Test System	Jun. 18, 2021

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	LP0002 4.10.1.6 (2)(A)	6dB Bandwidth	Pass	-
3.1	-	99% Occupied Bandwidth	Reporting only	-
3.2	LP0002 4.10.1.2 (1)(C)	Power Output Measurement	Pass	-
3.3	LP0002 4.10.1.6 (2)(B)	Power Spectral Density	Pass	-
3.4	LP0002 4.10.1.5	Conducted Band Edges	Pass	-
		Conducted Spurious Emission	Pass	-
3.5	LP0002 4.10.1.5	Radiated Band Edges and Radiated Spurious Emission	Pass	Under limit 3.27 dB at 4924.000 MHz
3.6	LP0002 3.3	AC Conducted Emission	Pass	Under limit 13.23 dB at 0.184 MHz
3.7	LP0002 3.2 4.10.1.3 4.10.1.4	Antenna Requirement	Pass	-
Annex A	LP0002 3.9	Receiver Radiated Emission	Pass	Please refer to Annex A
Annex B	LP0002 3.2 6.20.2	Maximum Power Density	Pass	-

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Wii Chang

Report Producer: Celery Wei

1 General Description

1.1 Product Feature of Equipment Under Test

Bluetooth-LE, Wi-Fi 2.4GHz 802.11b/g/n, Wi-Fi 5GHz 802.11a/n/ac, LoRa and 24G Radar.

Product Specification subjective to this standard	
Tx/Rx Frequency	2400 MHz ~ 2483.5 MHz
Type of Modulation	802.11 b: DSSS (DBPSK/DQPSK/CCK) 802.11 g/n: OFDM (BPSK/QPSK/16QAM/64QAM)

Antenna Information				
Antenna 1	**Brand Name**	INPAQ TECHNOLOGY CO., LTD	**Peak Gain**	WLAN 2.4GHz: 3.21 dBi
	Model Name	RFFPA322204IMLB301	**Type**	FPC Antenna
Antenna 2	**Brand Name**	INPAQ TECHNOLOGY CO., LTD	**Peak Gain**	WLAN 2.4GHz: 1.27 dBi
	Model Name	RFFPA322208IMLB301	**Type**	FPC Antenna

Remark:

1. The detail internal, external and transmit antenna photo please refer to Sporton report no.: EP120337.
2. The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.

1.2 Modification of EUT

No modifications are made to the EUT during all test items.

1.3 Testing Location

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	**Sporton Site No.**
	03CH13-HY, CO07-HY, TH04-HY

FCC designation No.: TW3786

1.4 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- NCC LP0002 (2020-07-01)
- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- FCC KDB 414788 D01 Radiated Test Site v01r01.
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The TAF code is not including all the FCC KDB listed without accreditation.

2 Test Configuration of Equipment Under Test

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y plane) were recorded in this report.

b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437		

2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

MIMO Antenna

Modulation	Data Rate
802.11b	1 Mbps
802.11g	6 Mbps
802.11n HT20	MCS0

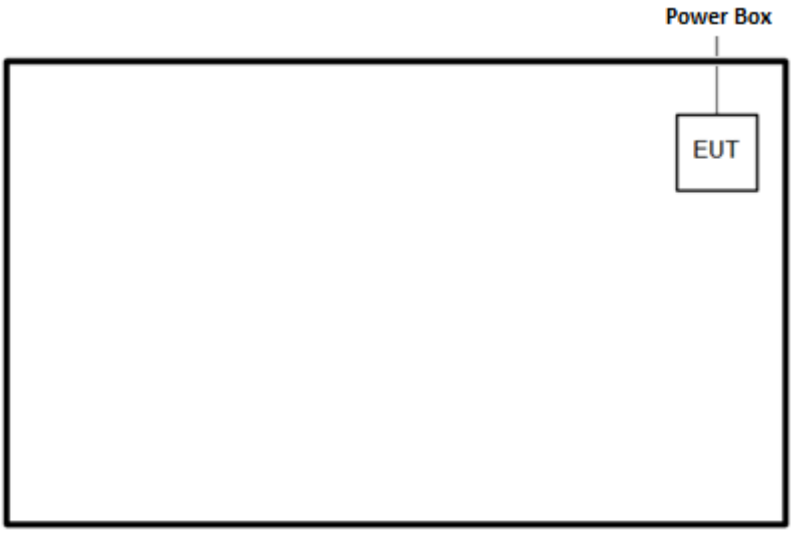
Test Cases	
AC Conducted Emission	Mode 1 : WLAN (2.4GHz) Tx + Bluetooth Tx + Lora Tx
Remark: For radiation spurious emission, after the test voltage (120Vac/60Hz and 110Vac/60Hz) is verified by lab, the test data can conform to the test requirements of NCC rule.	

Ch. #	2400-2483.5 MHz		
	802.11b	802.11g	802.11n HT20
Low	01	01	01
Middle	06	06	06
High	11	11	11

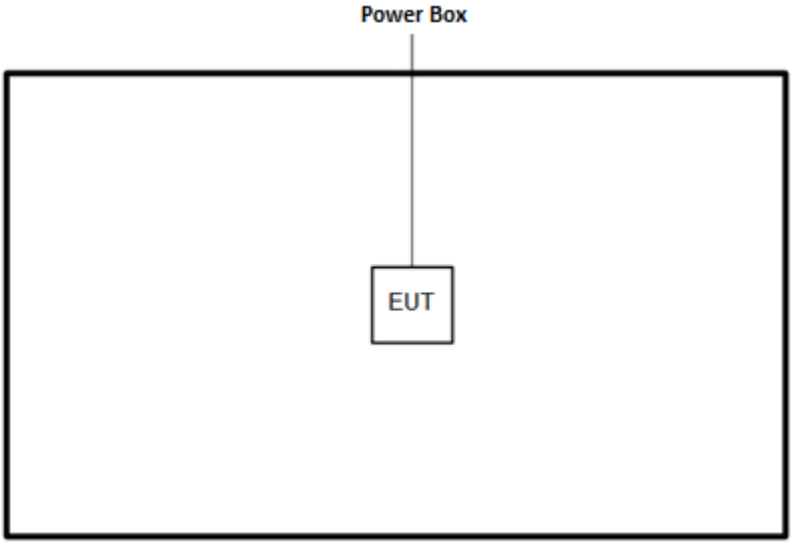
Remark: For radiation spurious emission, the final modulation and the worst data rate was reference the max RF conducted power.

2.3 Connection Diagram of Test System

<AC Conducted Emission Mode>



<WLAN Tx Mode>



2.4 EUT Operation Test Setup

The RF test items, utility “ComplianceTool V1.0.0.87” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

The Lora test items, utility “CMD V10.40.02” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

2.5 Measurement Results Explanation Example

For all conducted test items:

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

Example:
The spectrum analyzer offset is derived from RF cable loss and attenuator factor.
Offset = RF cable loss + attenuator factor.
Following shows an offset computation example with cable loss 4.2 dB and 10 dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).
= 4.2 + 10 = 14.2 (dB)

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

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

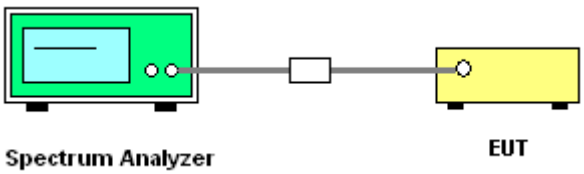
3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedures

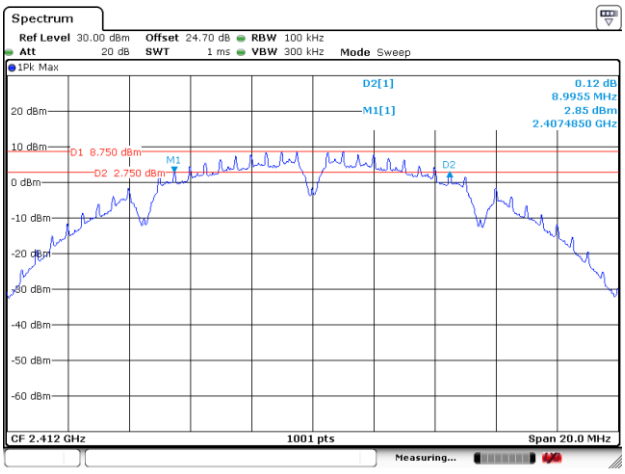
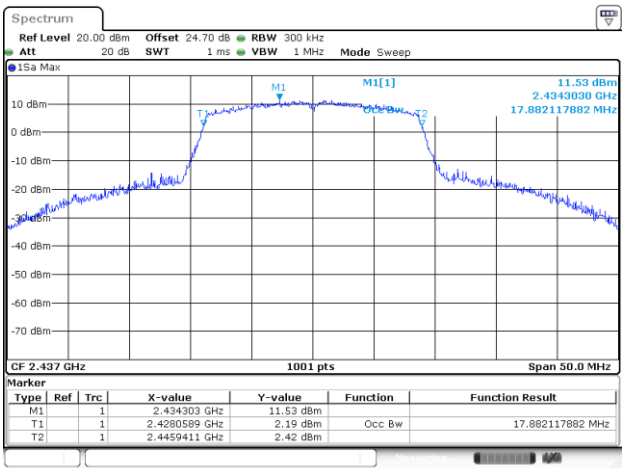
1. The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 11.8.1 (6dB BW).
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1-5% of the emission bandwidth and set the Video bandwidth (VBW) ≥ 3 * RBW.
6. Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A.

Minimum 6dB Bandwidth	Maximum 99% Occupied Bandwidth
	

Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5 MHz, the limit for output power is 30 dBm. If transmitting antenna with directional gain greater than 6 dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

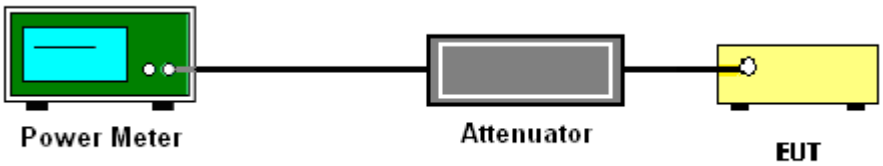
3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

3.2.3 Test Procedures

1. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Measure the conducted output power and record the results in the test report.
5. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

3.2.4 Test Setup



3.2.5 Test Result of Average Output Power

Please refer to Appendix A.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band at any time interval of continuous transmission.

3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

3.3.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.10.2 Method PKPSD.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.
7. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

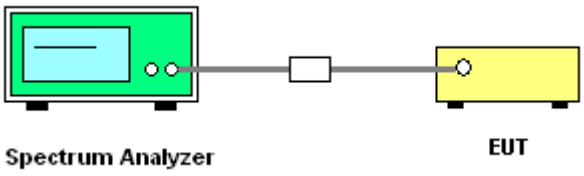
   If measurements performed using method (2) plus 10 log (N) exceeds the emission limit, the test should choose method (1) before declaring that the device fails the emission limit.

   Method (1): Measure and sum the spectra across the outputs.

   The total final Power Spectral Density is from a device with 2 transmitter outputs. The spectrum measurements of the individual outputs are all performed with the same span and number of points, the spectrum value in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 to obtain the value for the first frequency bin of the summed spectrum.

   Method (2): Measure and add 10 log (N) dB, where N is the number of outputs. (N=2)

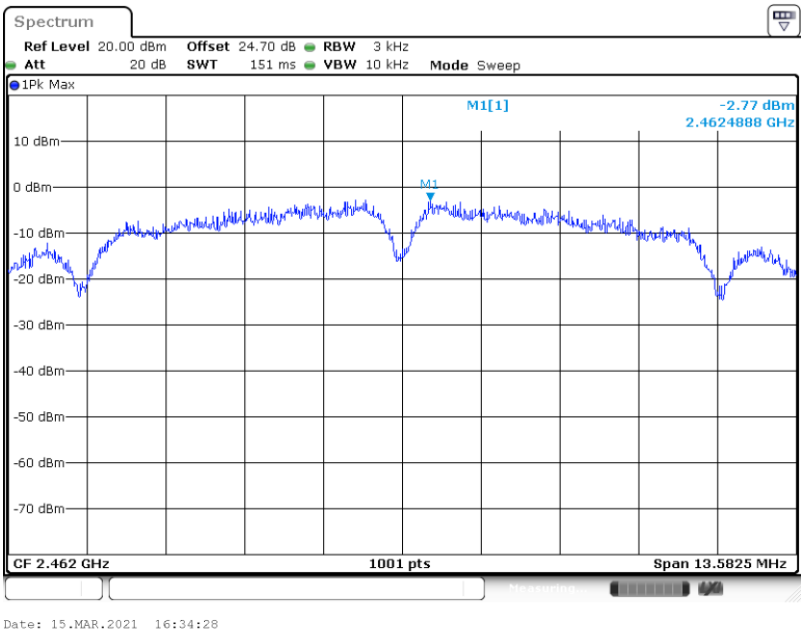
3.3.4 Test Setup



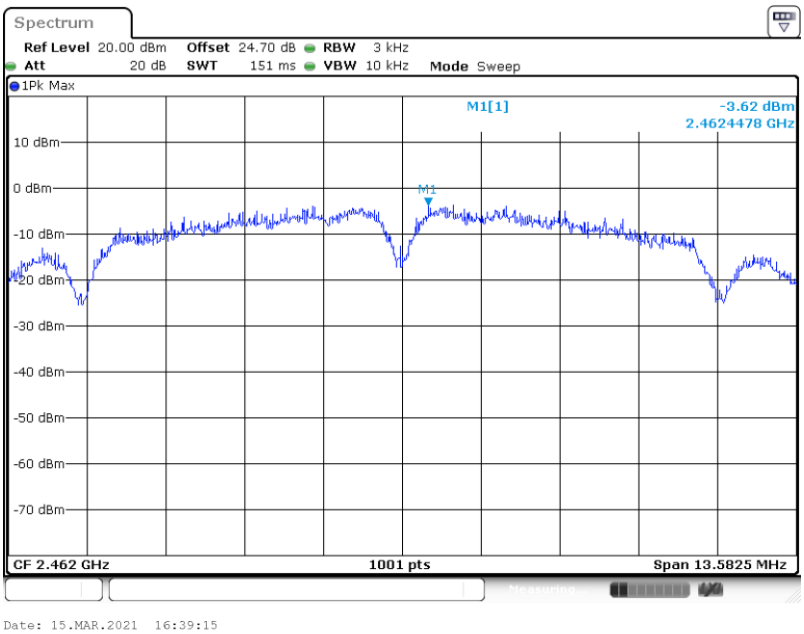
3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

Worst Case Power Density (dBm/3kHz) for MIMO Ant. 1



Worst Case Power Density (dBm/3kHz) for MIMO Ant. 2



3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement and radiated emissions which fall in the restricted bands, as defined in NCC LP0002 Section 3.5, must also comply with the radiated emission limits specified in NCC LP0002 Section 3.6.

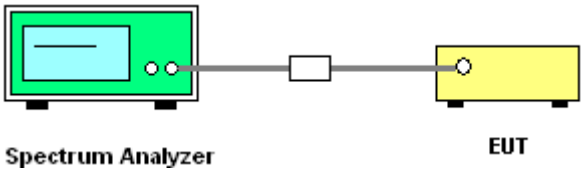
3.4.2 Measuring Instruments

See list of measuring equipment of this test report.

3.4.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.11.3 Emission level measurement.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions 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 when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup



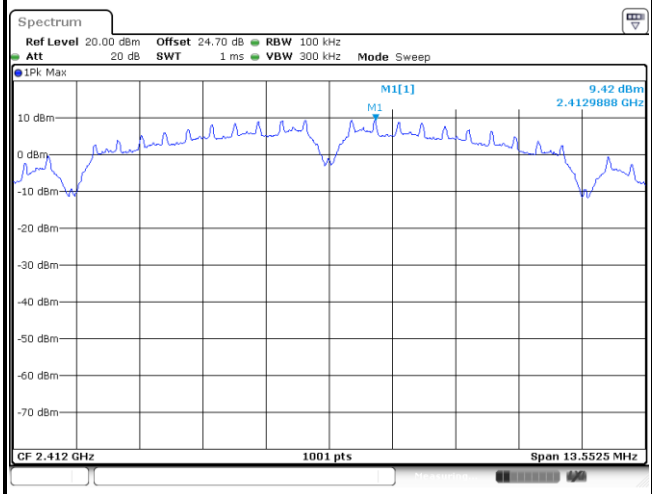
3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Test Engineer :	Eason Huang	**Temperature :**	21~25℃
		Relative Humidity :	51~54%

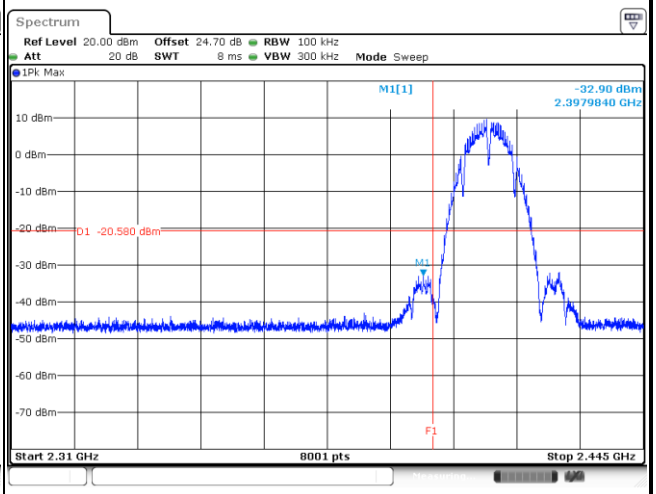
Number of TX = 2, Ant. 1 (Measured)

Test Mode :	802.11b	**Test Channel :**	01

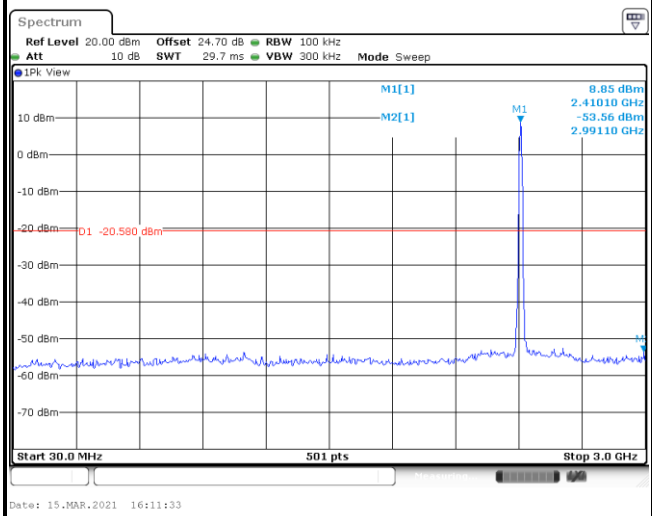
100kHz PSD reference Level



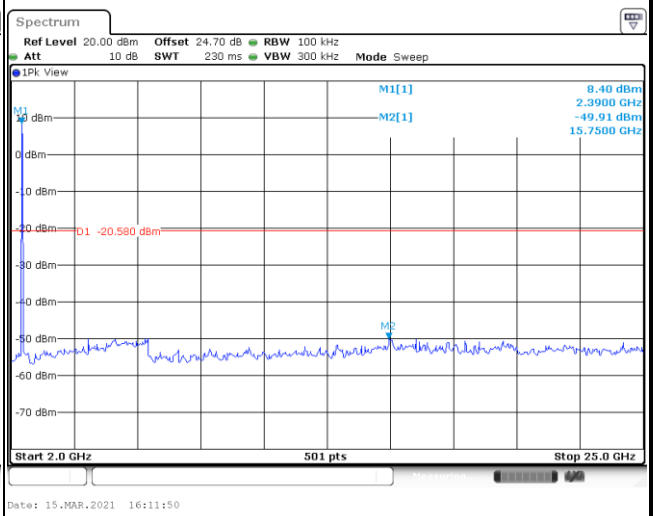
Low Channel Plot



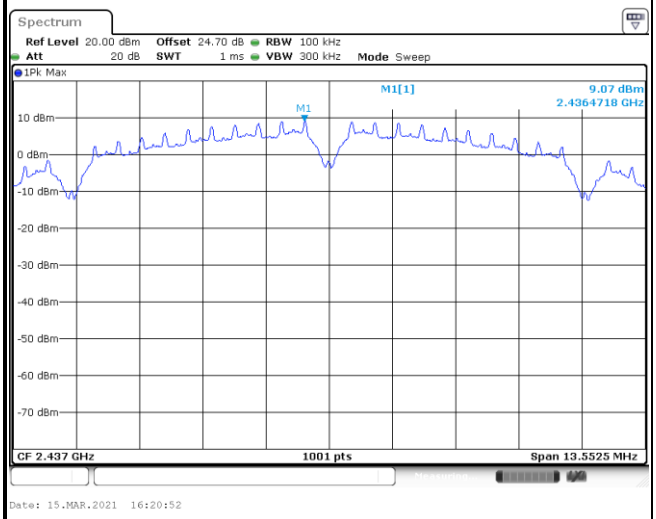
Spurious Emission 30MHz~3GHz

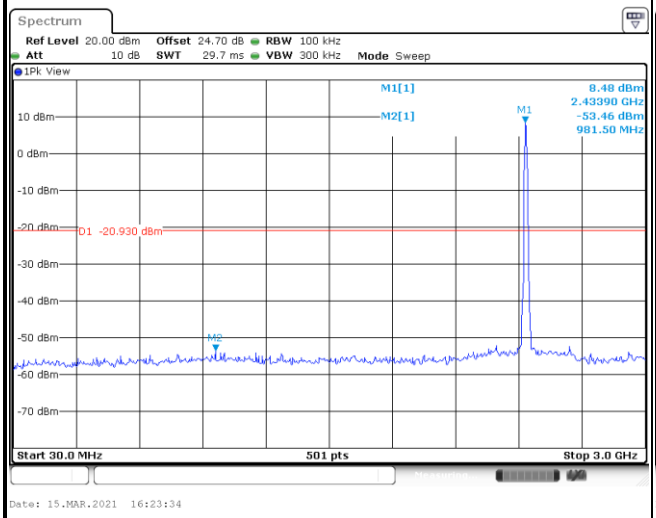
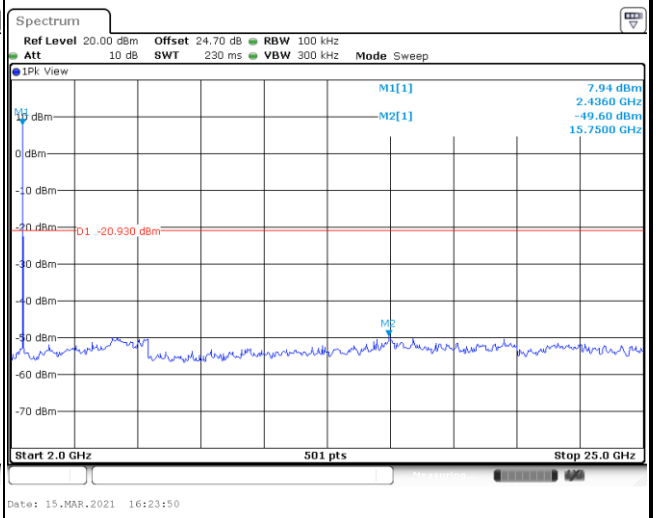


Spurious Emission 2GHz~25GHz

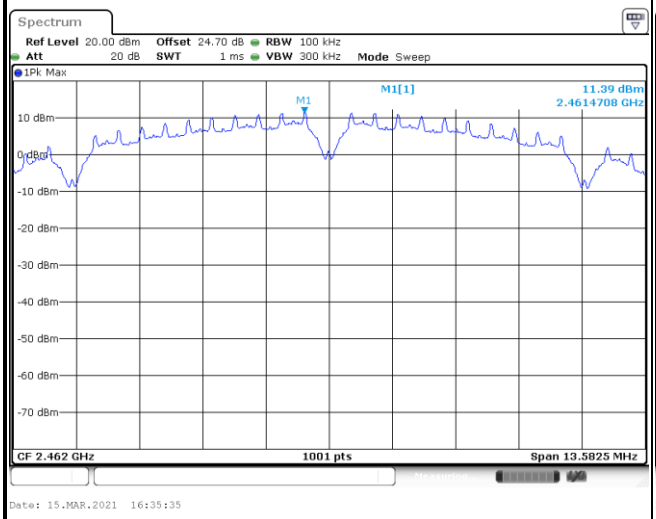
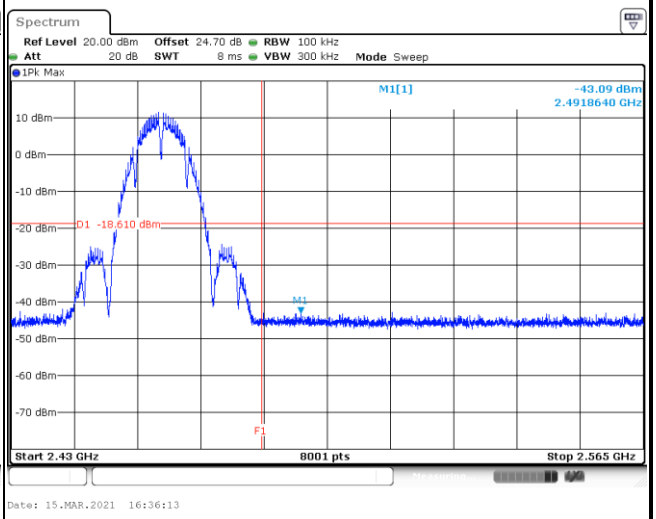
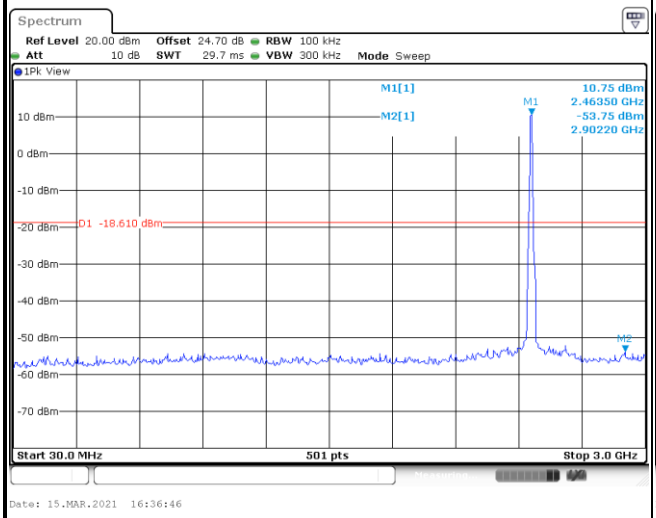
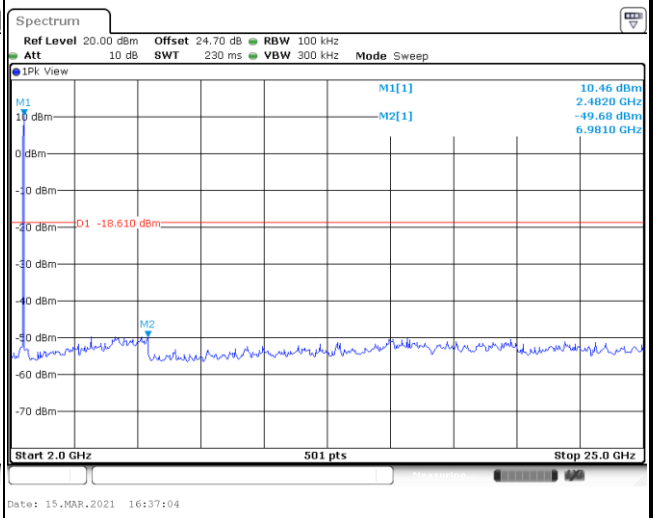


Test Mode :	802.11b	Test Channel :	06

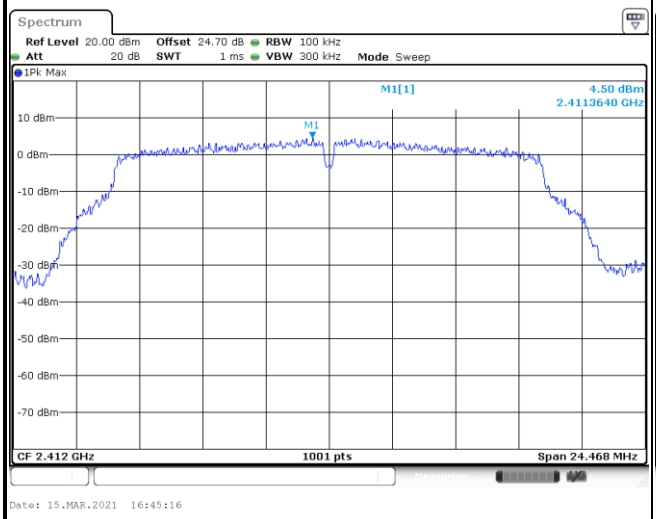
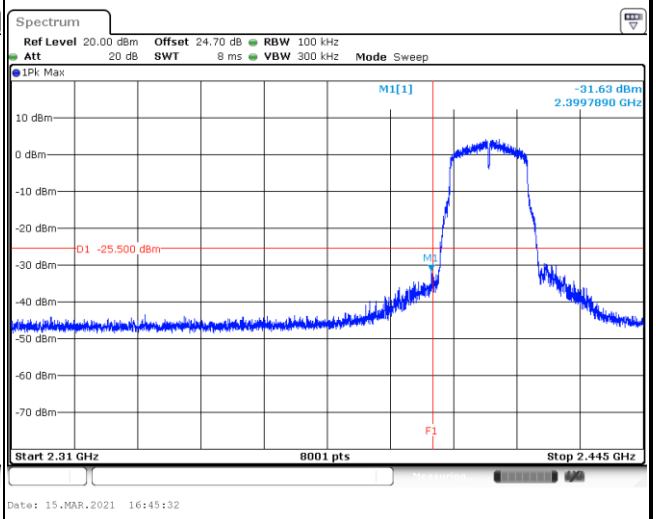
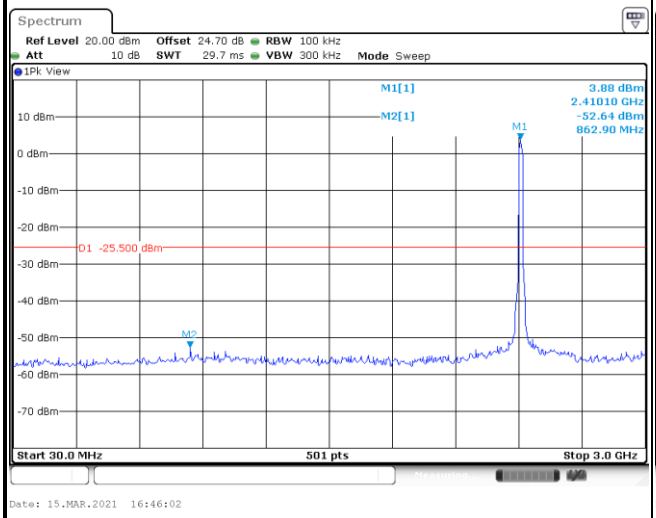
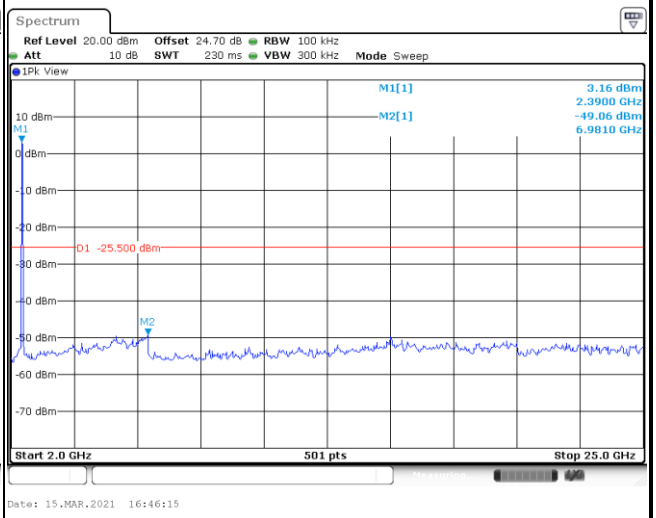
100kHz PSD reference Level	Mid Channel Plot
	

Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

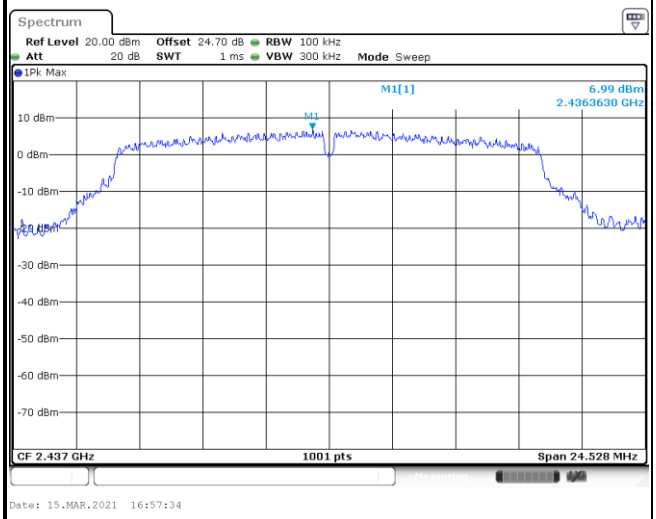
Test Mode :	802.11b	Test Channel :	11

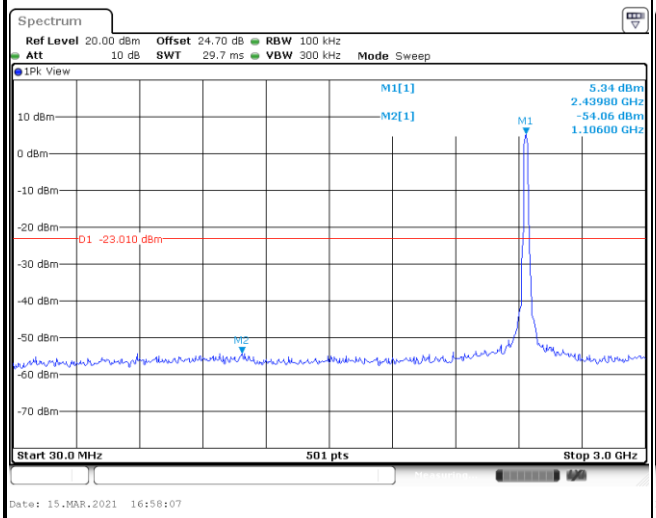
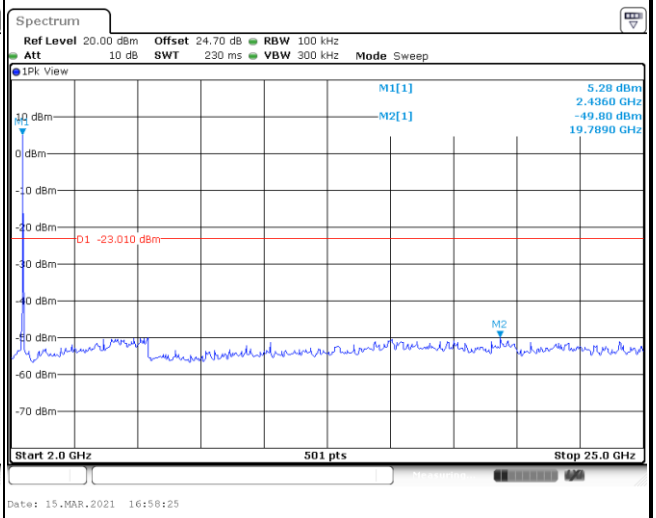
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11g	Test Channel :	01

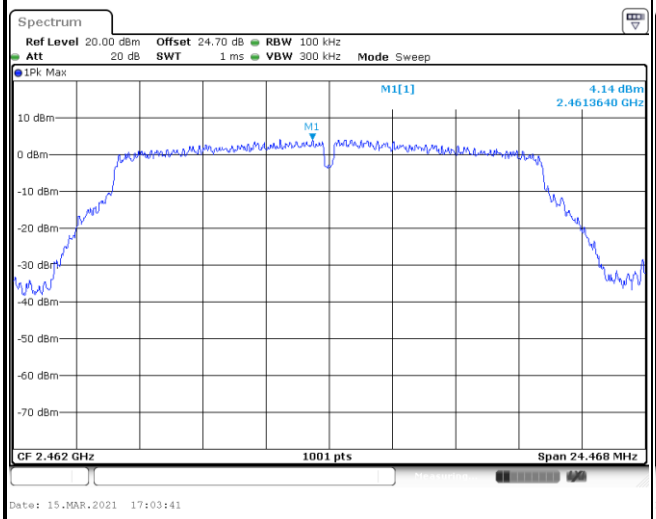
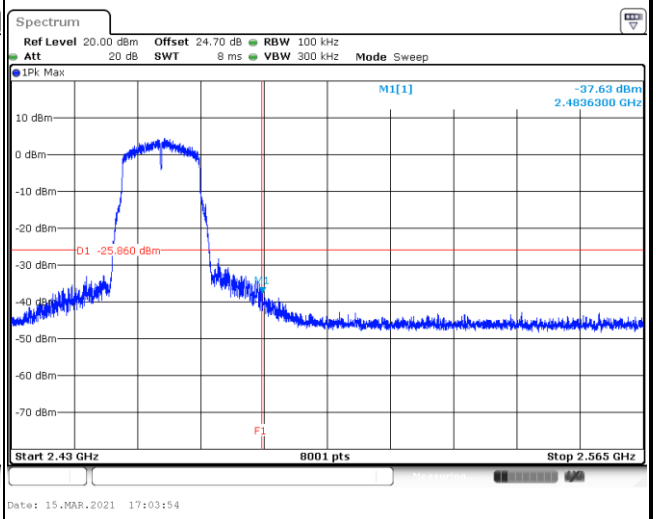
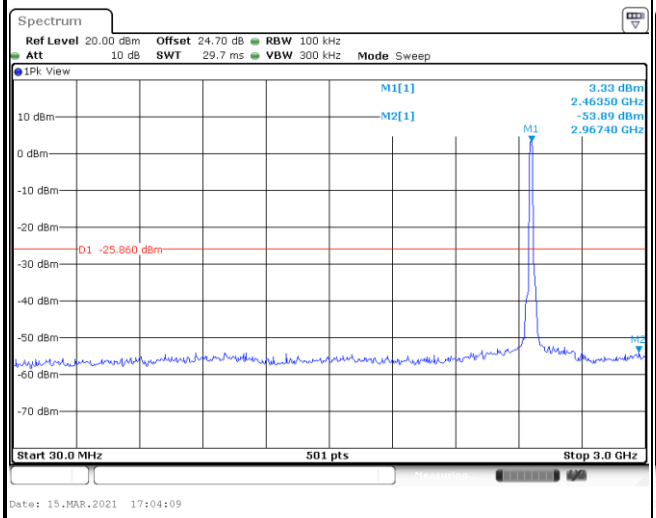
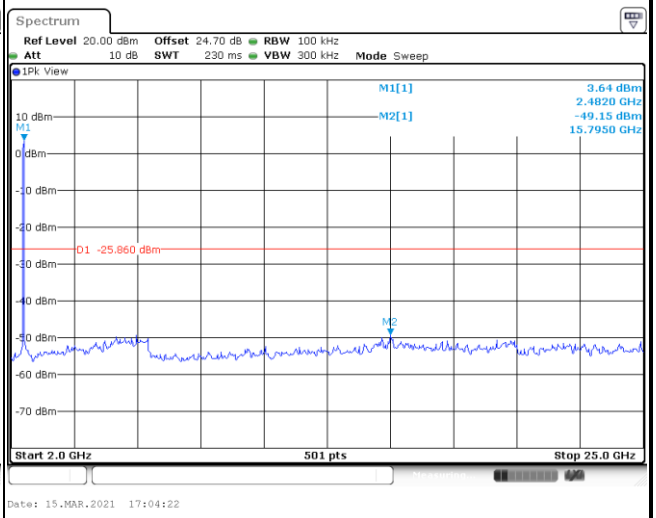
100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11g	Test Channel :	06

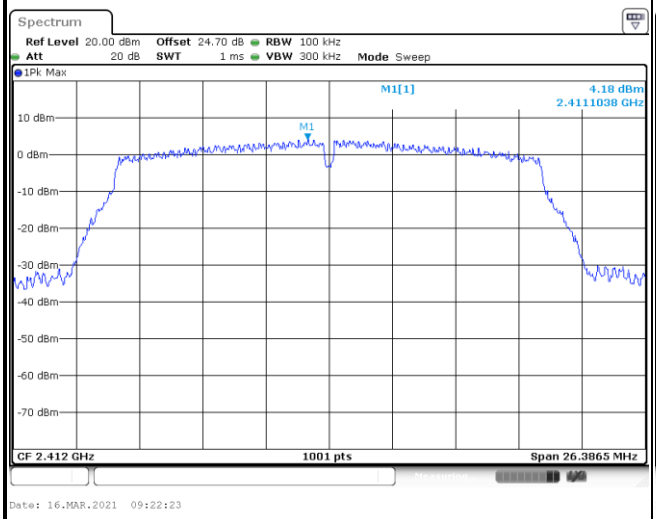
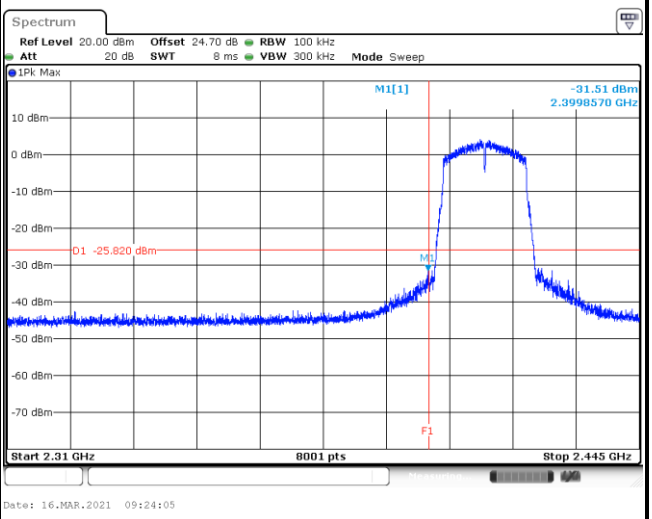
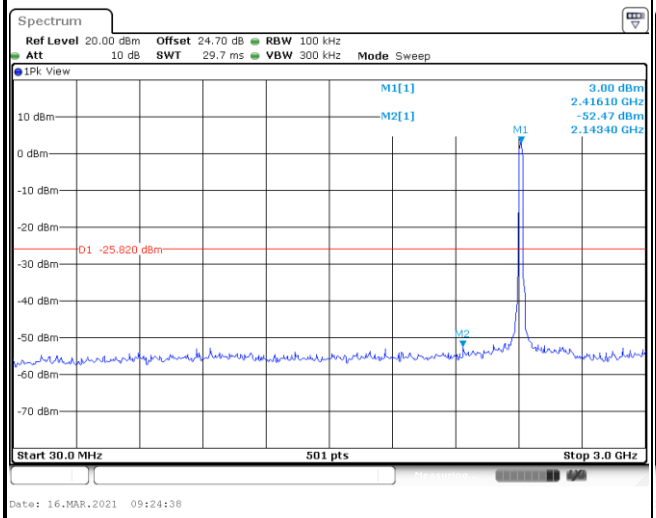
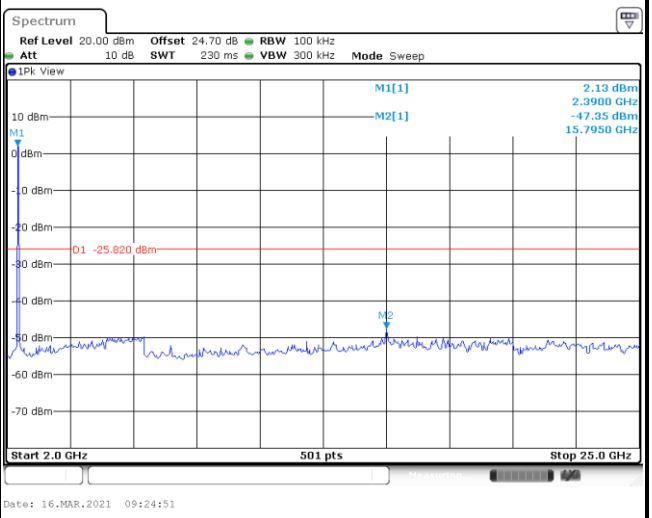
100kHz PSD reference Level	Mid Channel Plot
	

Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

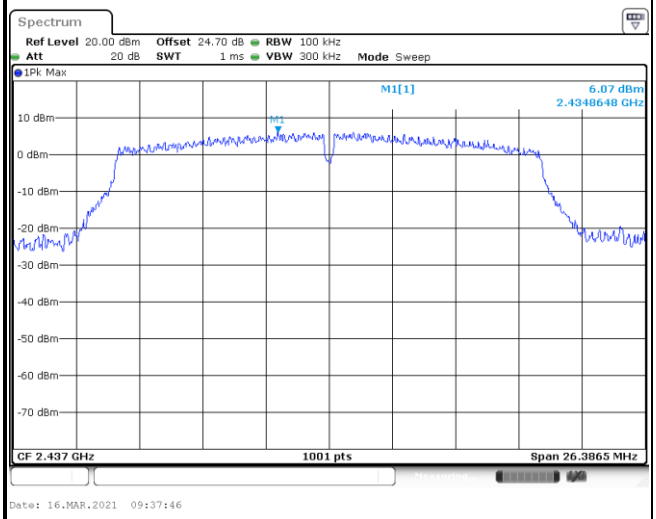
Test Mode :	802.11g	Test Channel :	11

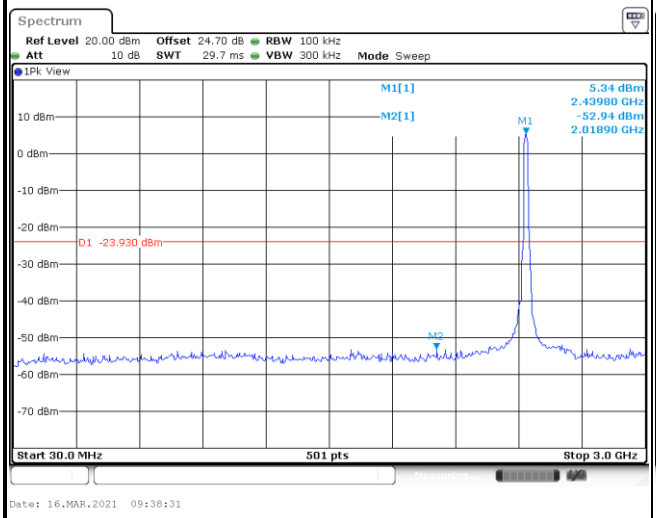
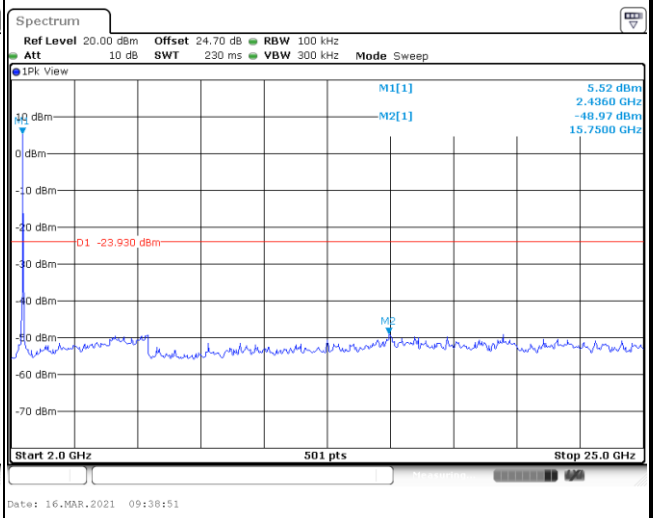
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11n HT20	Test Channel :	01

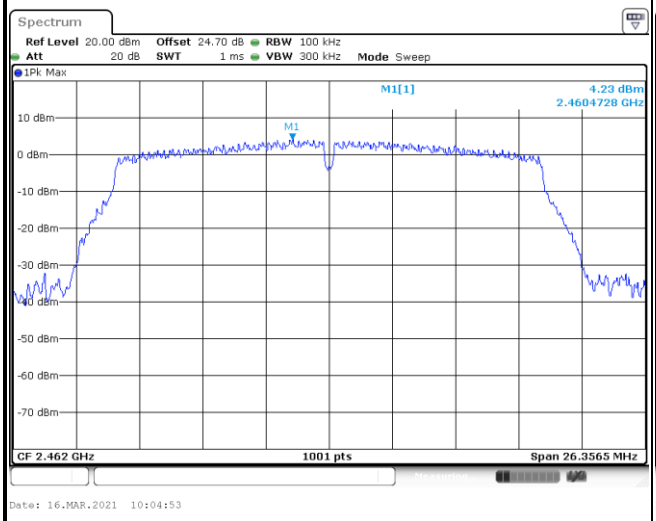
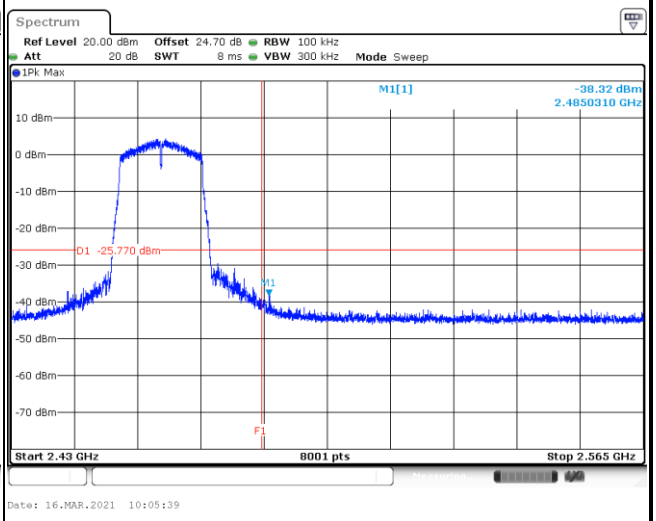
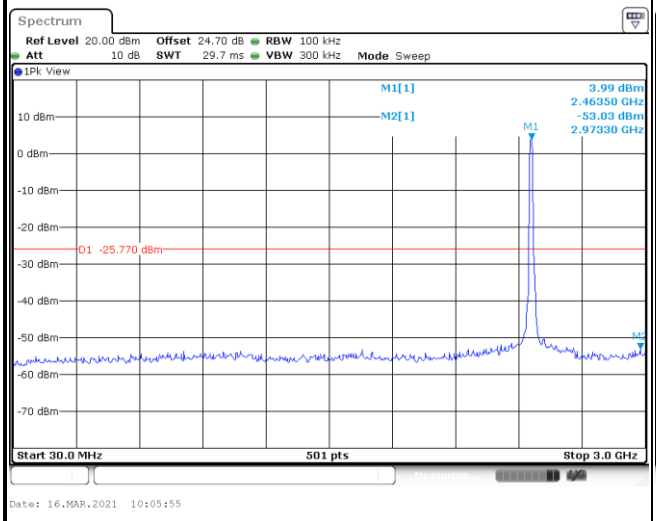
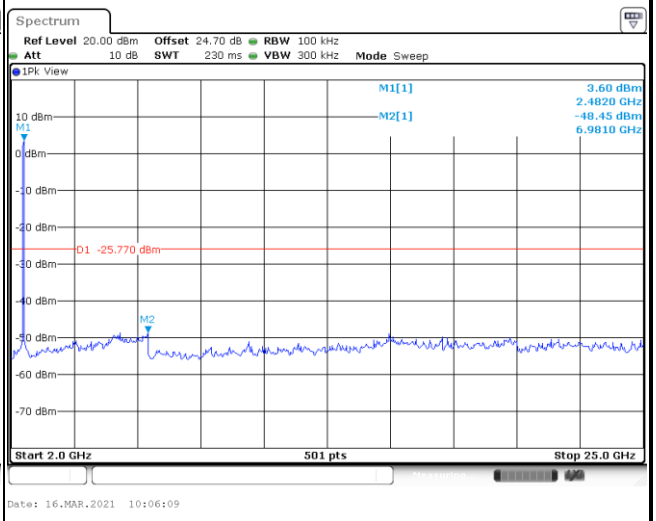
100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11n HT20	Test Channel :	06

100kHz PSD reference Level	Mid Channel Plot
	

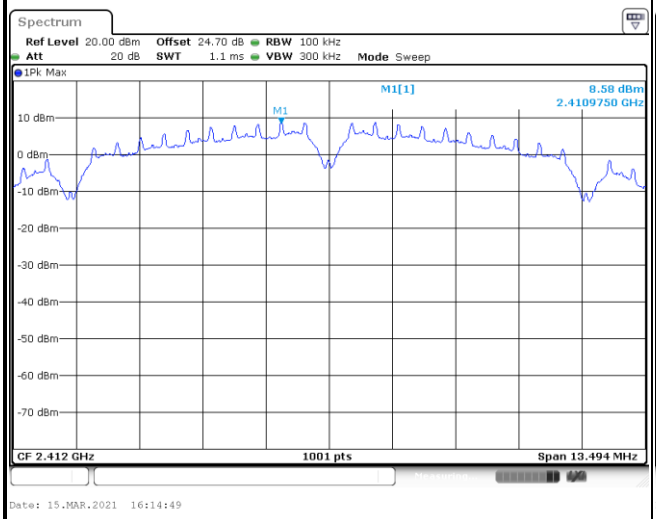
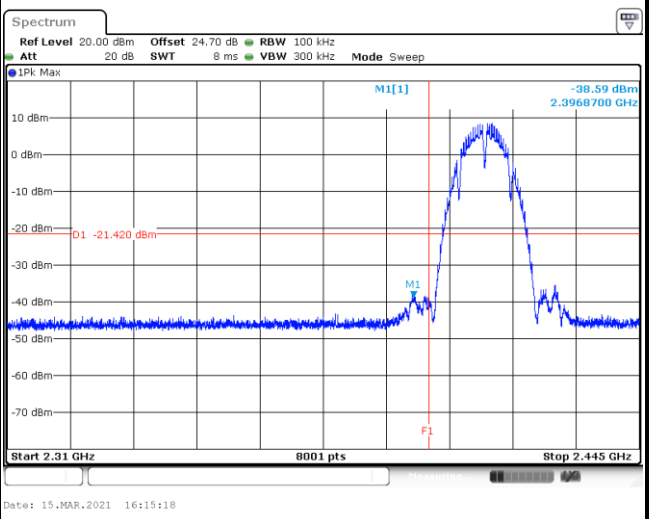
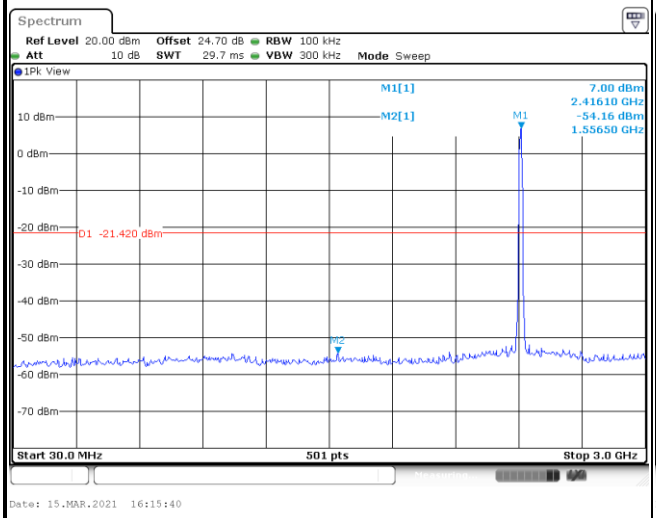
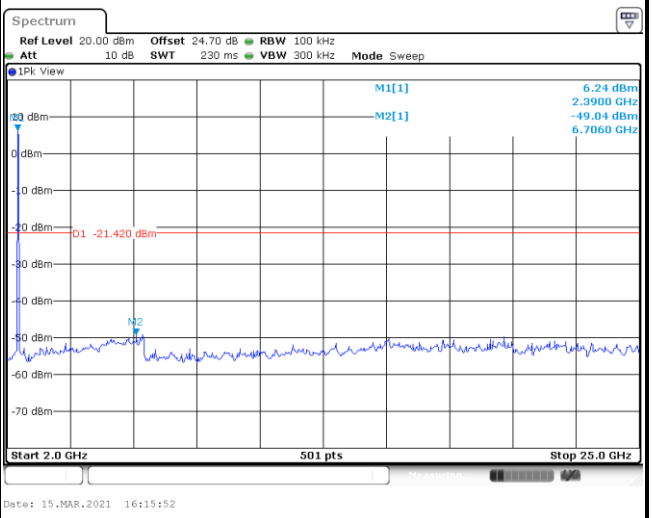
Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

Test Mode :	802.11n HT20	Test Channel :	11

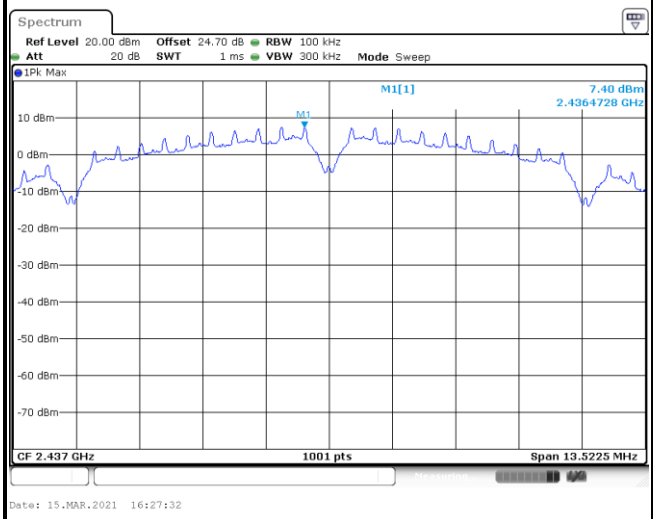
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

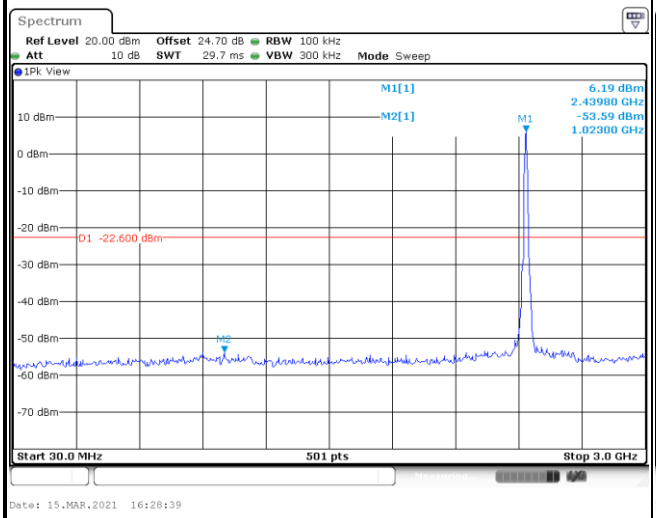
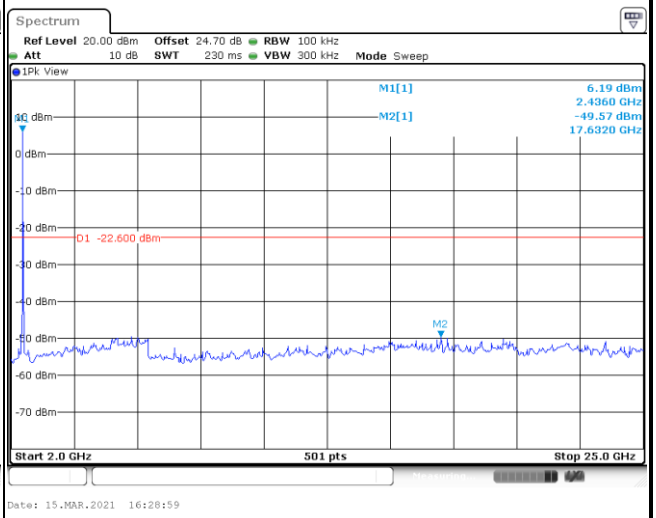
Number of TX = 2, Ant. 2 (Measured)

Test Mode :	802.11b	Test Channel :	01

100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

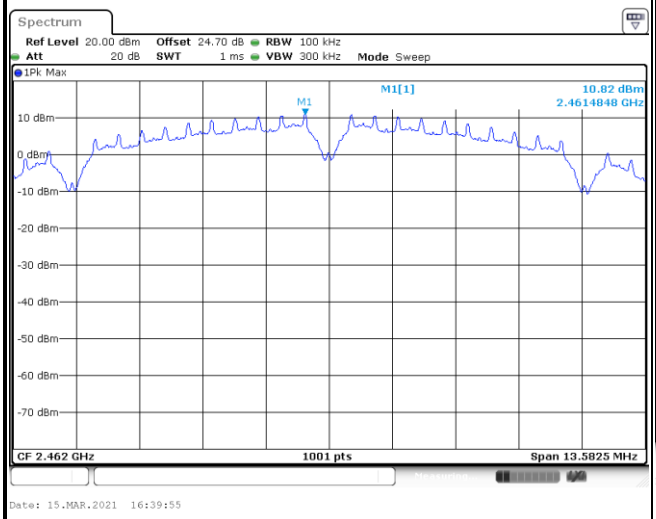
Test Mode :	802.11b	Test Channel :	06

100kHz PSD reference Level	Mid Channel Plot
	

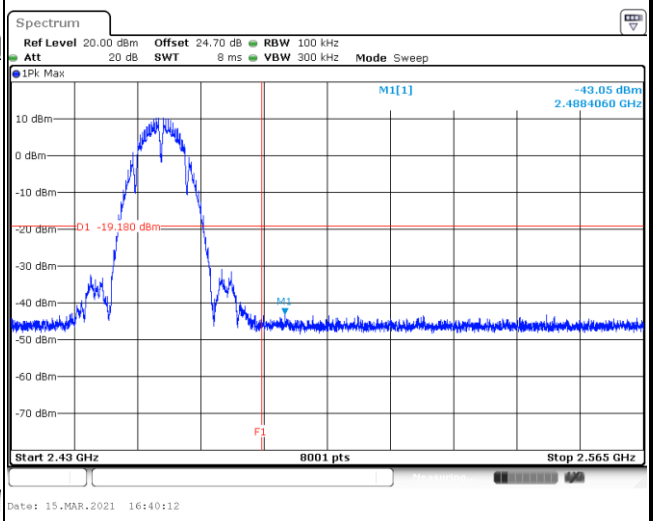
Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

Test Mode :	802.11b	Test Channel :	11

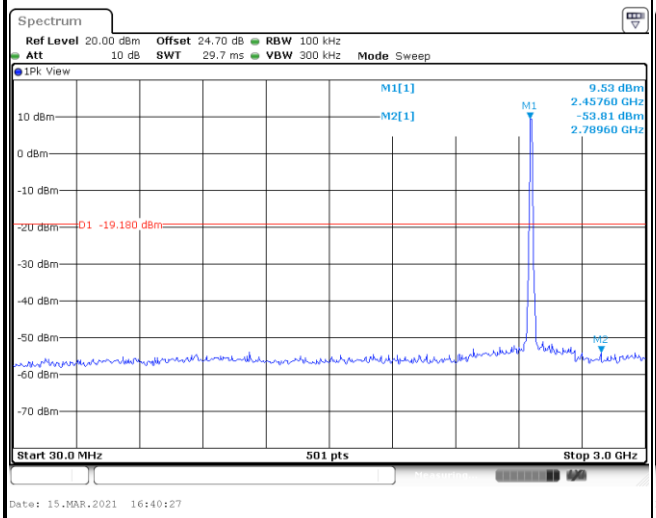
100kHz PSD reference Level



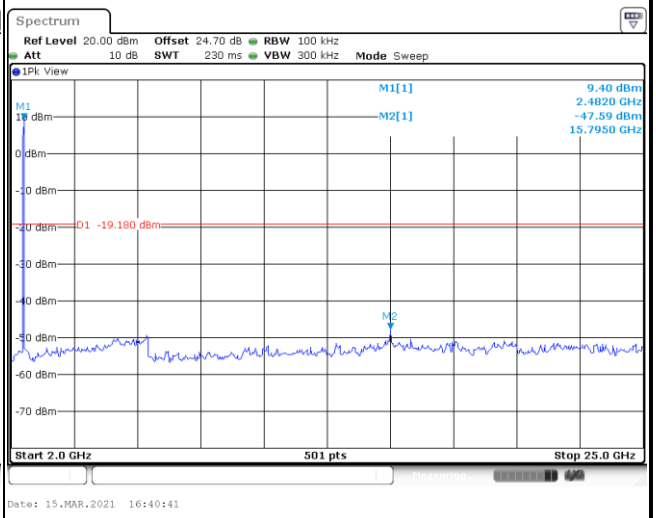
High Channel Plot



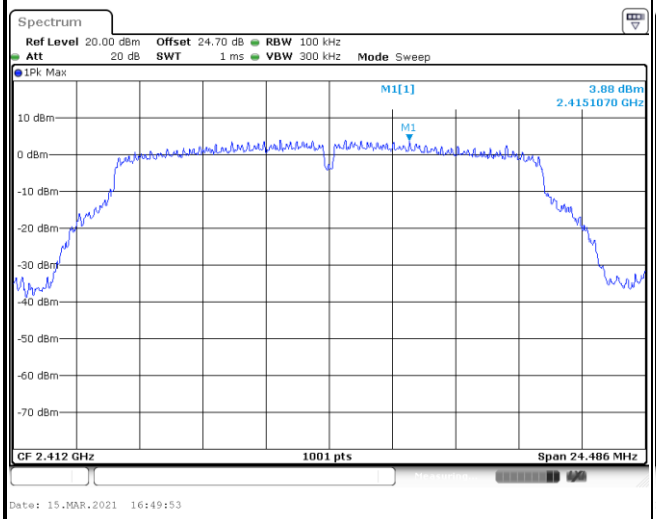
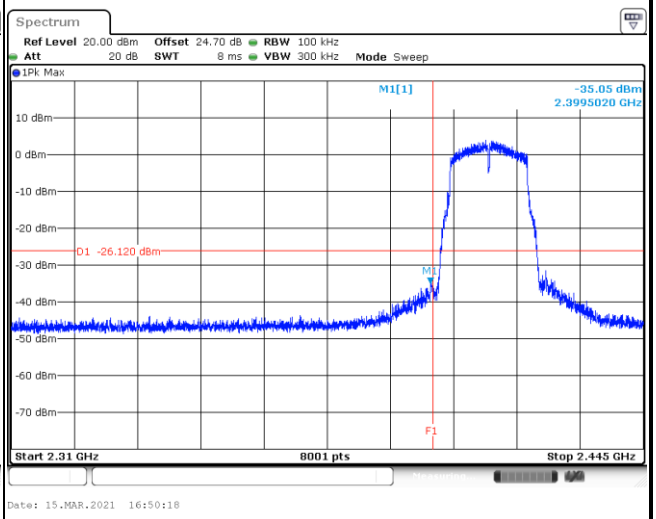
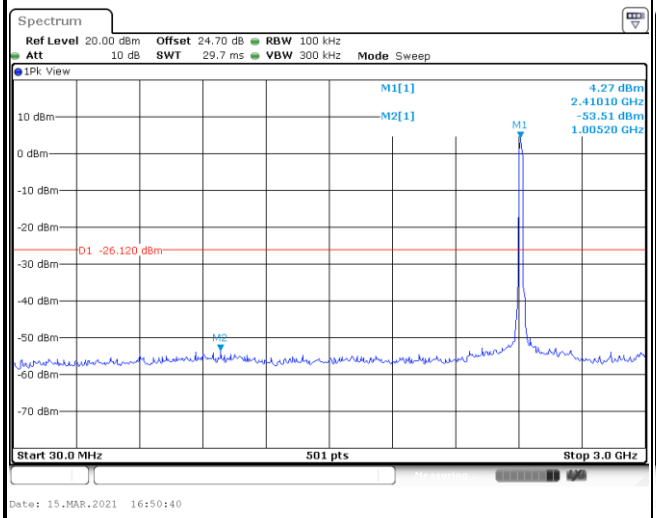
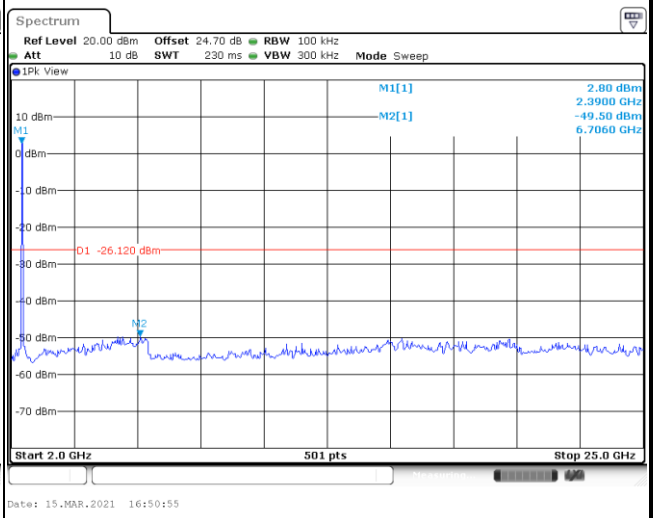
Spurious Emission 30MHz~3GHz



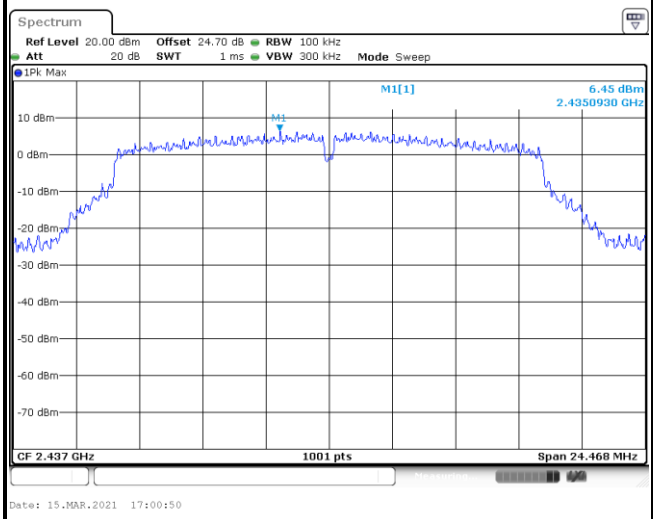
Spurious Emission 2GHz~25GHz

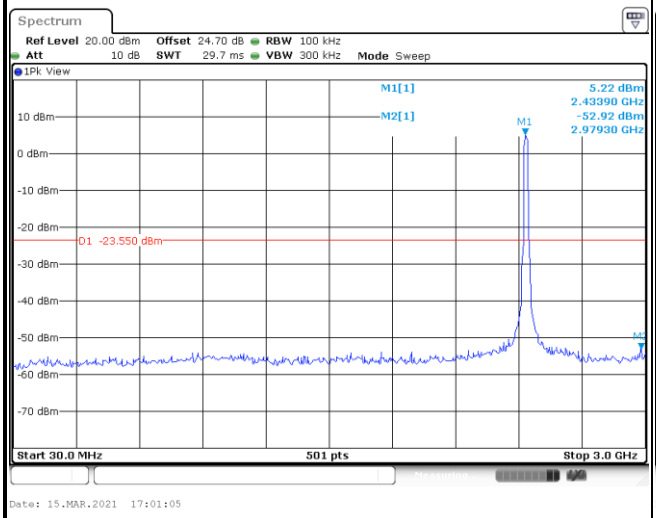
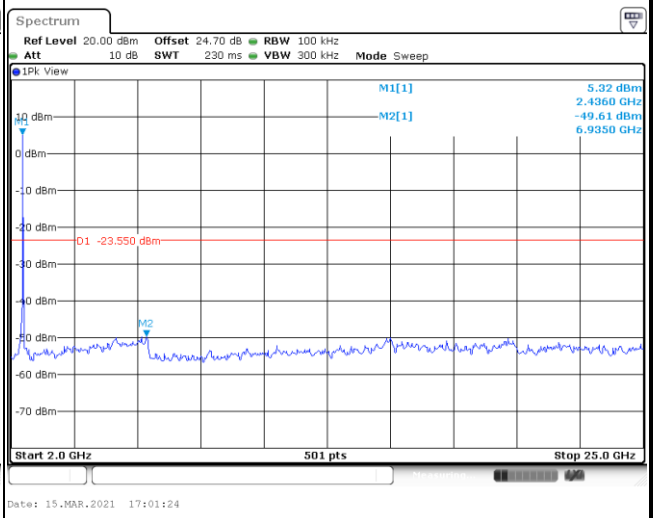


Test Mode :	802.11g	Test Channel :	01

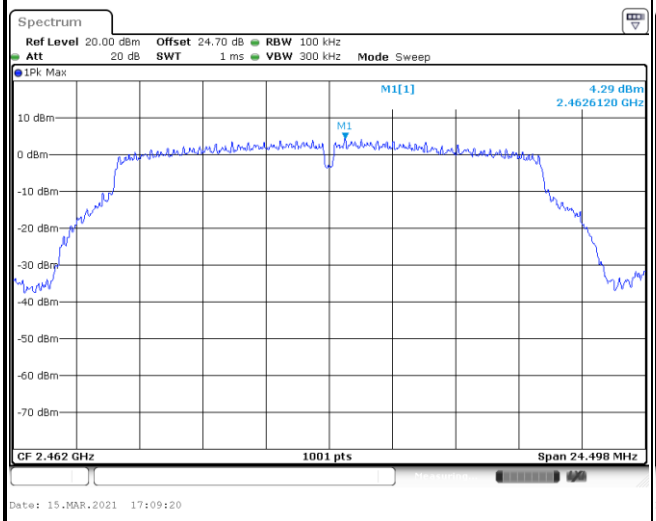
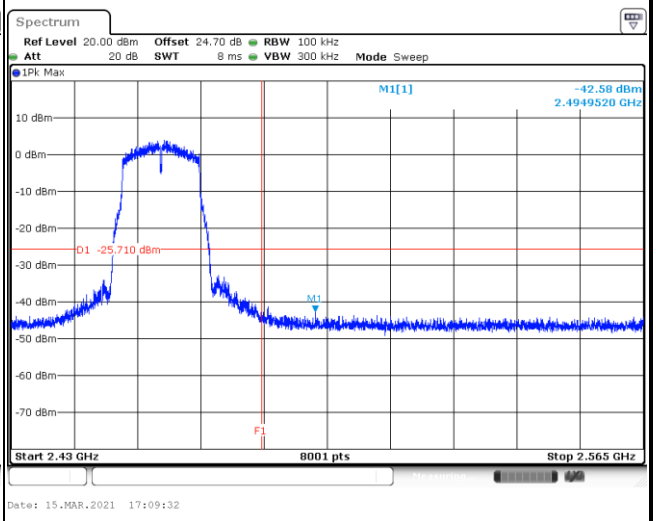
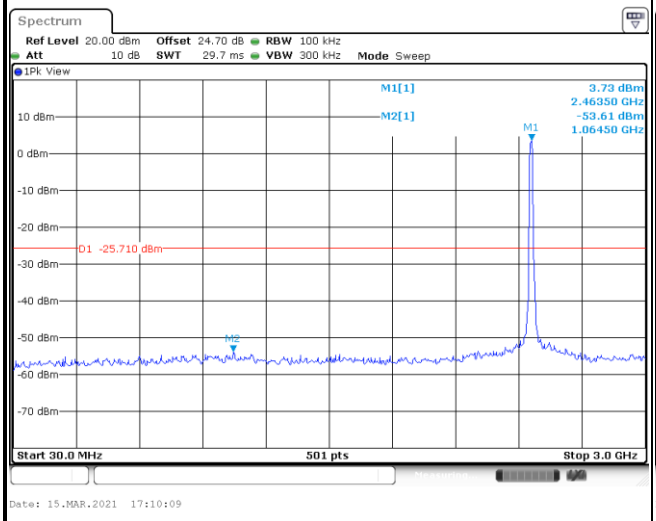
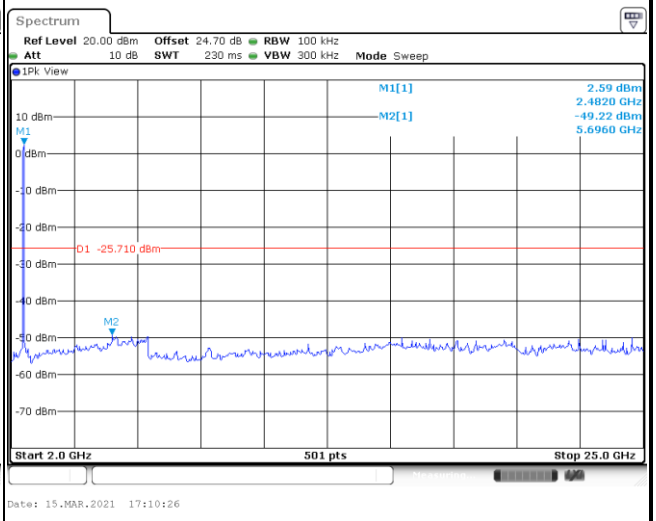
100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11g	Test Channel :	06

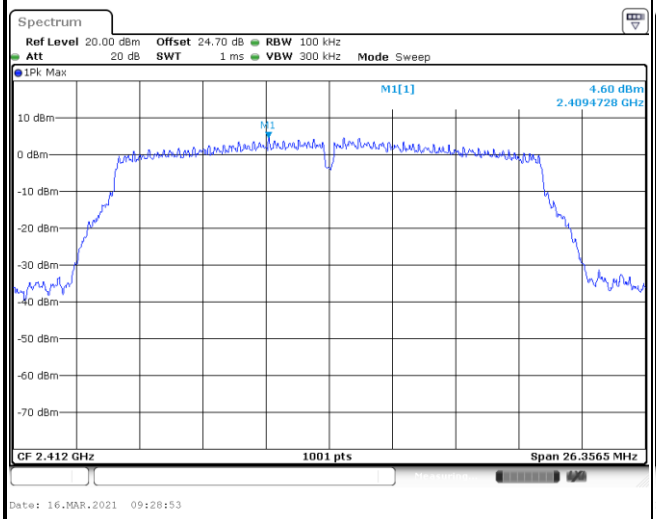
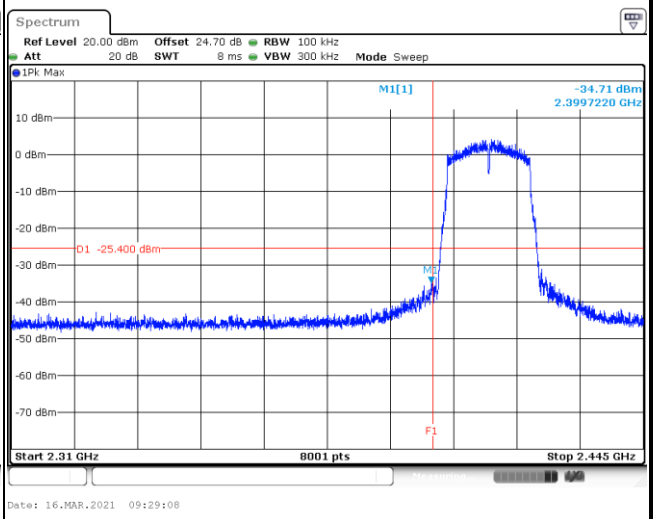
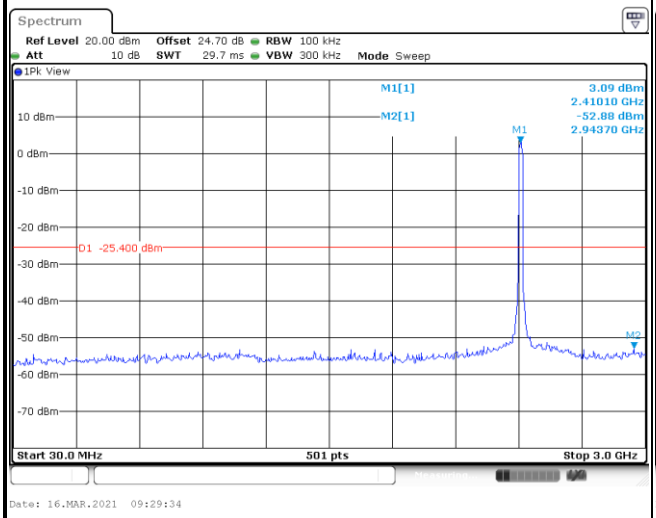
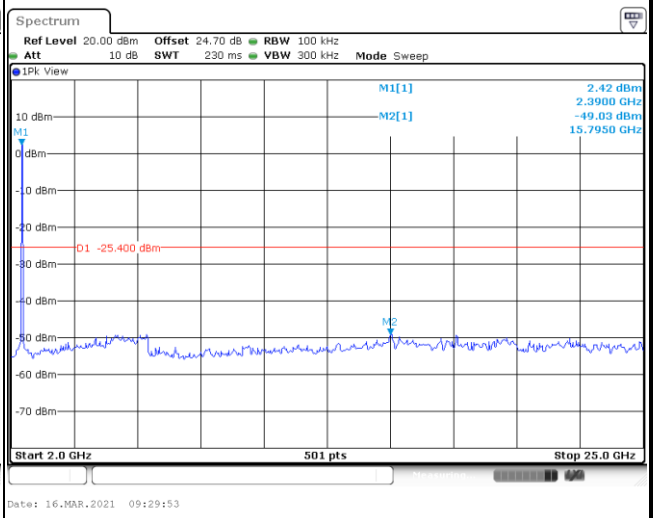
100kHz PSD reference Level	Mid Channel Plot
	

Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

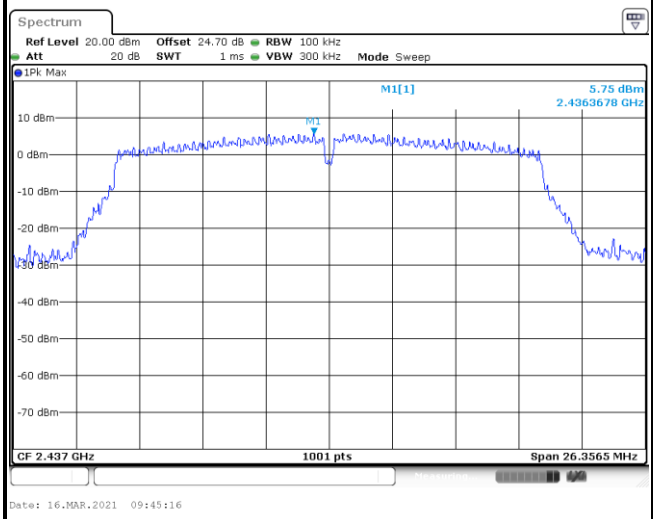
Test Mode :	802.11g	Test Channel :	11

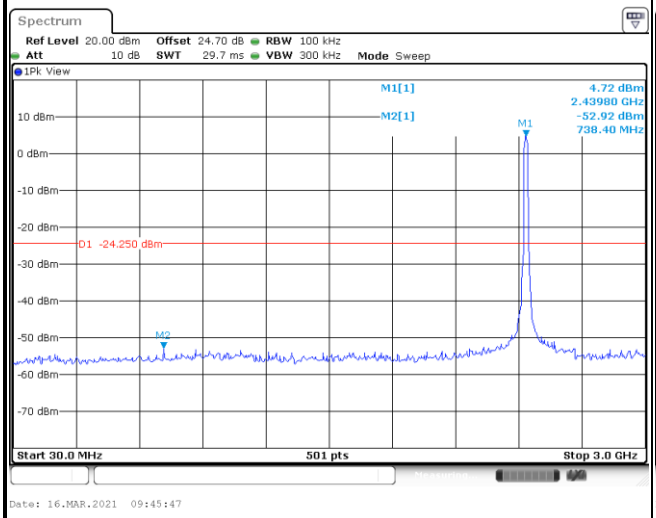
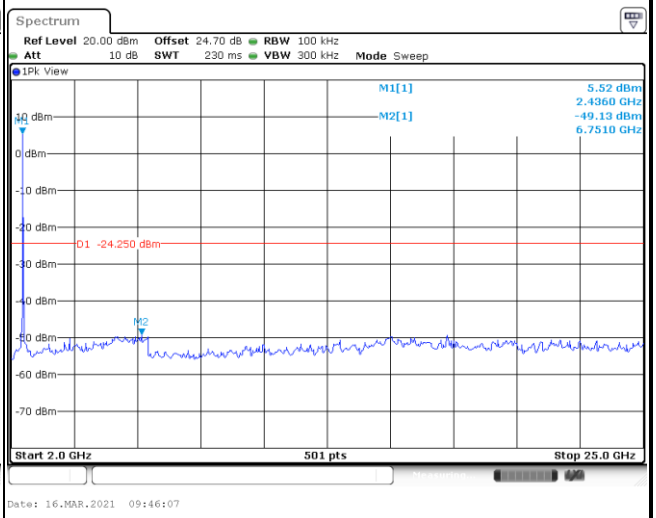
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11n HT20	Test Channel :	01

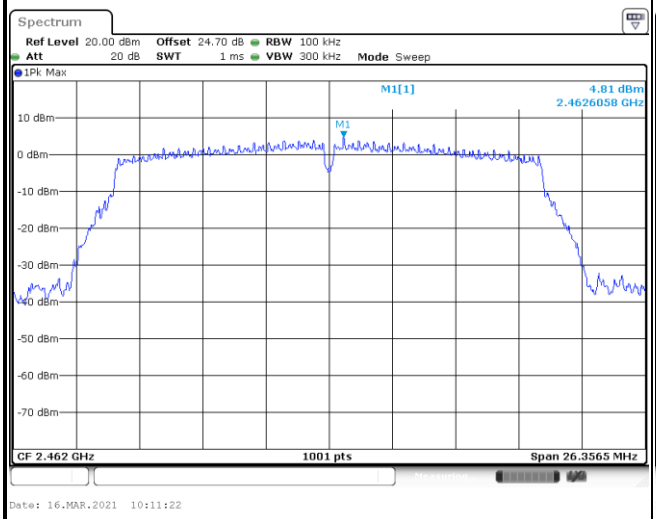
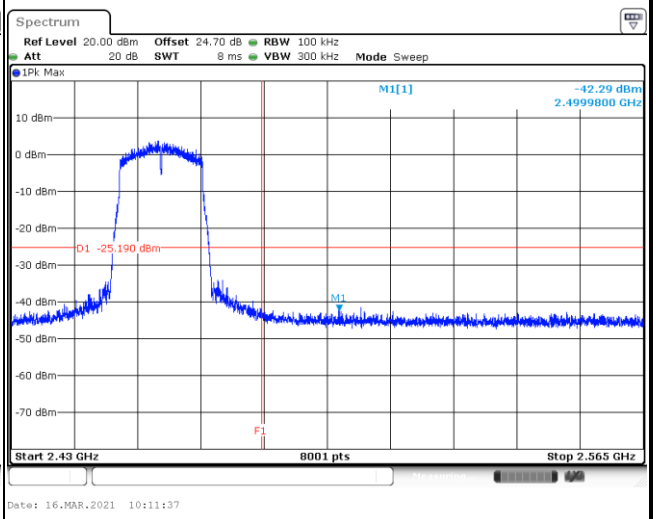
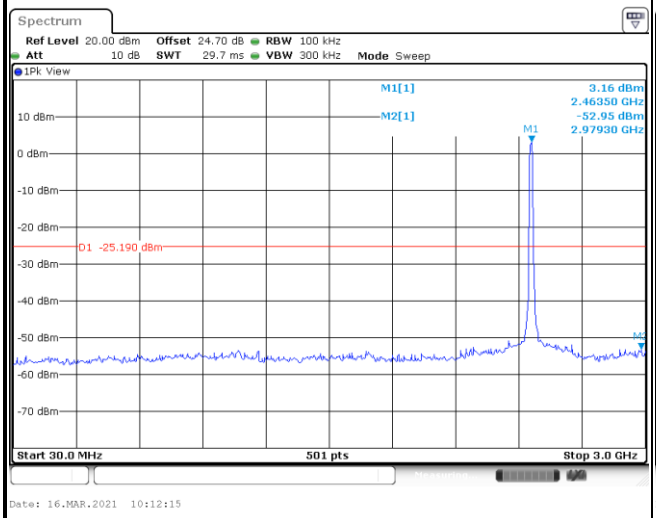
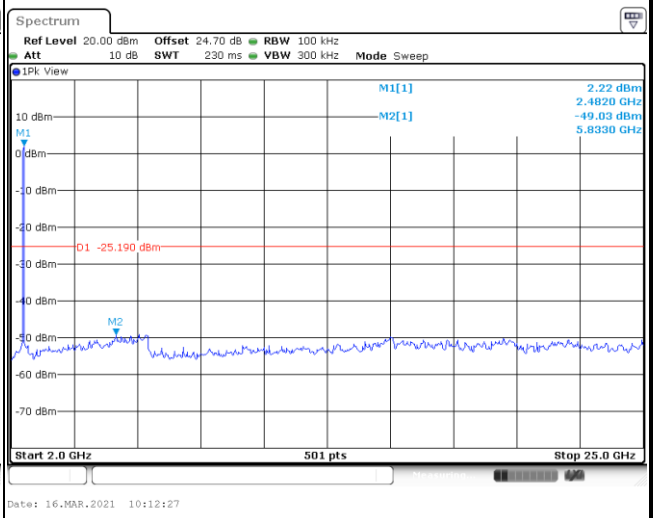
100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11n HT20	Test Channel :	06

100kHz PSD reference Level	Mid Channel Plot
	

Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

Test Mode :	802.11n HT20	Test Channel :	11

100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated band edge and Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the NCC LP0002 section 3.6 limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
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

3.5.2 Measuring Instruments

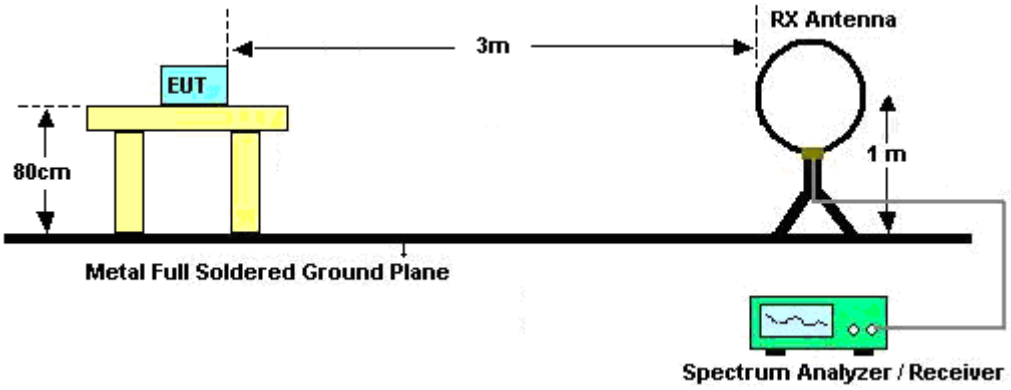
See list of measuring equipment of this test report.

3.5.3 Test Procedures

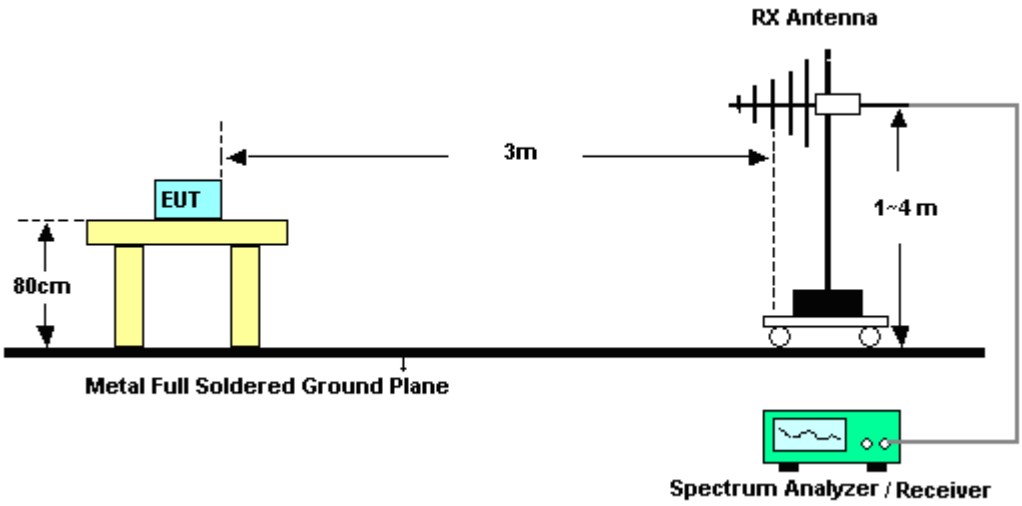
1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For testing below 1 GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1 GHz, the emission level of the EUT in peak mode was 20 dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
8. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW = 100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3 MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

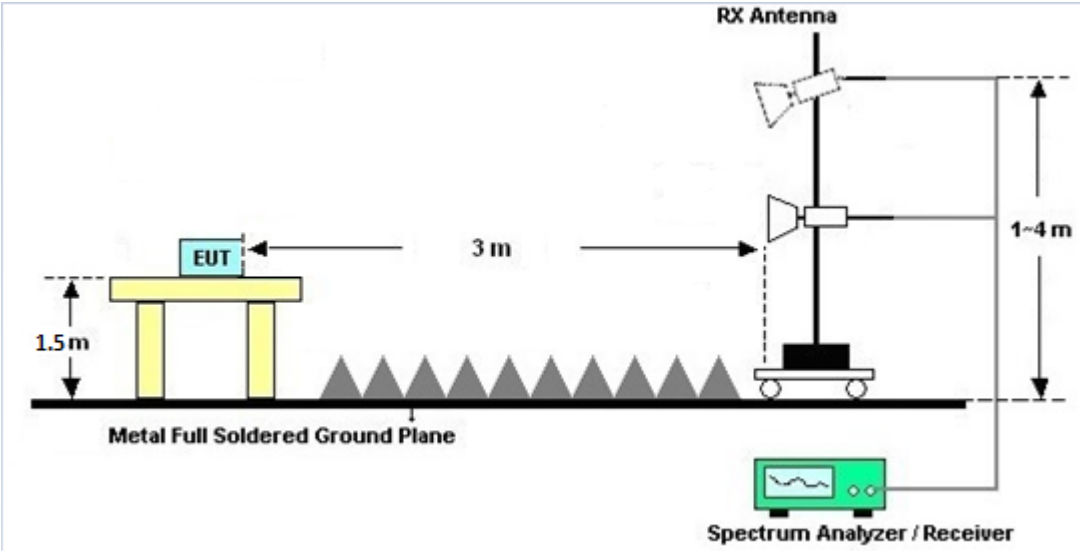
For radiated emissions below 30MHz



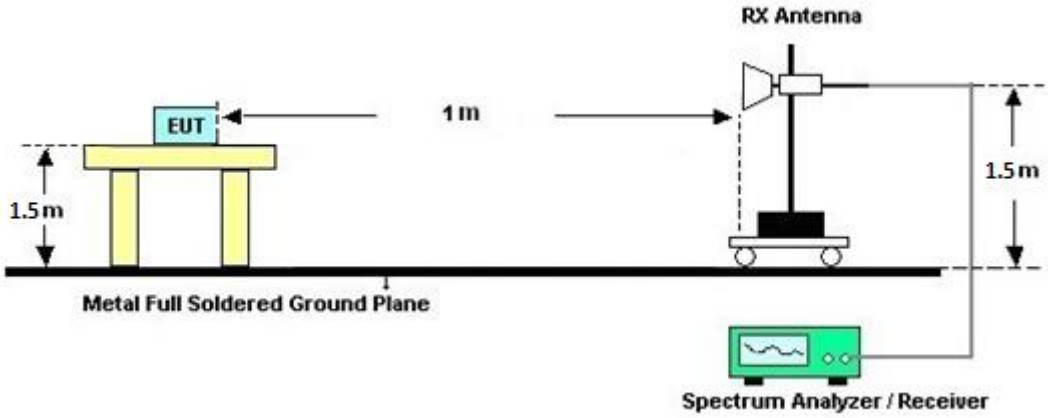
For radiated emissions from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



3.5.5 Test Results of Radiated Spurious Emissions (9kHz ~ 30MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per NCC LP0002 section 6.13 was not reported.

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.5.7 Duty Cycle

Please refer to Appendix E.

3.5.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix C and D.

3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

For equipment 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 or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

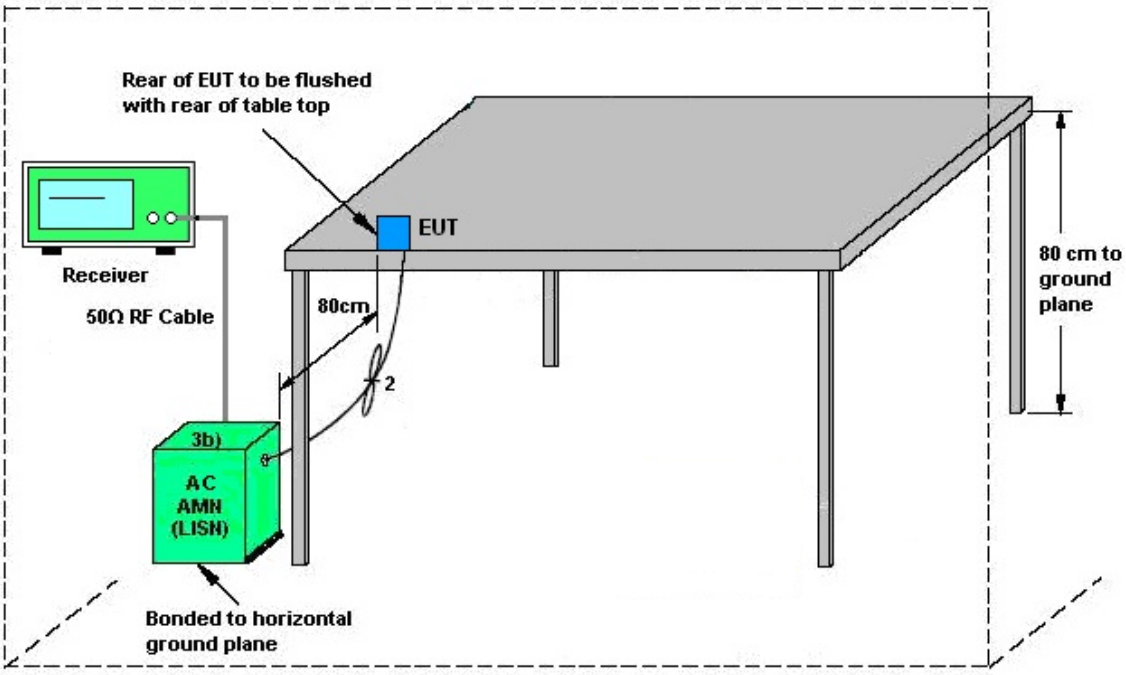
3.6.2 Measuring Instruments

See list of measuring equipment of this test report.

3.6.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN shall be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF bandwidth = 9kHz) with Maximum Hold Mode.

3.6.4 Test Setup



AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.7 Antenna Requirements

3.7.1 Standard Applicable

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. 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 LP0002 Section 3.2, Section 4.10.1.3, and Section 4.10.1.4

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

<CDD Modes >

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For CDD transmissions, directional gain is calculated as

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}=1) dB.

For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$.

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;

The EUT supports CDD mode.

For power, the directional gain G_{ANT} is set equal to the antenna having the highest gain, i.e., F)2)f)i).

For PSD, the directional gain calculation is following F)2)f)ii) of KDB 662911 D01 v02r01.

The power and PSD limit should be modified if the directional gain of EUT is over 6 dBi,

The directional gain “DG” is calculated as following table.

<CDD Modes>						
	Ant. 1 (dBi)	Ant. 2 (dBi)	DG for Power (dBi)	DG for PSD (dBi)	Power Limit Reduction (dB)	PSD Limit Reduction (dB)
2.4 GHz	3.21	1.27	3.21	5.30	0.00	0.00

Power Limit Reduction = DG(Power) – 6dBi, (min = 0)

PSD Limit Reduction = DG(PSD) – 6dBi, (min = 0)

4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Amplifier	Sonoma-Instrument	310 N	187282	9KHz~1GHz	Dec. 16, 2020	Feb. 25, 2021~ Mar. 08, 2021	Dec. 15, 2021	Radiation (03CH13-HY)
Bilog Antenna	TESEQ	CBL 6111D&00800N1D01N-06	40103&07	30MHz to 1GHz	Apr. 29, 2020	Feb. 25, 2021~ Mar. 08, 2021	Apr. 28, 2021	Radiation (03CH13-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1212	1GHz ~ 18GHz	May 20, 2020	Feb. 25, 2021~ Mar. 08, 2021	May 19, 2021	Radiation (03CH13-HY)
Preamplifier	MITEQ	AMF-7D-00101800-30-10P	1590074	1GHz~18GHz	May 19, 2020	Feb. 25, 2021~ Mar. 08, 2021	May 18, 2021	Radiation (03CH13-HY)
Preamplifier	Keysight	83017A	MY53270147	1GHz~26.5GHz	Oct. 28, 2020	Feb. 25, 2021~ Mar. 08, 2021	Oct. 27, 2021	Radiation (03CH13-HY)
Signal Generator	Anritsu	MG3694C	163401	0.1Hz~40GHz	Jan. 31, 2021	Feb. 25, 2021~ Mar. 08, 2021	Jan. 30, 2022	Radiation (03CH13-HY)
Spectrum Analyzer	Keysight	N9010A	MY55370526	10Hz~44GHz	Mar. 20, 2020	Feb. 25, 2021~ Mar. 08, 2021	Mar. 19, 2021	Radiation (03CH13-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	Feb. 25, 2021~ Mar. 08, 2021	N/A	Radiation (03CH13-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Feb. 25, 2021~ Mar. 08, 2021	N/A	Radiation (03CH13-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Feb. 25, 2021~ Mar. 08, 2021	N/A	Radiation (03CH13-HY)
Software	Audix	E3 6.2009-8-24	RK-000992	N/A	N/A	Feb. 25, 2021~ Mar. 08, 2021	N/A	Radiation (03CH13-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz ~ 40GHz	Dec. 11, 2020	Feb. 25, 2021~ Mar. 08, 2021	Dec. 10, 2021	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0030/126E	30M-18G	Feb. 10, 2021	Feb. 25, 2021~ Mar. 08, 2021	Feb. 09, 2022	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	804793/4	30M-18G	Feb. 10, 2021	Feb. 25, 2021~ Mar. 08, 2021	Feb. 09, 2022	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30M~40GHz	Feb. 22, 2021	Feb. 25, 2021~ Mar. 08, 2021	Feb. 21, 2022	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY4274/2	30M~40GHz	Mar. 12, 2020	Feb. 25, 2021~ Mar. 08, 2021	Mar. 11, 2021	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24961/4	30M-18G	Feb. 10, 2021	Feb. 25, 2021~ Mar. 08, 2021	Feb. 09, 2022	Radiation (03CH13-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4 PE	9kHz~30MHz	Mar. 12, 2020	Feb. 25, 2021~ Mar. 08, 2021	Mar. 11, 2021	Radiation (03CH13-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170584	18GHz- 40GHz	Dec. 11, 2020	Feb. 25, 2021~ Mar. 08, 2021	Dec. 10, 2021	Radiation (03CH13-HY)
Filter	Wainwright	WHKX12-1080-1200-15000-60SS	SN3	1.2GHz High Pass Filter	Jul. 02, 2020	Feb. 25, 2021~ Mar. 08, 2021	Jul. 01, 2021	Radiation (03CH13-HY)
Hygrometer	TECPEL	DTM-303A	TP190075	N/A	Apr. 23, 2020	Feb. 25, 2021~ Mar. 08, 2021	Apr. 22, 2021	Radiation (03CH13-HY)

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Hygrometer	TECPEL	DTM-303B	TP161250	N/A	May 08, 2021	Mar. 03, 2021~ Mar. 16. 2021	May 07, 2022	Conducted (TH04-HY)
Power Sensor	DARE	RPR3006W	16I00054SNO12	10MHz~6GHz	Dec. 16, 2020	Mar. 03, 2021~ Mar. 16. 2021	Dec. 15, 2021	Conducted (TH04-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101566	10Hz ~ 40GHz	Jul. 22, 2020	Mar. 03, 2021~ Mar. 16. 2021	Jul. 21, 2021	Conducted (TH04-HY)
Switch Box & RF Cable	Burgeon	ETF-058	EC1208382	N/A	Aug. 15, 2020	Mar. 04, 2021~ Mar. 16. 2021	Aug. 14, 2021	Conducted (TH04-HY)
AC Power Source	ACPOWER	AFC-11003G	F317040033	N/A	N/A	Mar. 22, 2021	N/A	Conduction (CO07-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Mar. 22, 2021	N/A	Conduction (CO07-HY)
Pulse Limiter	SCHWARZBECK	VTSD 9561-F N	9561-F N00373	9kHz-200MHz	Nov. 02, 2020	Mar. 22, 2021	Nov. 01, 2021	Conduction (CO07-HY)
RF Cable	HUBER + SUHNER	RG 214/U	1358175	9kHz~30MHz	N/A	Mar. 22, 2021	N/A	Conduction (CO07-HY)
Two-Line V-Network	TESEQ	NNB 51	45051	N/A	Feb. 01, 2021	Mar. 22, 2021	Jan. 31, 2022	Conduction (CO07-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102317	9kHz~3.6GHz	Sep. 11, 2020	Mar. 22, 2021	Sep. 10, 2021	Conduction (CO07-HY)

5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.2

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.8

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.1

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.8

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Eason Huang	Temperature:	21~25	°C
Test Date:	2021/3/3~3/16	Relative Humidity:	51~54	%

Maximum Power Density				
Max. Power	Gain	EIRP	20 cm PSD	PSD Limit
23.32	3.21	26.53	0.0895	1.00
dBm	dBi	dBm	mW/cm^2	mW/cm^2

Report Number : TR120337B

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

2.4GHz Band MIMO										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)		6dB BW (MHz)		6dB BW Limit (MHz)	Pass/Fail
					Ant1	Ant2	Ant1	Ant2		
11b	1Mbps	2	1	2412	13.79	13.54	9.04	9.00	0.50	Pass
11b	1Mbps	2	6	2437	13.69	13.94	9.04	9.02	0.50	Pass
11b	1Mbps	2	11	2462	14.24	13.79	9.06	9.06	0.50	Pass
11g	6Mbps	2	1	2412	16.73	16.58	16.31	16.32	0.50	Pass
11g	6Mbps	2	6	2437	17.18	16.78	16.35	16.31	0.50	Pass
11g	6Mbps	2	11	2462	16.68	16.58	16.31	16.33	0.50	Pass
HT20	MCS0	2	1	2412	17.68	17.63	17.59	17.57	0.50	Pass
HT20	MCS0	2	6	2437	17.88	17.73	17.59	17.57	0.50	Pass
HT20	MCS0	2	11	2462	17.68	17.63	17.57	17.57	0.50	Pass

Report Number : TR120337B

TEST RESULTS DATA
Average Output Power

2.4GHz Band MIMO																			
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail	Setting	
					Ant1	Ant2	SUM	Ant1	Ant2	Ant1	Ant2	Ant1	Ant2	Ant1	Ant2		Ant 1	Ant 2
11b	1Mbps	2	1	2412	18.30	17.80	21.07	30.00		3.21		24.28		36.00		Pass	18.50	
11b	1Mbps	2	6	2437	17.60	16.70	20.18	30.00		3.21		23.39		36.00		Pass	17.50	
11b	1Mbps	2	11	2462	20.60	20.00	23.32	30.00		3.21		26.53		36.00		Pass	21.00	
11g	6Mbps	2	1	2412	17.80	17.40	20.61	30.00		3.21		23.82		36.00		Pass	17.50	
11g	6Mbps	2	6	2437	19.80	19.30	22.57	30.00		3.21		25.78		36.00		Pass	20.00	
11g	6Mbps	2	11	2462	17.80	17.30	20.57	30.00		3.21		23.78		36.00		Pass	17.50	
HT20	MCS0	2	1	2412	16.90	16.70	19.81	30.00		3.21		23.02		36.00		Pass	17.00	
HT20	MCS0	2	6	2437	19.00	18.30	21.67	30.00		3.21		24.88		36.00		Pass	19.00	
HT20	MCS0	2	11	2462	16.60	16.10	19.37	30.00		3.21		22.58		36.00		Pass	16.50	

Note: Measured power (dBm) has offset with cable loss.

Report Number : TR120337B

TEST RESULTS DATA
Peak Power Spectral Density

2.4GHz Band MIMO												
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak PSD (dBm/3kHz)			DG (dBi)		Peak PSD Limit (dBm/3kHz)		Pass/Fail
					Ant1	Ant2	Worse + 3.01	Ant1	Ant2	Ant1	Ant2	
11b	1Mbps	2	1	2412	-4.22	-4.45	-1.21	5.30		8.00		Pass
11b	1Mbps	2	6	2437	-4.52	-5.88	-1.51	5.30		8.00		Pass
11b	1Mbps	2	11	2462	-2.77	-3.62	0.24	5.30		8.00		Pass
11g	6Mbps	2	1	2412	-7.04	-7.17	-4.03	5.30		8.00		Pass
11g	6Mbps	2	6	2437	-4.12	-5.71	-1.11	5.30		8.00		Pass
11g	6Mbps	2	11	2462	-7.15	-7.41	-4.14	5.30		8.00		Pass
HT20	MCS0	2	1	2412	-6.57	-7.47	-3.56	5.30		8.00		Pass
HT20	MCS0	2	6	2437	-3.99	-4.60	-0.98	5.30		8.00		Pass
HT20	MCS0	2	11	2462	-6.96	-7.68	-3.95	5.30		8.00		Pass

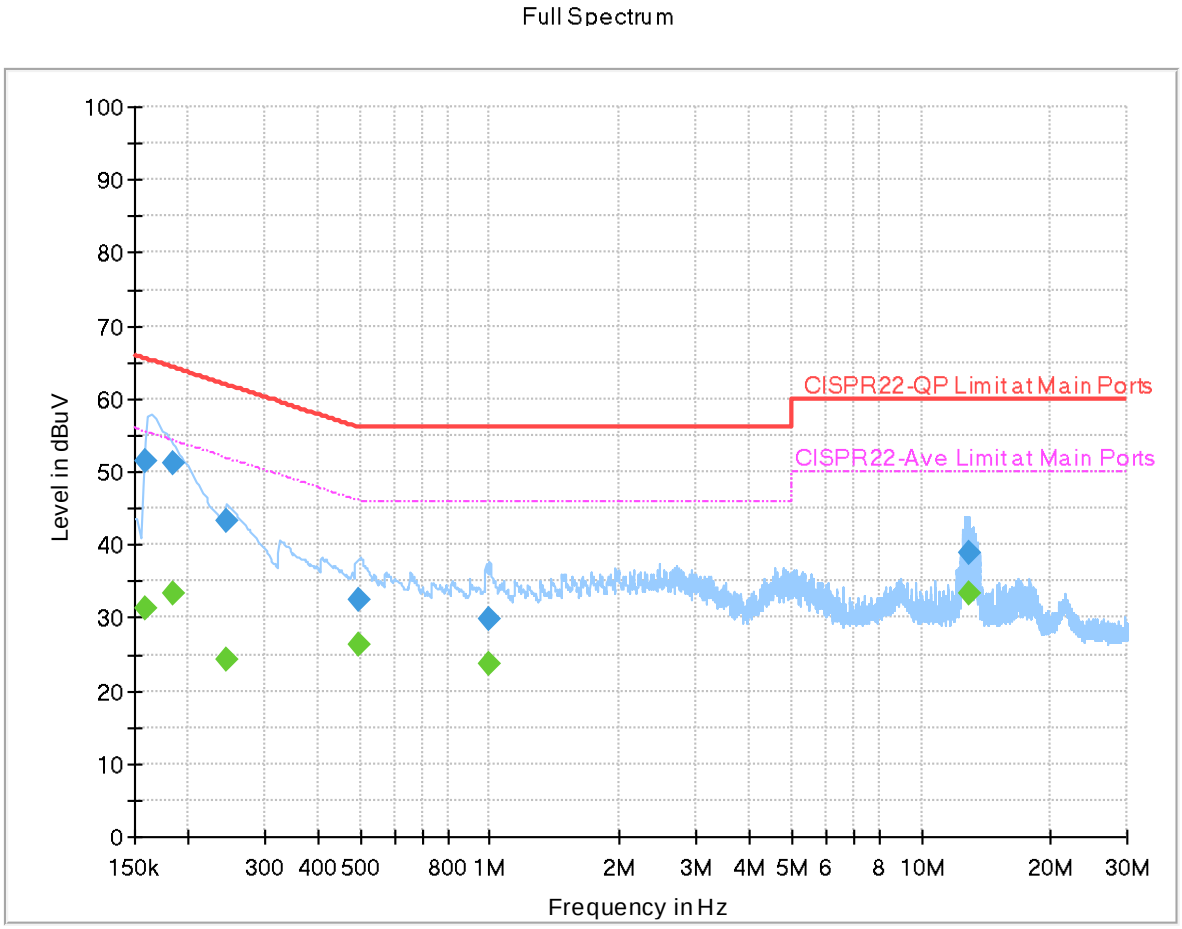
Measured power density (dBm) has offset with cable loss.

Appendix B. AC Conducted Emission Test Results

Test Engineer :	Eric Jeng	**Temperature :**	23~26℃
		Relative Humidity :	40~50%

EUT Information

Report NO :	120337
Test Mode :	Mode 1
Test Voltage :	110Vac/60Hz
Phase :	Line

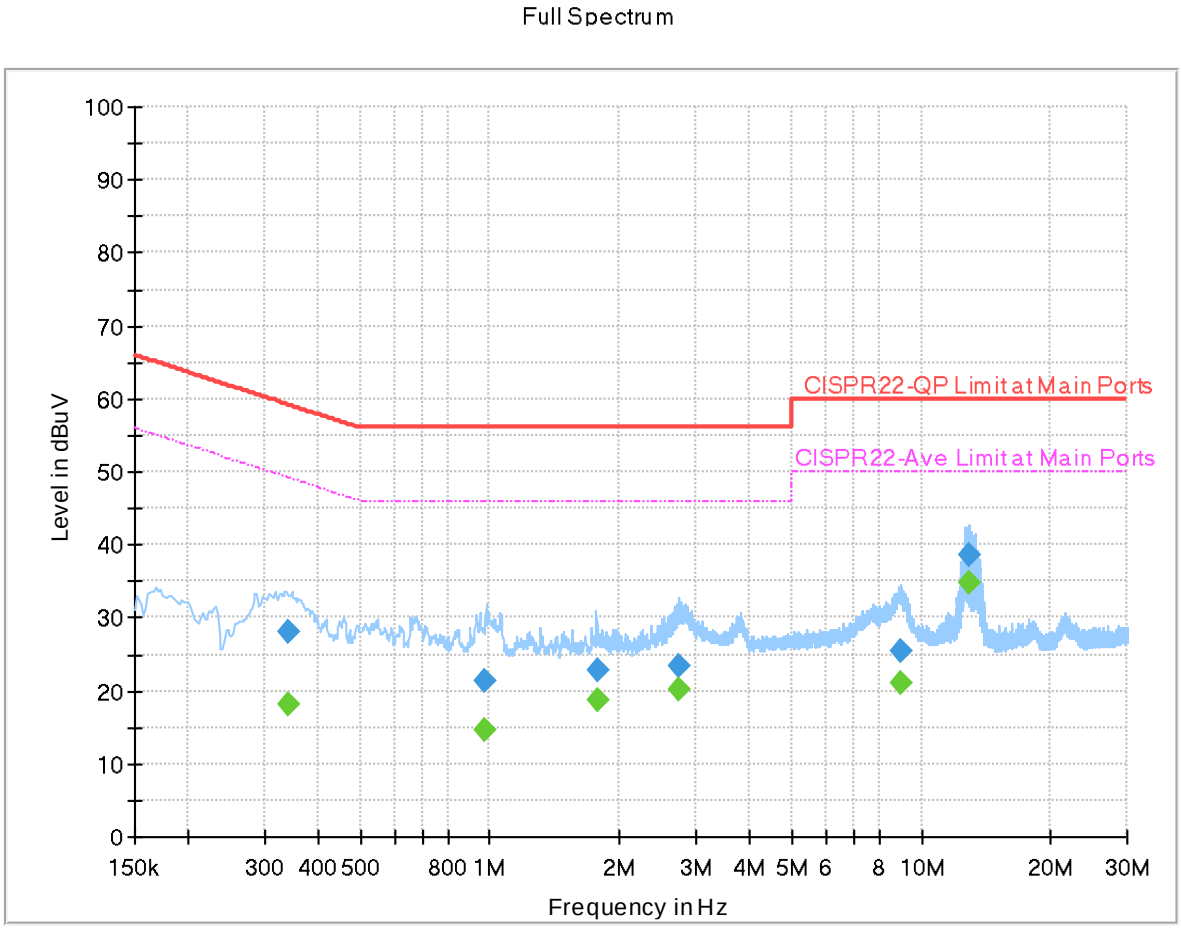


Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.159000	---	31.28	55.52	24.24	L1	OFF	20.0
0.159000	51.44	---	65.52	14.08	L1	OFF	20.0
0.183750	---	33.29	54.31	21.02	L1	OFF	20.0
0.183750	51.08	---	64.31	13.23	L1	OFF	20.0
0.244590	---	24.24	51.94	27.70	L1	OFF	20.0
0.244590	43.38	---	61.94	18.56	L1	OFF	20.0
0.498300	---	26.23	46.03	19.80	L1	OFF	20.0
0.498300	32.38	---	56.03	23.65	L1	OFF	20.0
0.997260	---	23.79	46.00	22.21	L1	OFF	20.0
0.997260	29.96	---	56.00	26.04	L1	OFF	20.0
12.862500	---	33.30	50.00	16.70	L1	OFF	20.2
12.862500	38.98	---	60.00	21.02	L1	OFF	20.2

EUT Information

Report NO :	120337
Test Mode :	Mode 1
Test Voltage :	110Vac/60Hz
Phase :	Neutral



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.339000	---	18.19	49.23	31.04	N	OFF	20.0
0.339000	28.07	---	59.23	31.16	N	OFF	20.0
0.975750	---	14.63	46.00	31.37	N	OFF	20.0
0.975750	21.22	---	56.00	34.78	N	OFF	20.0
1.768290	---	18.67	46.00	27.33	N	OFF	20.0
1.768290	22.77	---	56.00	33.23	N	OFF	20.0
2.744250	---	20.22	46.00	25.78	N	OFF	20.1
2.744250	23.26	---	56.00	32.74	N	OFF	20.1
8.925270	---	21.11	50.00	28.89	N	OFF	20.1
8.925270	25.41	---	60.00	34.59	N	OFF	20.1
12.963480	---	34.70	50.00	15.30	N	OFF	20.2
12.963480	38.69	---	60.00	21.31	N	OFF	20.2

Appendix C. Radiated Spurious Emission

Test Engineer :	Daniel Lee, Jacky Hong and Wilson Wu	Temperature :	20~25°C
		Relative Humidity :	50~60%

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Band Edge @ 3m)

WIFI Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2368.695	55.05	-18.95	74	41.14	27.66	14.1	27.85	243	187	P	H
		2390	44.99	-9.01	54	31.09	27.62	14.12	27.84	243	187	A	H
	*	2412	110.58	-	-	96.7	27.58	14.14	27.84	243	187	P	H
	*	2412	107.59	-	-	93.71	27.58	14.14	27.84	243	187	A	H
													H
		2343.6	55.74	-18.26	74	41.81	27.71	14.07	27.85	305	204	P	V
		2389.695	44.85	-9.15	54	30.95	27.62	14.12	27.84	305	204	A	V
	*	2412	110.7	-	-	96.82	27.58	14.14	27.84	305	204	P	V
	*	2412	107.89	-	-	94.01	27.58	14.14	27.84	305	204	A	V
													V
802.11b CH 06 2437MHz		2332.82	55.44	-18.56	74	41.5	27.73	14.06	27.85	236	187	P	H
		2381.96	44.2	-9.8	54	30.29	27.64	14.11	27.84	236	187	A	H
	*	2436	109.53	-	-	95.67	27.53	14.16	27.83	236	187	P	H
	*	2436	106.48	-	-	92.62	27.53	14.16	27.83	236	187	A	H
		2496.71	55.17	-18.83	74	41.28	27.5	14.21	27.82	236	187	P	H
		2489.08	44.03	-9.97	54	30.15	27.5	14.2	27.82	236	187	A	H
		2382.8	54.71	-19.29	74	40.81	27.63	14.11	27.84	271	204	P	V
		2381.96	44.18	-9.82	54	30.27	27.64	14.11	27.84	271	204	A	V
	*	2437	110.31	-	-	96.45	27.53	14.16	27.83	271	204	P	V
	*	2437	107.45	-	-	93.59	27.53	14.16	27.83	271	204	A	V
		2489.43	55.93	-18.07	74	42.05	27.5	14.2	27.82	271	204	P	V
		2484.95	44.61	-9.39	54	30.73	27.5	14.2	27.82	271	204	A	V

802.11b CH 11 2462MHz	*	2462	109	-	-	95.15	27.5	14.18	27.83	264	200	P	H
	*	2462	106.05	-	-	92.2	27.5	14.18	27.83	264	200	A	H
		2483.76	55.83	-18.17	74	41.95	27.5	14.2	27.82	264	200	P	H
		2483.52	45.97	-8.03	54	32.09	27.5	14.2	27.82	264	200	A	H
													H
													H
	*	2462	114.87	-	-	101.02	27.5	14.18	27.83	319	202	P	V
	*	2462	111.75	-	-	97.9	27.5	14.18	27.83	319	202	A	V
		2483.64	57.07	-16.93	74	43.19	27.5	14.2	27.82	319	202	P	V
		2483.52	49.42	-4.58	54	35.54	27.5	14.2	27.82	319	202	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 01 2412MHz		4824	47.11	-26.89	74	66.82	31.15	6.59	57.45	100	0	P	H
		18000	56.54	-17.46	74	51.73	48.1	13.18	56.47	208	140	P	H
		18000	46.16	-7.84	54	41.35	48.1	13.18	56.47	208	140	A	H
													H
		4824	52.73	-21.27	74	72.44	31.15	6.59	57.45	215	224	P	V
		4824	50.61	-3.39	54	70.32	31.15	6.59	57.45	215	224	A	V
		17985	56.72	-17.28	74	52.35	47.68	13.17	56.48	135	190	P	V
		17985	46.35	-7.65	54	41.98	47.68	13.17	56.48	135	190	A	V
802.11b CH 06 2437MHz		4874	45.25	-28.75	74	64.59	31.2	6.8	57.34	100	0	P	H
		7311	54.73	-19.27	74	66.31	36.78	8.73	57.09	220	99	P	H
		7311	50.28	-3.72	54	61.86	36.78	8.73	57.09	220	99	A	H
		18000	56.64	-17.36	74	51.83	48.1	13.18	56.47	205	143	P	H
		18000	46.67	-7.33	54	41.86	48.1	13.18	56.47	205	143	A	H
		4874	48.5	-25.5	74	67.84	31.2	6.8	57.34	100	0	P	V
		7311	48.26	-25.74	74	59.84	36.78	8.73	57.09	100	0	P	V
		18000	56.12	-17.88	74	51.31	48.1	13.18	56.47	136	187	P	V
		18000	46.36	-7.64	54	41.55	48.1	13.18	56.47	136	187	A	V

802.11b CH 11 2462MHz		4924	52.83	-21.17	74	71.74	31.3	7.02	57.23	330	145	P	H
		4924	50.73	-3.27	54	69.64	31.3	7.02	57.23	330	145	A	H
		7386	55.02	-18.98	74	66.94	36.56	8.72	57.2	208	94	P	H
		7386	49.9	-4.1	54	61.82	36.56	8.72	57.2	208	94	A	H
		17970	56.5	-17.5	74	52.57	47.26	13.16	56.49	207	145	P	H
		17970	46.16	-7.84	54	42.23	47.26	13.16	56.49	207	145	A	H
		4924	52.28	-21.72	74	71.19	31.3	7.02	57.23	209	225	P	V
		4924	49.23	-4.77	54	68.14	31.3	7.02	57.23	209	225	A	V
		7386	49.37	-24.63	74	61.29	36.56	8.72	57.2	100	0	P	V
		17985	56.2	-17.8	74	51.83	47.68	13.17	56.48	137	192	P	V
		17985	45.98	-8.02	54	41.61	47.68	13.17	56.48	137	192	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11g (Band Edge @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz		2386.23	64.5	-9.5	74	50.59	27.63	14.12	27.84	243	182	P	H
		2390	48.64	-5.36	54	34.74	27.62	14.12	27.84	243	182	A	H
	*	2412	111.46	-	-	97.58	27.58	14.14	27.84	243	182	P	H
	*	2412	103.77	-	-	89.89	27.58	14.14	27.84	243	182	A	H
													H
													H
		2388.015	67.53	-6.47	74	53.63	27.62	14.12	27.84	301	199	P	V
		2390	50.02	-3.98	54	36.12	27.62	14.12	27.84	301	199	A	V
	*	2412	114	-	-	100.12	27.58	14.14	27.84	301	199	P	V
	*	2412	106.28	-	-	92.4	27.58	14.14	27.84	301	199	A	V
													V
													V
802.11g CH 06 2437MHz		2389.52	58.21	-15.79	74	44.31	27.62	14.12	27.84	150	183	P	H
		2389.8	46.99	-7.01	54	33.09	27.62	14.12	27.84	150	183	A	H
	*	2437	113.23	-	-	99.37	27.53	14.16	27.83	150	183	P	H
	*	2437	106.02	-	-	92.16	27.53	14.16	27.83	150	183	A	H
		2485.79	56.79	-17.21	74	42.91	27.5	14.2	27.82	150	183	P	H
		2483.5	46.66	-7.34	54	32.78	27.5	14.2	27.82	150	183	A	H
		2384.9	58.26	-15.74	74	44.36	27.63	14.11	27.84	264	203	P	V
		2389.94	47.34	-6.66	54	33.44	27.62	14.12	27.84	264	203	A	V
	*	2437	116.18	-	-	102.32	27.53	14.16	27.83	264	203	P	V
	*	2437	108.9	-	-	95.04	27.53	14.16	27.83	264	203	A	V
		2485.23	59.38	-14.62	74	45.5	27.5	14.2	27.82	264	203	P	V
		2483.69	48.69	-5.31	54	34.81	27.5	14.2	27.82	264	203	A	V

802.11g CH 11 2462MHz	*	2462	111.58	-	-	97.73	27.5	14.18	27.83	259	181	P	H
	*	2462	103.58	-	-	89.73	27.5	14.18	27.83	259	181	A	H
		2483.52	69.71	-4.29	74	55.83	27.5	14.2	27.82	259	181	P	H
		2483.56	50.48	-3.52	54	36.6	27.5	14.2	27.82	259	181	A	H
													H
													H
	*	2462	114.54	-	-	100.69	27.5	14.18	27.83	314	201	P	V
	*	2462	106.83	-	-	92.98	27.5	14.18	27.83	314	201	A	V
		2485.92	69.94	-4.06	74	56.06	27.5	14.2	27.82	314	201	P	V
		2485.84	50.59	-3.41	54	36.71	27.5	14.2	27.82	314	201	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11g (Harmonic @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz		4824	42.88	-31.12	74	62.59	31.15	6.59	57.45	100	0	P	H
		17970	56.74	-17.26	74	52.81	47.26	13.16	56.49	213	150	P	H
		17970	46.19	-7.81	54	42.26	47.26	13.16	56.49	213	150	A	H
													H
		4824	45.47	-28.53	74	65.18	31.15	6.59	57.45	100	0	P	V
		17985	58.39	-15.61	74	54.02	47.68	13.17	56.48	138	185	P	V
		17985	47.07	-6.93	54	42.7	47.68	13.17	56.48	138	185	A	V
													V
802.11g CH 06 2437MHz		4874	44.8	-29.2	74	64.14	31.2	6.8	57.34	100	0	P	H
		7311	61.81	-12.19	74	73.39	36.78	8.73	57.09	220	97	P	H
		7311	50.29	-3.71	54	61.87	36.78	8.73	57.09	220	97	A	H
		17970	56.12	-17.88	74	52.19	47.26	13.16	56.49	201	156	P	H
		17970	46.19	-7.81	54	42.26	47.26	13.16	56.49	201	156	A	H
		4874	46.33	-27.67	74	65.67	31.2	6.8	57.34	100	0	P	V
		7311	56.84	-17.16	74	68.42	36.78	8.73	57.09	211	152	P	V
		7311	45.1	-8.9	54	56.68	36.78	8.73	57.09	211	152	A	V
		17985	57.1	-16.9	74	52.73	47.68	13.17	56.48	142	193	P	V
		17985	47.14	-6.86	54	42.77	47.68	13.17	56.48	142	193	A	V

802.11g CH 11 2462MHz		4924	45.15	-28.85	74	64.06	31.3	7.02	57.23	100	0	P	H
		7386	56.77	-17.23	74	68.69	36.56	8.72	57.2	217	95	P	H
		7386	44.73	-9.27	54	56.65	36.56	8.72	57.2	217	95	A	H
		17985	56.89	-17.11	74	52.52	47.68	13.17	56.48	210	151	P	H
		17985	46.72	-7.28	54	42.35	47.68	13.17	56.48	210	151	A	H
		4924	47.41	-26.59	74	66.32	31.3	7.02	57.23	100	0	P	V
		7386	48.09	-25.91	74	60.01	36.56	8.72	57.2	100	0	P	V
		18000	57.65	-16.35	74	52.84	48.1	13.18	56.47	141	192	P	V
		18000	47.17	-6.83	54	42.36	48.1	13.18	56.47	141	192	A	V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (Band Edge @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 01 2412MHz		2389.59	65.54	-8.46	74	51.64	27.62	14.12	27.84	243	182	P	H
		2389.695	49.87	-4.13	54	35.97	27.62	14.12	27.84	243	182	A	H
	*	2412	110.19	-	-	96.31	27.58	14.14	27.84	243	182	P	H
	*	2412	102.76	-	-	88.88	27.58	14.14	27.84	243	182	A	H
													H
													H
		2383.815	64.5	-9.5	74	50.6	27.63	14.11	27.84	301	200	P	V
		2390	50.71	-3.29	54	36.81	27.62	14.12	27.84	301	200	A	V
	*	2412	113.21	-	-	99.33	27.58	14.14	27.84	301	200	P	V
	*	2412	105.46	-	-	91.58	27.58	14.14	27.84	301	200	A	V
													V
													V
802.11n HT20 CH 06 2437MHz		2389.52	57.14	-16.86	74	43.24	27.62	14.12	27.84	152	179	P	H
		2389.94	46.37	-7.63	54	32.47	27.62	14.12	27.84	152	179	A	H
	*	2438	112.13	-	-	98.28	27.52	14.16	27.83	152	179	P	H
	*	2438	104.74	-	-	90.89	27.52	14.16	27.83	152	179	A	H
		2484.25	57.7	-16.3	74	43.82	27.5	14.2	27.82	152	179	P	H
		2483.5	46.32	-7.68	54	32.44	27.5	14.2	27.82	152	179	A	H
		2388.82	57.53	-16.47	74	43.63	27.62	14.12	27.84	258	204	P	V
		2389.8	47.04	-6.96	54	33.14	27.62	14.12	27.84	258	204	A	V
	*	2437	115.05	-	-	101.19	27.53	14.16	27.83	258	204	P	V
	*	2437	107.83	-	-	93.97	27.53	14.16	27.83	258	204	A	V
		2486.91	58.59	-15.41	74	44.71	27.5	14.2	27.82	258	204	P	V
		2483.5	48.17	-5.83	54	34.29	27.5	14.2	27.82	258	204	A	V

802.11n HT20 CH 11 2462MHz	*	2462	108.85	-	-	95	27.5	14.18	27.83	271	184	P	H
	*	2462	101.69	-	-	87.84	27.5	14.18	27.83	271	184	A	H
		2483.68	60.92	-13.08	74	47.04	27.5	14.2	27.82	271	184	P	H
		2484.96	46.49	-7.51	54	32.61	27.5	14.2	27.82	271	184	A	H
													H
													H
	*	2462	113.09	-	-	99.24	27.5	14.18	27.83	317	202	P	V
	*	2462	105.58	-	-	91.73	27.5	14.18	27.83	317	202	A	V
		2484.12	63.88	-10.12	74	50	27.5	14.2	27.82	317	202	P	V
		2483.52	50.2	-3.8	54	36.32	27.5	14.2	27.82	317	202	A	V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (Harmonic @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT20 CH 01 2412MHz		4824	41.91	-32.09	74	61.62	31.15	6.59	57.45	100	0	P	H
		17985	56.53	-17.47	74	52.16	47.68	13.17	56.48	213	152	P	H
		17985	46.5	-7.5	54	42.13	47.68	13.17	56.48	213	152	A	H
													H
		4824	44.45	-29.55	74	64.16	31.15	6.59	57.45	100	0	P	V
		17985	56.61	-17.39	74	52.24	47.68	13.17	56.48	147	191	P	V
		17985	46.69	-7.31	54	42.32	47.68	13.17	56.48	147	191	A	V
													V
802.11n HT20 CH 06 2437MHz		4874	44.77	-29.23	74	64.11	31.2	6.8	57.34	100	0	P	H
		7311	59.11	-14.89	74	70.69	36.78	8.73	57.09	221	97	P	H
		7311	47.12	-6.88	54	58.7	36.78	8.73	57.09	221	97	A	H
		18000	56.51	-17.49	74	51.7	48.1	13.18	56.47	207	138	P	H
		18000	46.49	-7.51	54	41.68	48.1	13.18	56.47	207	138	A	H
		4874	45.26	-28.74	74	64.6	31.2	6.8	57.34	100	0	P	V
		7311	49.81	-24.19	74	61.39	36.78	8.73	57.09	100	0	P	V
		18000	56.86	-17.14	74	52.05	48.1	13.18	56.47	132	185	P	V
		18000	47.31	-6.69	54	42.5	48.1	13.18	56.47	132	185	A	V
802.11n HT20 CH 11 2462MHz		4924	42.6	-31.4	74	61.51	31.3	7.02	57.23	100	0	P	H
		7386	54.81	-19.19	74	66.73	36.56	8.72	57.2	212	92	P	H
		7386	42.27	-11.73	54	54.19	36.56	8.72	57.2	212	92	A	H
		18000	56.58	-17.42	74	51.77	48.1	13.18	56.47	211	150	P	H
		18000	46.46	-7.54	54	41.65	48.1	13.18	56.47	211	150	A	H
		4924	43.07	-30.93	74	61.98	31.3	7.02	57.23	100	0	P	V
		7386	45.06	-28.94	74	56.98	36.56	8.72	57.2	100	0	P	V
		18000	56.3	-17.7	74	51.49	48.1	13.18	56.47	139	193	P	V
		18000	46.1	-7.9	54	41.29	48.1	13.18	56.47	139	193	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission above 18GHz

2.4GHz WIFI 802.11b (SHF)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
2.4GHz 802.11b SHF		22389	40.72	-33.28	74	43.91	38.52	11.91	53.62	150	0	P	H
													H
													H
													H
													H
													H
													H
													H
		19442	38.94	-35.06	74	45.05	37.75	10.19	54.05	150	0	P	V
													V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Emission below 1GHz

2.4GHz WIFI 802.11b (LF)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
2.4GHz 802.11b LF		124.09	37.22	-6.28	43.5	50.78	17.64	1.04	32.24	100	0	P	H
		165.8	24.01	-19.49	43.5	38.96	16.09	1.22	32.26	-	-	P	H
		419.94	28.1	-17.9	46	35.16	22.76	1.8	31.62	-	-	P	H
		718.7	29.16	-16.84	46	31.71	26.98	2.41	31.94	-	-	P	H
		876.81	31.58	-14.42	46	31.17	28.84	2.68	31.11	-	-	P	H
		956.35	32.32	-13.68	46	29.6	30.66	2.82	30.76	-	-	P	H
													H
													H
													H
													H
													H
													H
		42.61	35.73	-4.27	40	49.2	18.17	0.63	32.27	100	169	QP	V
		86.26	27.31	-12.69	40	44.41	14.28	0.87	32.25	-	-	P	V
		121.18	31.09	-12.41	43.5	44.77	17.53	1.03	32.24	-	-	P	V
		163.86	26.09	-17.41	43.5	40.85	16.29	1.21	32.26	-	-	P	V
		480.08	27.36	-18.64	46	33.65	23.64	1.94	31.87	-	-	P	V
		948.59	32.3	-13.7	46	29.86	30.44	2.8	30.8	-	-	P	V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) =

Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is “PASS”.

Appendix D. Radiated Spurious Emission Plots

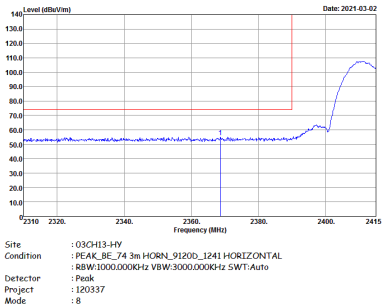
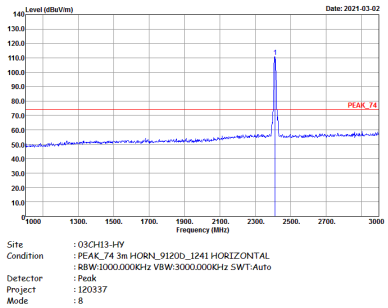
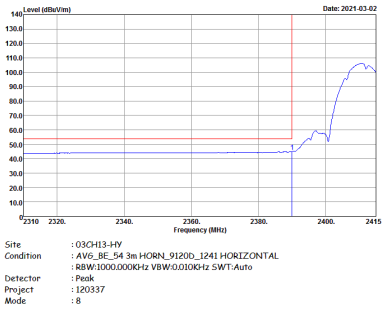
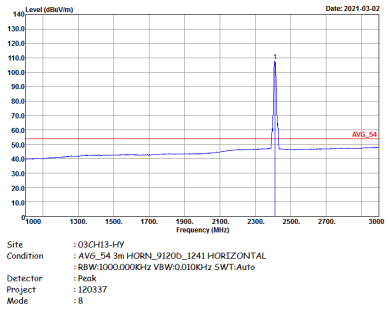
Test Engineer :	Daniel Lee, Jacky Hong and Wilson Wu	**Temperature :**	20~25°C
		Relative Humidity :	50~60%

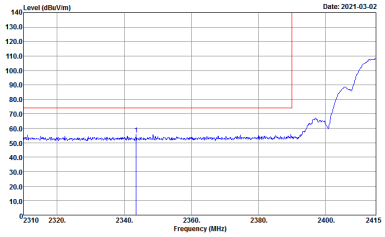
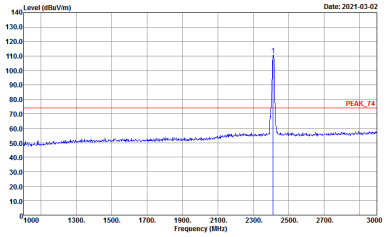
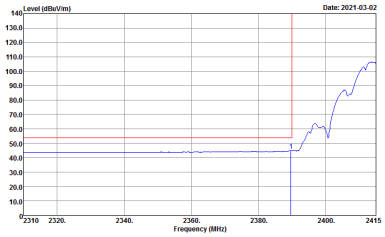
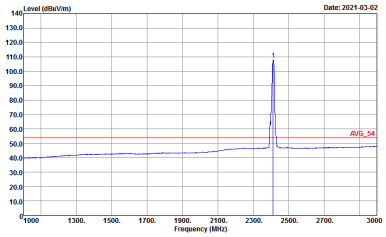
Note symbol

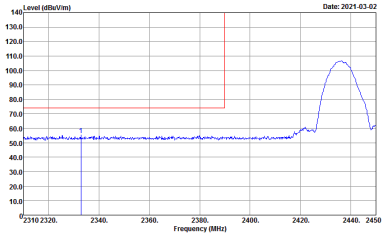
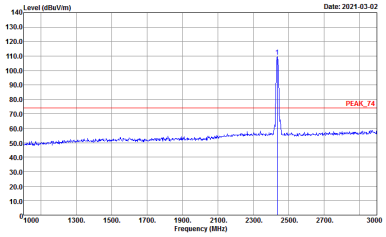
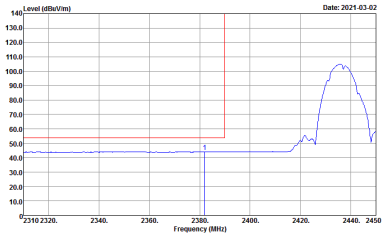
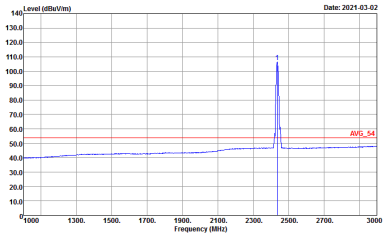
-L	**Low channel location**
-R	**High channel location**

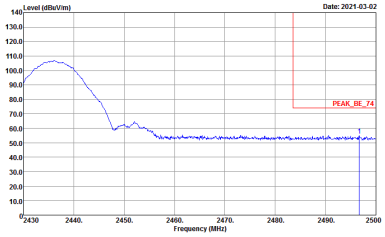
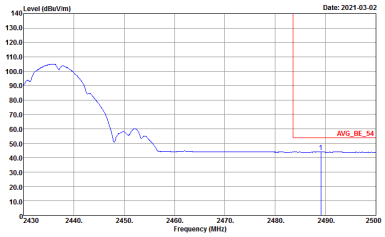
2.4GHz 2400~2483.5MHz

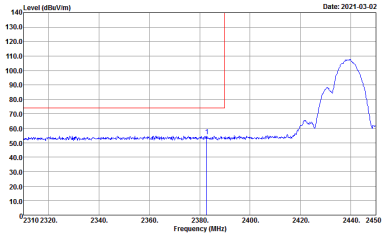
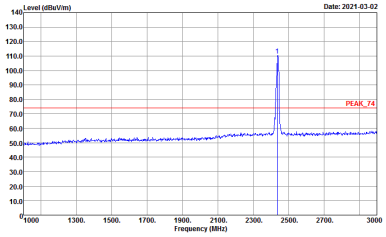
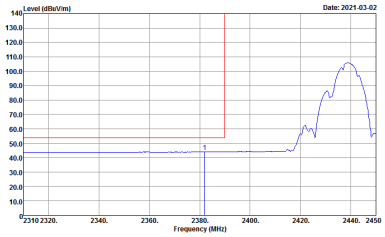
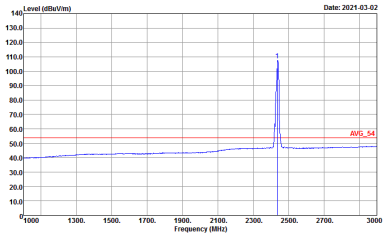
WIFI 802.11b (Band Edge @ 3m)

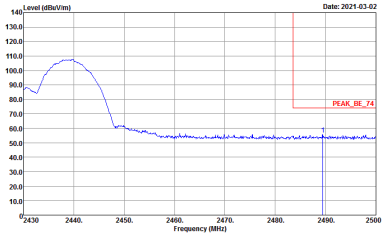
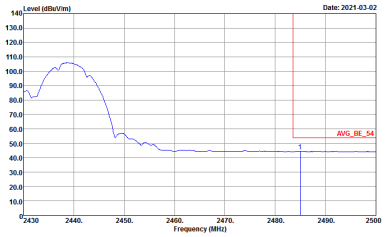
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH01 2412MHz	
1+2	Horizontal	Fundamental
Peak		
Avg.		

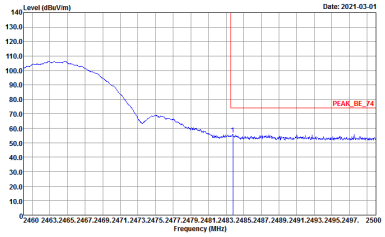
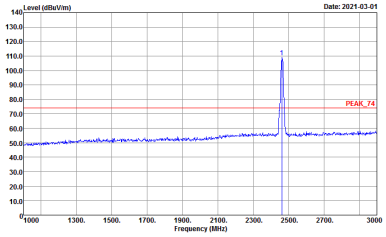
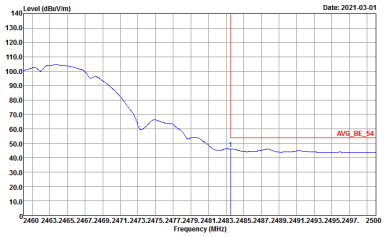
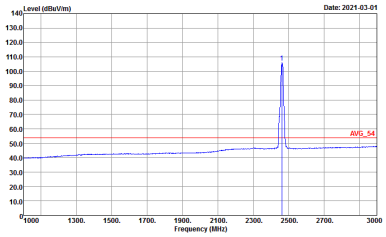
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH01 2412MHz	
1+2	Vertical	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 8	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 8
Avg.	 Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 8	 Site : 03CH13-HY Condition : AVG_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 8

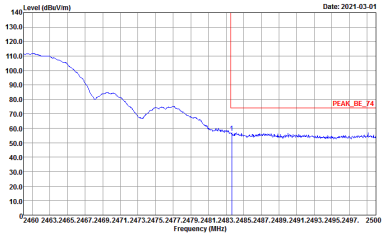
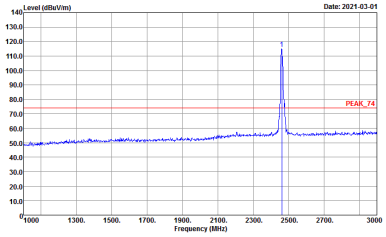
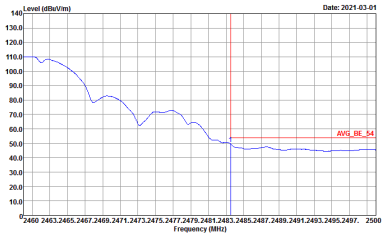
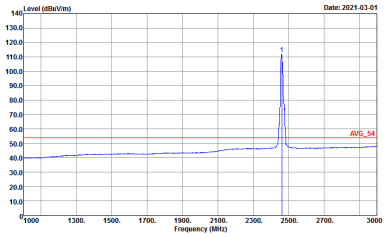
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH06 2437MHz - L	
1+2	Horizontal	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 9	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 9
Avg.	 Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 9	 Site : 03CH13-HY Condition : AVG_54 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 9

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH06 2437MHz - R	
1+2	Horizontal	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 9	Left blank
Avg.	 Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 9	Left blank

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH06 2437MHz - L	
1+2	Vertical	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 9	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 9
Avg.	 Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 9	 Site : 03CH13-HY Condition : AVG_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 9

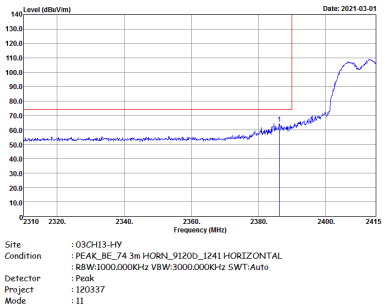
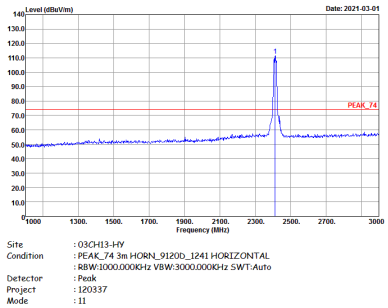
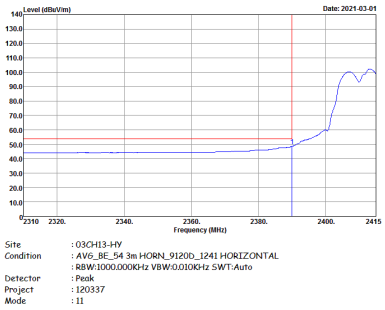
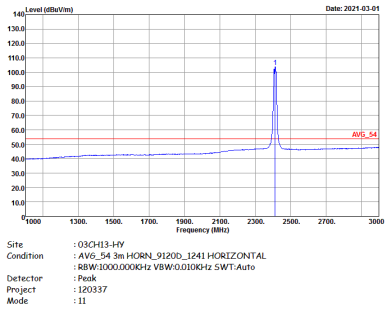
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH06 2437MHz - R	
1+2	Vertical	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 9	Left blank
Avg.	 Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 9	Left blank

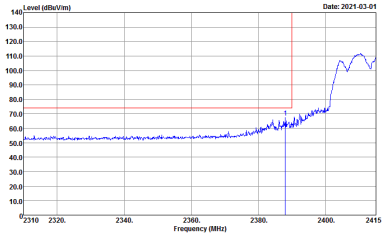
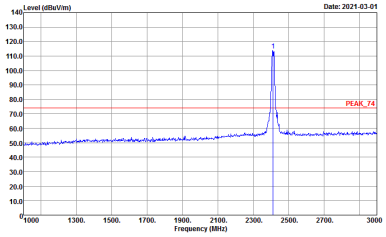
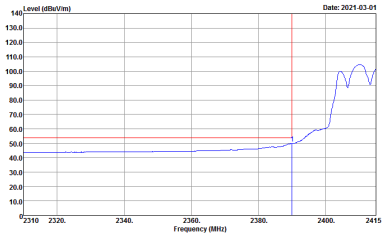
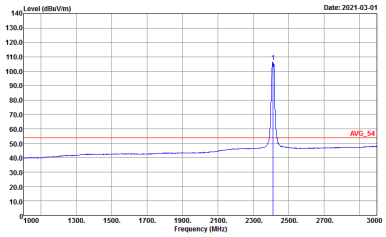
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
1+2	Horizontal	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 10	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 10
Avg.	 Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 10	 Site : 03CH13-HY Condition : AVG_54 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 10

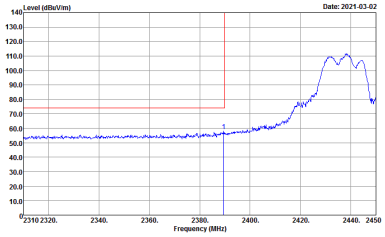
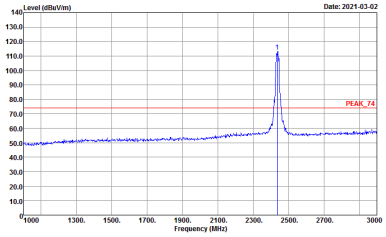
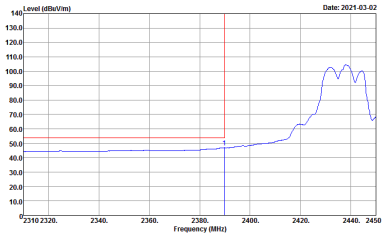
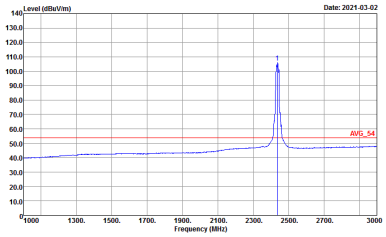
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11b CH11 2462MHz	
1+2	Vertical	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 10	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 10
Avg.	 Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 10	 Site : 03CH13-HY Condition : AVG_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 10

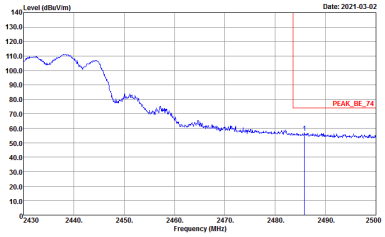
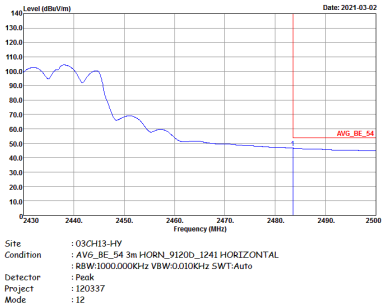
2.4GHz 2400~2483.5MHz

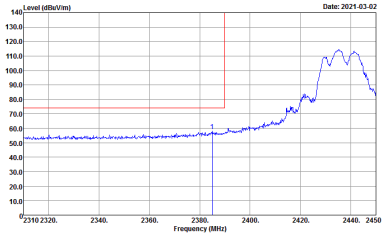
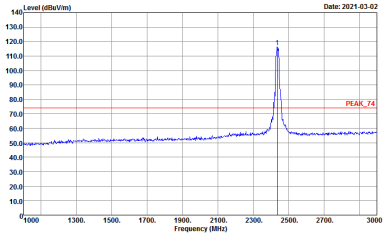
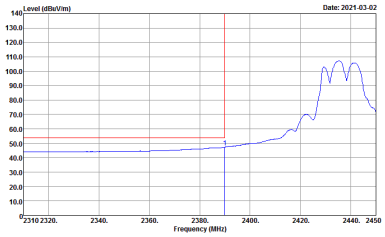
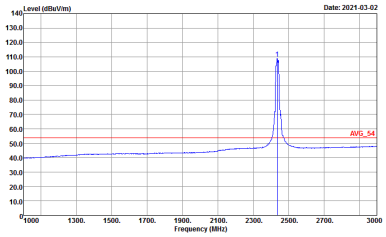
WIFI 802.11g (Band Edge @ 3m)

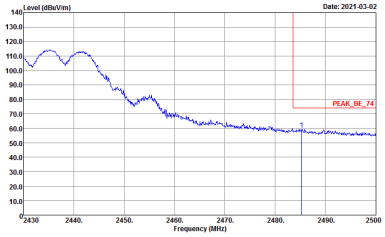
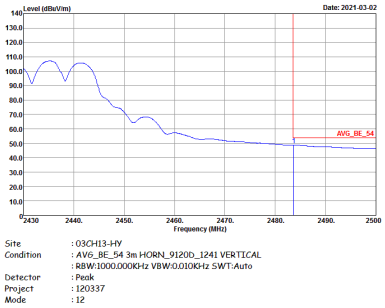
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH01 2412MHz	
1+2	Horizontal	Fundamental
Peak		
Avg.		

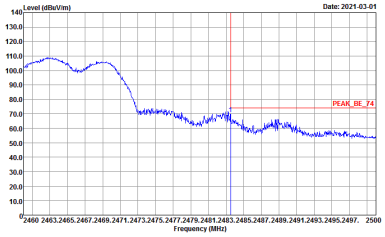
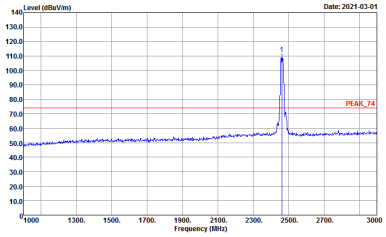
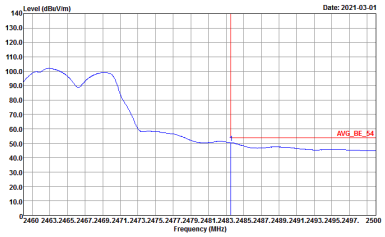
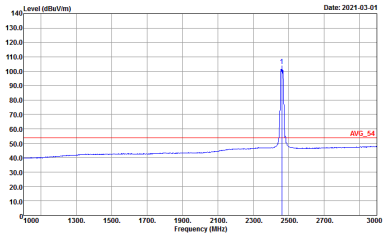
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH01 2412MHz	
1+2	Vertical	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 11	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 11
Avg.	 Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 11	 Site : 03CH13-HY Condition : AVG_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 11

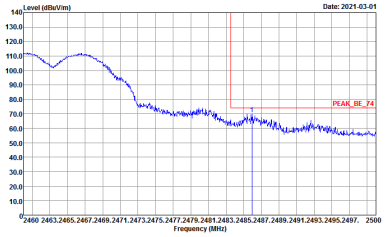
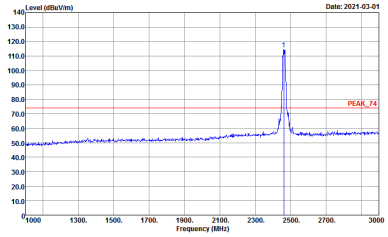
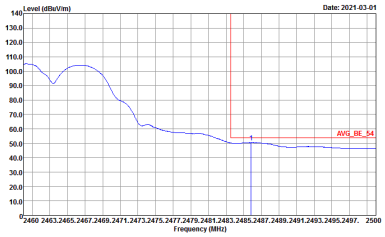
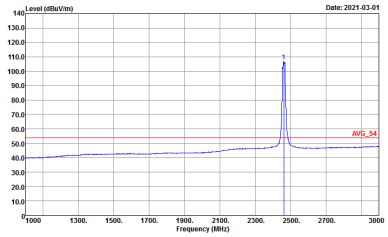
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH06 2437MHz - L	
1+2	Horizontal	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 12	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 12
Avg.	 Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 12	 Site : 03CH13-HY Condition : AVG_54 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 12

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH06 2437MHz - R	
1+2	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH06 2437MHz - L	
1+2	Vertical	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 12	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 12
Avg.	 Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 12	 Site : 03CH13-HY Condition : AVG_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 12

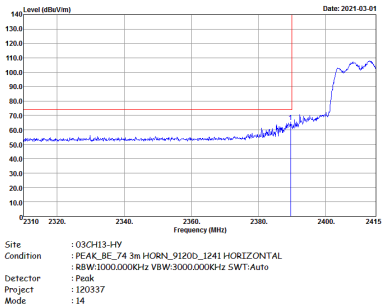
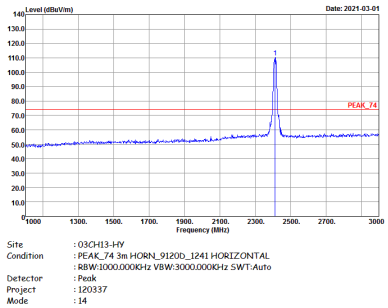
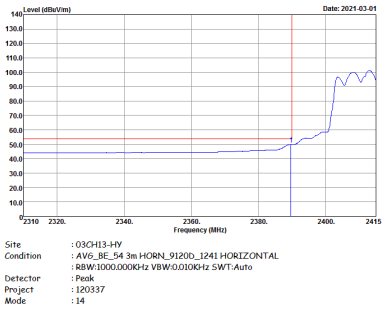
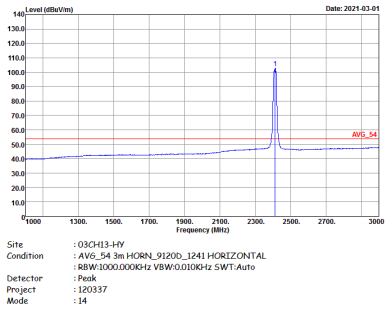
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH06 2437MHz - R	
1+2	Vertical	Fundamental
Peak		Left Blank
Avg.		Left Blank

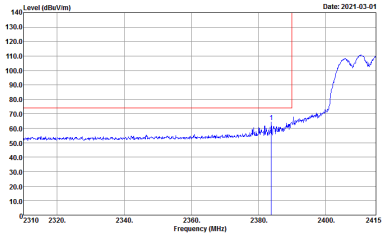
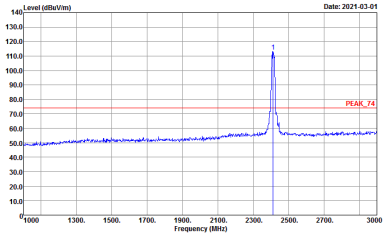
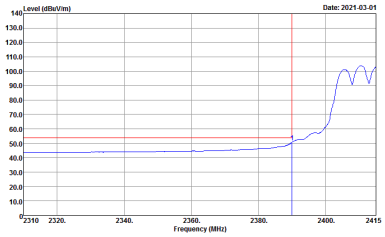
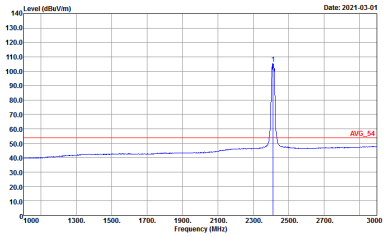
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH11 2462MHz	
1+2	Horizontal	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 13	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 13
Avg.	 Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 13	 Site : 03CH13-HY Condition : AVG_54 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 13

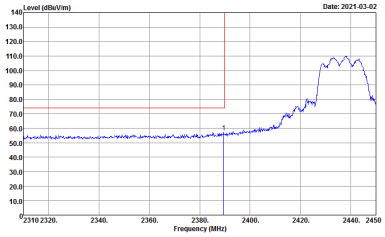
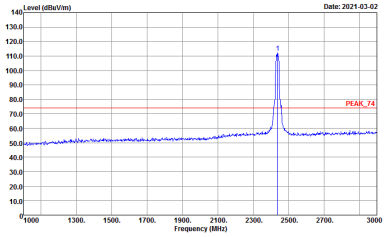
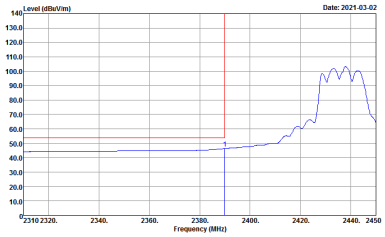
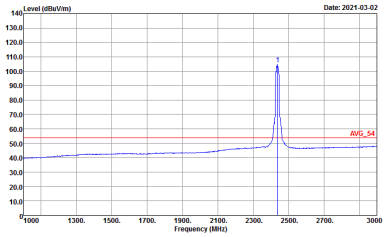
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11g CH11 2462MHz	
1+2	Vertical	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 13	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 13
Avg.	 Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 13	 Site : 03CH13-HY Condition : AVG_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 13

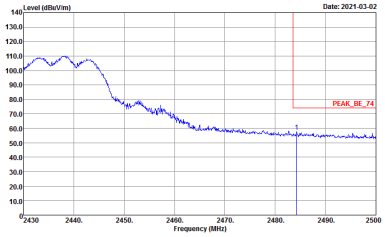
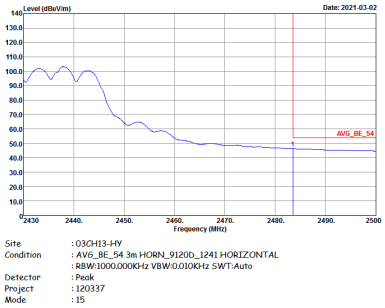
2.4GHz 2400~2483.5MHz

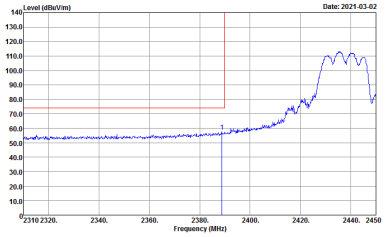
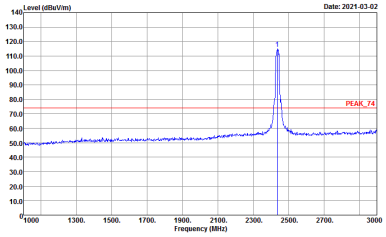
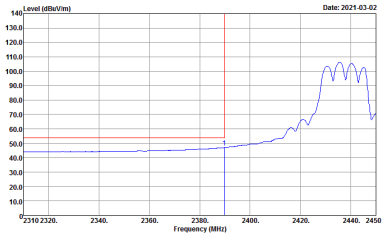
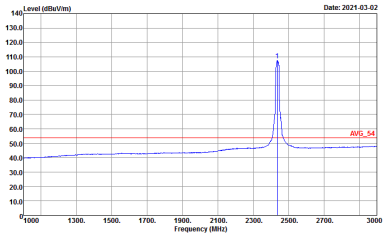
WIFI 802.11n HT20 (Band Edge @ 3m)

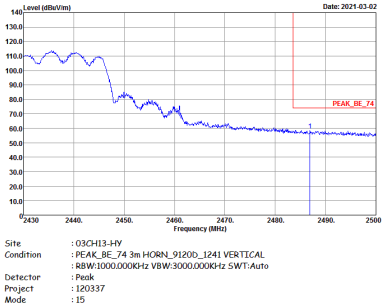
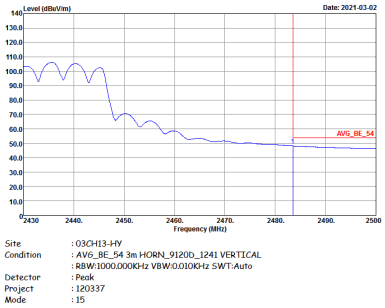
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
1+2	Horizontal	Fundamental
Peak		
Avg.		

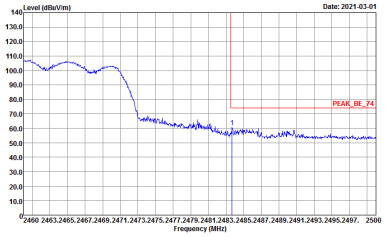
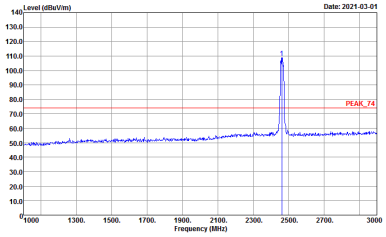
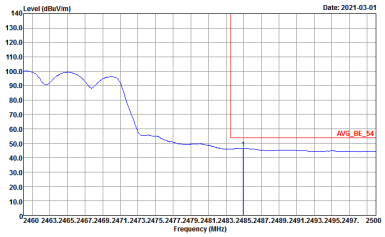
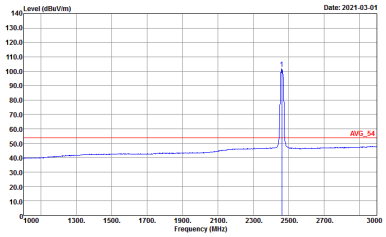
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
1+2	Vertical	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 14	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 14
Avg.	 Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 14	 Site : 03CH13-HY Condition : AVG_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 14

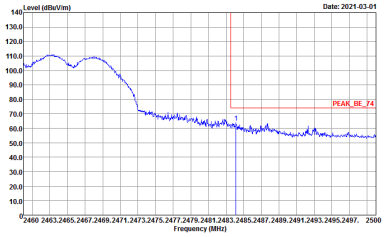
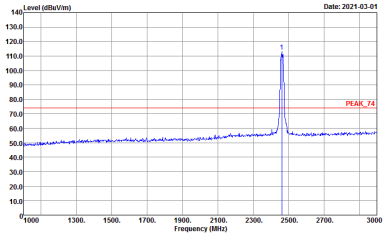
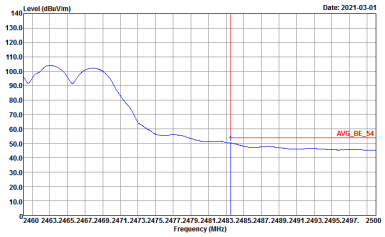
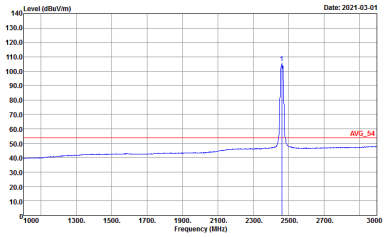
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH06 2437MHz - L	
1+2	Horizontal	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 15	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 15
Avg.	 Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 15	 Site : 03CH13-HY Condition : AVG_54 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 15

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH06 2437MHz - R	
1+2	Horizontal	Fundamental
Peak		Left blank
Avg.		Left blank

WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH06 2437MHz - L	
1+2	Vertical	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 15	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 15
Avg.	 Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 15	 Site : 03CH13-HY Condition : AVG_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 15

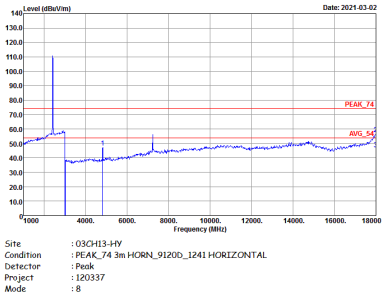
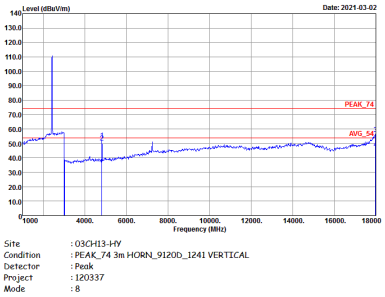
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH06 2437MHz - R	
1+2	Vertical	Fundamental
Peak		Left Blank
Avg.		Left Blank

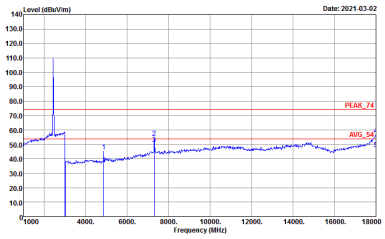
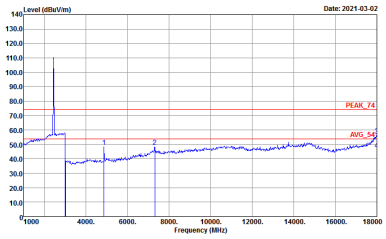
WIFI	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	802.11n HT20 CH11 2462MHz	
1+2	Horizontal	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 16	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 16
Avg.	 Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 16	 Site : 03CH13-HY Condition : AVG_54 3m HORN_9120D_1241 HORIZONTAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 16

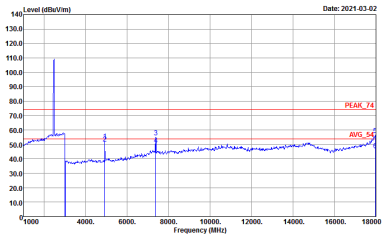
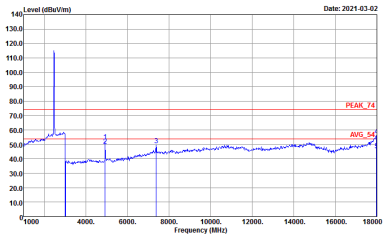
WIFI	2.4GHz 2400~2483.5MHz Fundamental @ 3m	
ANT	802.11n HT20 CH11 2462MHz	
1+2	Vertical	Fundamental
Peak	 Site : 03CH13-HY Condition : PEAK_BE_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 16	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 120337 Mode : 16
Avg.	 Site : 03CH13-HY Condition : AVG_BE_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 16	 Site : 03CH13-HY Condition : AVG_54 3m HORN_9120D_1241 VERTICAL : RBW:1000.000KHz VBW:0.010KHz SWT:Auto Detector : Peak Project : 120337 Mode : 16

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

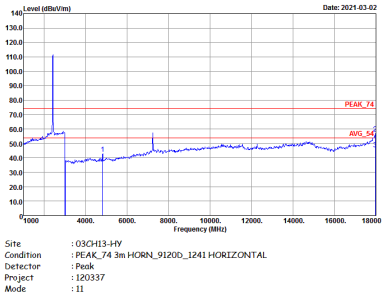
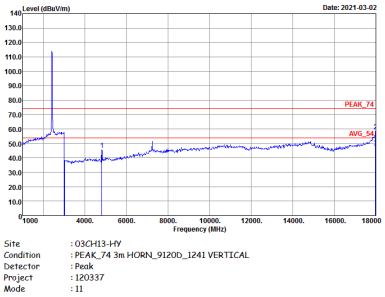
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH01 2412MHz	
1+2	Horizontal	Vertical
Peak Avg.		

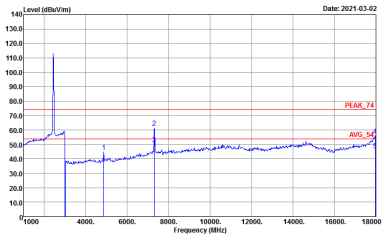
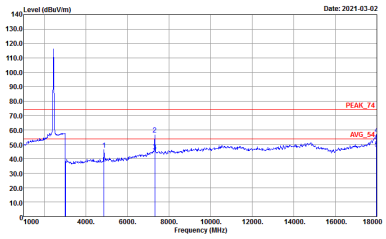
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH06 2437MHz	
1+2	Horizontal	Vertical
Peak Avg.		

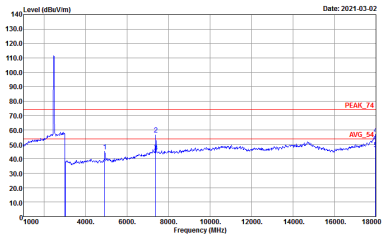
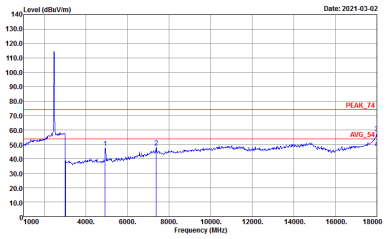
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11b CH11 2462MHz	
1+2	Horizontal	Vertical
Peak Avg.	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 HORIZONTAL Detector : Peak Project : 120337 Mode : 10	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 VERTICAL Detector : Peak Project : 120337 Mode : 10

2.4GHz 2400~2483.5MHz

WIFI 802.11g (Harmonic @ 3m)

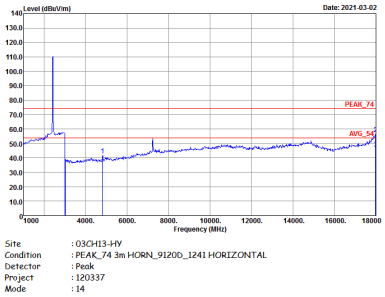
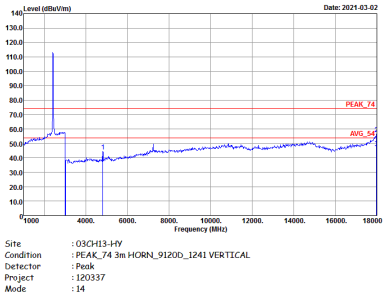
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11g CH01 2412MHz	
1+2	Horizontal	Vertical
Peak Avg.		

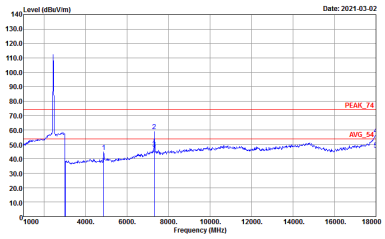
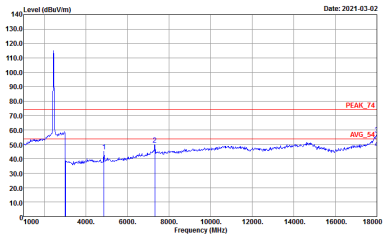
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11g CH06 2437MHz	
1+2	Horizontal	Vertical
Peak Avg.	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 HORIZONTAL Detector : Peak Project : 120337 Mode : 12	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 VERTICAL Detector : Peak Project : 120337 Mode : 12

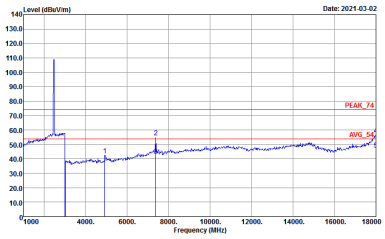
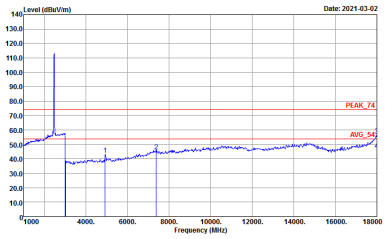
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11g CH11 2462MHz	
1+2	Horizontal	Vertical
Peak Avg.	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 HORIZONTAL Detector : Peak Project : 120337 Mode : 13	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 VERTICAL Detector : Peak Project : 120337 Mode : 13

2.4GHz 2400~2483.5MHz

WIFI 802.11n HT20 (Harmonic @ 3m)

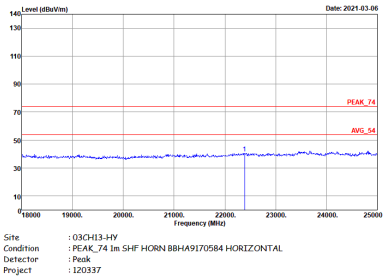
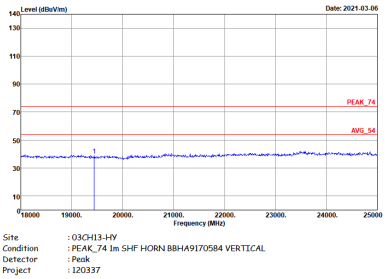
WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11n HT20 CH01 2412MHz	
1+2	Horizontal	Vertical
Peak Avg.		

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11n HT20 CH06 2437MHz	
1+2	Horizontal	Vertical
Peak Avg.		

WIFI	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
ANT	802.11n HT20 CH11 2462MHz	
1+2	Horizontal	Vertical
Peak Avg.	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 HORIZONTAL Detector : Peak Project : 120337 Mode : 16	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 VERTICAL Detector : Peak Project : 120337 Mode : 16

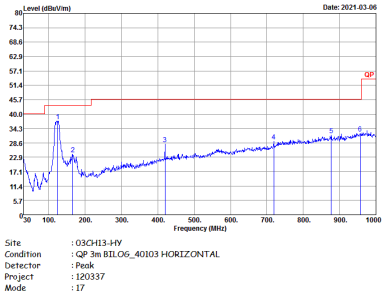
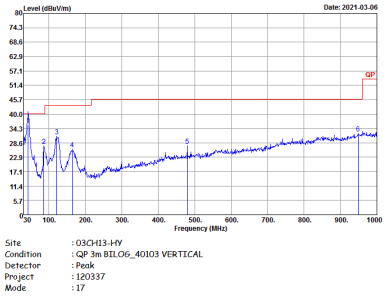
Emission above 18GHz

2.4GHz WIFI 802.11b (SHF)

WIFI	2.4GHz 2400~2483.5MHz	
ANT	802.11b SHF	
1+2	Horizontal	Vertical
QP / Peak		

Emission below 1GHz

2.4GHz WIFI 802.11b (LF)

WIFI	2.4GHz 2400~2483.5MHz	
ANT	802.11b LF	
1+2	Horizontal	Vertical
QP / Peak		

Annex. A Receiver Radiated Emission Measurement

A.1 Limit of Receiver Radiated Emission

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
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

A.2 Measuring Instruments

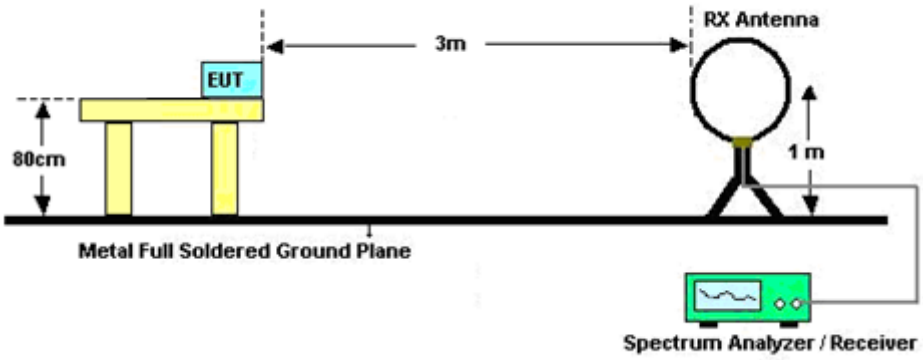
See list of measuring equipment of this test report.

A.3 Test Procedures

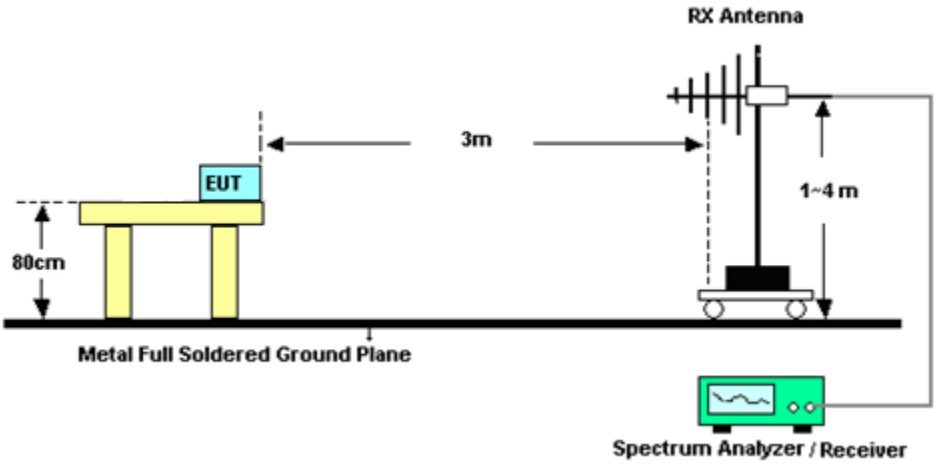
1. The EUT was placed on a turntable with 0.8 meter above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation.
4. The antenna is a Bi-Log antenna and its height is adjusted between one to four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode (RBW=120kHz/VBW=300kHz for frequency below 1GHz; RBW=1MHz VBW=3MHz (Peak), RBW=1MHz/VBW=10Hz (Average) for frequency above 1GHz).
7. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, peak values of EUT will be reported. Otherwise, the emission will be repeated by using the quasi-peak method and reported.
8. Emission level (dBμV/m) = 20 log Emission level (μV/m)
9. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

A.4 Test Setup

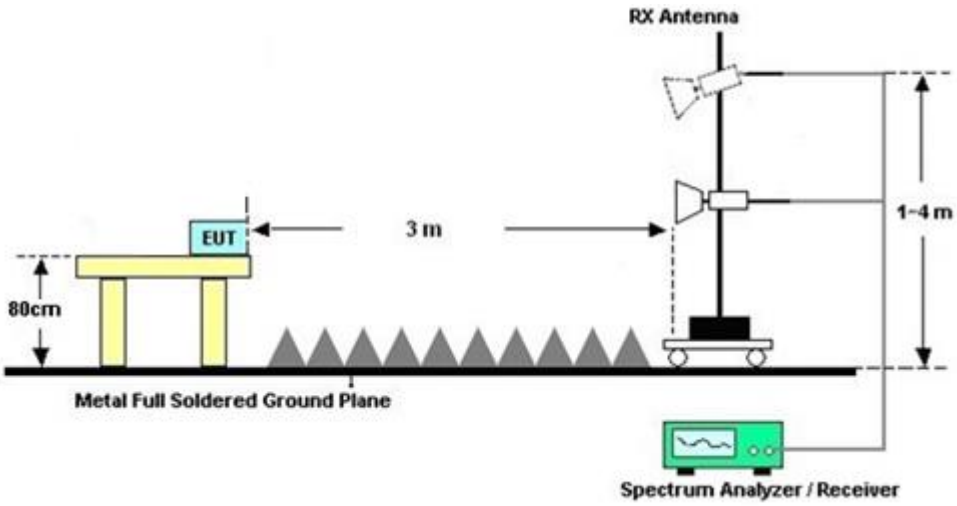
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz

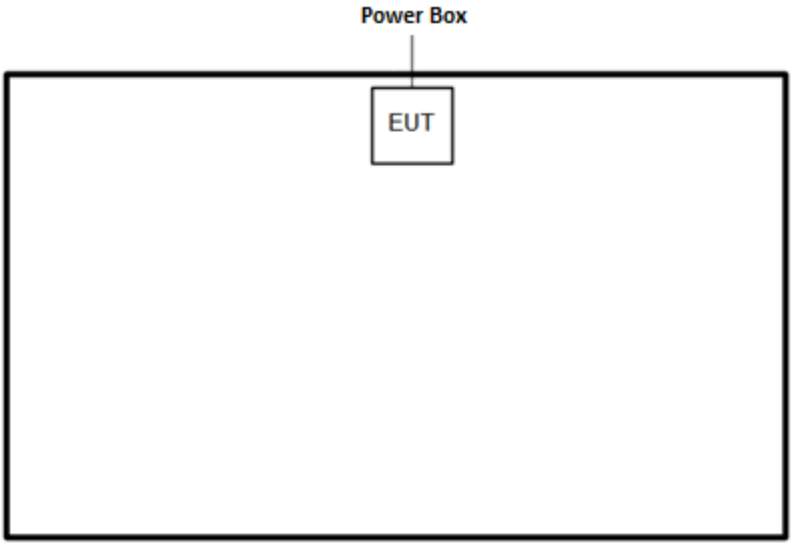


A.5 Test Result of Receiver Radiated Spurious Emissions (9kHz ~ 30MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per NCC LP0002 section 6.13 was not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

A.6 Connection Diagram of Test System

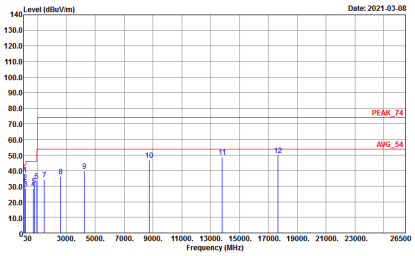
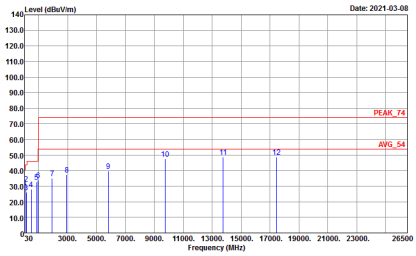


A.7 EUT Operation Test Setup

The RF test items, utility “ComplianceTool V1.0.0.87” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, data rate (MCS0) and the application type and for continuous receiving signals.

A.8 Test Result of Receiver Radiated Spurious Emission (30MHz ~ 5th Harmonic)

Test Engineer :	Daniel Lee, Jacky Hong and Wilson Wu	**Temperature :**	20~25°C
		Relative Humidity :	50~60%
Frequency :	117.300 MHz	**Margin :**	Under 6.02 dB
Test Mode :	WLAN (5GHz) Rx + Bluetooth RX		

	Idle Mode	
	Horizontal	**Vertical**
Peak **Avg.**	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 HORIZONTAL Detector : Peak Project : 120337 Mode : 21 	Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Remark
MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	117.30	37.48	-6.02	43.50	51.27	17.43	0.95	32.24	100	15	QP
2	129.91	32.57	-10.93	43.50	46.14	17.61	0.99	32.24	---	---	Peak
3	161.92	28.52	-14.98	43.50	43.01	16.55	1.11	32.25	---	---	Peak
4	714.82	28.52	-17.48	46.00	31.32	26.77	2.27	31.97	---	---	Peak
5	770.11	30.53	-15.47	46.00	31.55	28.03	2.36	31.55	---	---	Peak
6	951.50	33.57	-12.43	46.00	30.98	30.57	2.59	30.78	---	---	Peak
7	1464.00	34.40	-39.60	74.00	63.07	25.72	3.59	57.98	---	---	Peak
8	2600.00	36.34	-37.66	74.00	61.48	27.50	4.72	57.36	---	---	Peak
9	4245.00	39.87	-34.13	74.00	61.16	30.17	6.80	58.26	---	---	Peak
10	8760.00	46.71	-27.29	74.00	55.85	38.30	8.79	56.23	---	---	Peak
11	13800.00	48.69	-25.31	74.00	54.80	40.10	10.88	57.09	---	---	Peak
12	17670.00	49.75	-24.25	74.00	52.16	42.12	12.19	56.72	100	0	Peak | |	 Site : 03CH13-HY Condition : PEAK_74 3m HORN_9120D_1241 VERTICAL Detector : Peak Project : 120337 Mode : 21 | Freq	Level	Over Limit	Limit Line	ReadAntenna Level	Factor	Cable Loss	Preamp Factor	A/Pos	T/Pos	Remark
MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	45.52	29.15	-10.85	40.00	44.03	16.76	0.61	32.28	100	0	Peak
2	117.30	31.59	-11.91	43.50	45.38	17.43	0.95	32.24	---	---	Peak
3	155.13	26.29	-17.21	43.50	40.41	16.95	1.08	32.25	---	---	Peak
4	480.08	28.05	-17.95	46.00	34.34	23.64	1.86	31.87	---	---	Peak
5	868.08	32.63	-13.37	46.00	32.15	28.96	2.50	31.14	---	---	Peak
6	960.00	33.97	-12.03	46.00	31.33	30.55	2.61	30.74	---	---	Peak
7	1940.00	34.93	-39.07	74.00	62.69	25.86	4.02	57.64	---	---	Peak
8	2946.00	37.51	-36.49	74.00	61.58	28.39	5.12	57.58	---	---	Peak
9	5820.00	39.83	-34.17	74.00	55.91	32.18	7.05	55.31	---	---	Peak
10	9750.00	47.56	-26.44	74.00	55.54	39.40	9.36	56.74	---	---	Peak
11	13755.00	48.80	-25.20	74.00	54.94	40.06	10.87	57.07	100	0	Peak
12	17445.00	48.77	-25.23	74.00	52.62	40.83	12.06	56.74	---	---	Peak	 	