Test Report No.: *Prüfbericht-Nr.:*	**US21JEHB 001 Rev1.0**	**Order No.:** *Auftrags-Nr.:*	P00075250 234162161	Page 1 of 57 *Seite 1 von 57*
Client Reference No.: *Kunden-Referenz-Nr.:*	2239677	**Order date:** *Auftragsdatum:*	10/30/2020	
Client: *Auftraggeber:*	Thales Group, Inc. 51 Discovery, Irvine California 92618 U.S.A.			
Test item: *Prüfgegenstand:*	Wireless Mode Controller - Lite (WMC-L)			
Identification/ Type No.: *Bezeichnung / Typ-Nr.*	10.1” WMC: 186521-20x, 13.3” WMC: 187554-10x			
Order content: *Auftrags-Inhalt:*	Class II Permissive Change			
Test specification: *Prüfgrundlage:*	CFR 47 Part 15.247: 2021, CFR 47 Part 15.407: 2021 and RSS 247 Issue 2, 2017			
Date of sample receipt: *Wareneingangsdatum:*	12/10/2020	See Test Setup Exhibit for Photos		
Test sample No: *Prüfmuster-Nr.:*	WMC, 13.3			
Testing period: *Prüfzeitraum:*	11/23/2021- 11/30/2021			
Testing laboratory: *Prüflaboratorium:*	TUV Rheinland of North America 5015 Brandin Ct. Fremont, CA 94538			
Test result*: *Prüfergebnis*:*	Pass			

tested by:
geprüft von:

Date: 12/2/2021
Datum:

Position / Stellung: Expert

authorized by: /
genehmigt von:

Issue Date: 12/2/2021
Ausstellungsdatum:

Position / Stellung: Expert

Others /
Sonstiges:

Condition of the test item at delivery:
Zustand des Prüfgegenstandes bei Anlieferung: Test sample complete and undamaged

* Legend:	P(ass) = passed a.m. test specification(s)	F(ail) = failed a.m. test specification(s)	N/A = not applicable	N/T = not tested
** Legende:*	*P(ass) = entspricht o.g. Prüfgrundlage(n)*	*F(ail) = entspricht nicht o.g. Prüfgrundlage(n)*	*N/A = nicht anwendbar*	*N/T = nicht getestet*

This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.
V05

Remarks
Anmerkungen

1	The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system. Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request. *Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben.* *Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden.*
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3	Test clauses with remark of * are subcontracted to qualified subcontractors and descripted under the respective test clause in the report. Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report. *Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben.* *Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt.*
4	The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. The report must not be used by the client to claim product certification, approval, or endorsement by A2LA.
5	Radio Compliance Emissions Test Report. The above product was found to be Compliant to the above test standard(s).

Product description
Produktbeschreibung

1	**Product details:** *Produktdetails:*	The Wireless Mode Controller (WMC) product line includes the tablet devices and docking stations. The First-class (13.3" WMC) and business-class passengers (10.1" WMC) will use the tablet as the second screen device.
2	**Dimensions / Weight:** *Maße / Gewicht:*	13.3" WMC – 20.84 cm x 32.28 cm x 1.68 cm / 1.20Kg
3	**Operating elements:** *Bedienelemente:*	+28VDC/4.5A, Transmit bands 2.4 – 2.4835 GHz, 5.15– 5.25 GHz, 5.25– 5.35 GHz, 5.47– 5.72 GHz, and 5.725– 5.85 GHz.
4	**Equipment / Accessories:** *Ausstattung / Zubehör:*	Dell Laptop
5	**Used materials:** *Verwendete Materialien:*	None.
6	**Other:** *Sonstiges:*	Test sample(s), as well sample information, description, product details and intended usage was provided by customer.
7	**Test sample obtaining:** *Prüfmusterbereitstellung:*	☒ Sending by customer ☐ Sampling by TÜV Rheinland Group ☐ others:

Revisions

Date mm/dd/yy	Name	Page Number of Change	Describe Change
12/02/2021	Rev. 1	N/A	Original Document

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1 General Information

1.1 Scope

This report is intended to document the status of conformance with the requirements of the Class II Permissive Change based on the results of testing performed from November 23, 2021 through November 30, 2021 on Model 10.1" WMC: 186521-20x, 13.3" WMC: 187554-10x manufactured by Thales Avionics Inc. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report. Thales Avionics Inc is seeking to add new antenna to the existing FCC ID 2AFDI-ITCNFA324 filing using the provisions of the Class II Permissive Change as stated in KDB 178919.

1.3 Summary of Test Results

Table 1 - Summary of Test Results

Test	Test Method ANSI C 63.10 & C63.4	Test Parameters	Result
Maximum Output Power	CFR47 15.247 (b), RSS 247 Sect. 5.4 (d) CFR47 15.407 (a) RSS 247 Sect. 6.2.3.1 [see Note 1]	Band 2400-2483.5 MHz: 1W 5GHz UNII1: 1W 5GHz UNII2A, 2C: 250mW 5GHz UNII3: 1W	**Complied**
Restricted Bands of Operation	CFR47 15.205, RSS GEN Sect.8.10	Class B	**Complied**
Transmitter Spurious Emissions	CFR47 15.209, CFR47 15.247 (d), CFR47 15.407 (b) RSS-GEN Sect.8.9, RSS 247 Sect. 6.2.1.2	Class B	**Complied**
Note: 1. Measurements are conducted 2x2 total power for 2.4GHz and 5GHz WiFi. * Test Results not present in this report will be leveraged from the Report on file with the FCC ID 2AFDI-ITCNFA324.			

1.4 Special Accessories

No special accessories were necessary in order to achieve compliance.

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America EMC test facilities located at 1279 Quarry Lane, Ste. A, Pleasanton, CA, 94566, and 5015 Brandin Ct, Fremont, CA. 94538, are recognized by the Commission for performing testing services for the general public on a fee basis. These laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Pleasanton Registration No. US1131, Fremont Registration No. US1131). The laboratory Scopes of Accreditation include Title 47 CFR Parts 15, 18 and 90. The accreditations are updated every three years.

2.1.2 A2LA

TUV Rheinland of North America EMC test facilities are accredited by the American Association for Laboratory Accreditation (A2LA). The laboratories have been assessed and accredited by A2LA in accordance with ISO Standard 17025:2017 (Testing Certificate #3331.02). The Scope of Laboratory Accreditation includes emission and immunity testing. The accreditations are updated annually.

2.1.3 Industry Canada

The Pleasanton 5-meter Semi-Anechoic Chamber, Registration No. 2932M-1, has been accepted by Industry Canada to perform testing to 3 and 5 meters based on the test procedures described in ANSI C63.4-2014. The Fremont 10-meter Semi-Anechoic Chamber, Registration No. 2932D-1, has been accepted by Industry Canada to perform testing to 3 and 10 meters based on the test procedures described in ANSI C63.4-2014.

2.1.4 Japan – VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland of North America EMC test facilities located at 1279 Quarry Lane, Ste. A, Pleasanton, CA, 94566, and 5051 Brandin Ct, Fremont, CA. 94538, have been assessed and approved in accordance with the Regulations for Voluntary Control Measures.

VCCI Registration No. for Pleasanton: A-0326

VCCI Registration No. for Fremont: A-0327

2.1.5 Acceptance by Mutual Recognition Arrangement

The United States has an established agreement with specific countries under the Asia Pacific Laboratory Accreditation Corporation (APLAC) Mutual Recognition Arrangement. Under this agreement, all TUV Rheinland at 1279 Quarry Ln, Pleasanton, CA 94566 test results and test reports within the scope of the laboratory NIST / A2LA accreditation will be accepted by each member country.

2.2 Test Facilities & EMC Software

Test facilities are located at 1279 Quarry Lane, Ste. A, Pleasanton, California 94566, U.S.A. and 5015 Brandin Ct, Fremont, CA. 94538, U.S.A. (Fremont is the Pleasanton Annex).

2.2.1 Emission Test Facility

The Semi-Anechoic Chambers and AC Line Conducted measurement facilities used to collect radiated and conducted emissions data have been constructed in accordance with ANSI C63.7:1992. The Fremont 10 meter semi-anechoic chamber has been measured in accordance with and verified to comply with the theoretical volumetric normalized site attenuation of ANSI C63.4-2014 and SVSWR requirements of CISPR 16-1-4 Consol. Ed. 3.0 (2010-04), at test distances of 3 and 10 meters. This site has been described in reports dated November 1st, 2006, submitted to the FCC, and accepted by letter dated November 28, 2006. The site is listed with the FCC and accredited by A2LA (Testing Certificate #3331.02). The Pleasanton 5 meter semi-anechoic chamber has been verified to comply with the theoretical volumetric normalized site attenuation of ANSI C63.4-2014 and SVSWR requirements of CISPR 16-1-4 Consol. Ed. 3.0 (2010-04) at a test distance of 3 meters. This site has been described in reports dated November 1st, 2006, submitted to the FCC, and accepted by letter dated November 28, 2006. The site is listed with the FCC and accredited by A2LA (Testing Certificate #3331.02).

2.2.2 Immunity Test Facility

ESD, EFT, Surge, PQF: These tests are performed in an environmentally controlled room with a 3.7 m x 4.8 m x 3.175 mm thick aluminum floor connected to PE ground.

For ESD testing, tabletop equipment is placed on an insulated mat with a surface resistivity of 10^9 Ohms/square on a 1.6 m x 0.8 m x 0.8 m high non-conductive table with a 3.175 mm aluminum top (Horizontal Coupling Plane). The HCP is connected to the main ground plane via a low impedance ground strap through two 470-kΩ resistors. The Vertical Coupling Plane consists of an aluminum plate 50 cm x 50 cm x 3.175 mm thick. The VCP is connected to the main ground plane via a low impedance ground strap through two 470-kΩ resistors.

For EFT, Surge, PQF, the HCP and VCP are removed.

RF Field Immunity testing is performed in a 7.3 m x 4.3 m x 4.1 m anechoic chamber.

RF Conducted and Magnetic Field Immunity testing is performed on a 4.8 m x 3.7 m x 3.175 mm thick aluminum ground plane.

All test areas allow a minimum distance of 1 meter from the EUT to walls or conducting objects.

2.2.3 EMC Software – Pleasanton and Fremont

Manufacturer	Name	Version	Test Type
Rohde & Schwarz	EMC32	10.40.10	Radiated Emissions
ETS-Lindgren	TILE	3.4.K.14 @ 4.0.A.5	Radiated & Conducted Emissions
Agilent	Agilent MXE	A.11.02	Radiated & Conducted Emissions
ETS-Lindgren	TILE	3.4.K.14	Radiated & Conducted Immunity
Thermo Electron - Keytek	CEWare32	4.00	EFT/Surge/Voltage Dips & Interrupt
Voltech	IEC61000-3	1.21.07RC2	Harmonic & Flicker

2.3 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide to the Expression of Uncertainty in Measurement*, 1st Edition, 1995.

The Combined Standard Uncertainty is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities; it is equal to the positive square root of the sum of the variances or co-variances of these other quantities, weighted according to how the measurement result varies with changes in these quantities. The term *standard uncertainty* is the result of a measurement expressed as a standard deviation.

The Expanded Uncertainty defines an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurement. The fraction may be viewed as the coverage probability or level of confidence of the interval.

2.3.1 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

2.3.2 Measurement Uncertainty

Measurement Uncertainty Emissions

Per CISPR 16-4-2	**U_{lab}**	**U_{cispr}**
Radiated Disturbance @ 10 meters		
30 – 1,000 MHz	2.25 dB	4.51 dB
Radiated Disturbance @ 3 meters		
30 – 1,000 MHz	2.26 dB	4.52 dB
1 – 6 GHz	2.12 dB	4.25 dB
6 – 40 GHz	2.47 dB	4.93 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	1.09 dB	2.18 dB

Voltech PM6000A

The estimated combined standard uncertainty for harmonic current and flicker measurements is ± 5.0%.	Per CISPR 16-4-2 Methods

Measurement Uncertainty Immunity

The estimated combined standard uncertainty for ESD immunity measurements is ± 8.2%.	Per IEC 61000-4-2
The estimated combined standard uncertainty for radiated immunity measurements is ± 4.10 dB.	Per IEC 61000-4-3
The estimated combined standard uncertainty for conducted immunity measurements with CDN is ± 3.66 dB	Per IEC 61000-4-6
The estimated combined standard uncertainty for power frequency magnetic field immunity is ± 2.9%.	Per IEC 61000-4-8

Thermo KeyTek EMC Pro

The estimated combined standard uncertainty for EFT fast transient immunity measurements is ± 2.6%.
The estimated combined standard uncertainty for surge immunity measurements is ± 2.6%.
The estimated combined standard uncertainty for voltage variation and interruption measurements is ± 1.74%.

Measurement Uncertainty – Radio Testing

The estimated combined standard uncertainty for frequency error measurements is ± 3.88 Hz
The estimated combined standard uncertainty for carrier power measurements is ± 0.70 dB.
The estimated combined standard uncertainty for adjacent channel power measurements is ± 1.47 dB.
The estimated combined standard uncertainty for modulation frequency response measurements is ± 0.46 dB.
The estimated combined standard uncertainty for transmitter conducted emission measurements is ± 2.06 dB

The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria are not based on measurement uncertainty.

2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2017. Equipment calibration records are kept on file at the test facility.

3 Product Information

3.1 Product Description

The Wireless Mode Controller (WMC) product line includes the tablet devices and docking stations. The First-class (13.3" WMC) and business-class passengers (10.1" WMC) will use the tablet as the second screen device to:

1. Augment the primary screen
2. Deliver audio/video on Demand (AVDO) application and services
3. Application platform for Thales and third-party applications
4. Communication between the FC or BC passenger and flight screw
5. Control of on-wing subsystem.

Model 13.3" WMC: 187554-10x is used for testing.

3.2 Equipment Configuration

A description and justification of the equipment configuration is given in the EMC Test Plan. The EUT was tested as described in the EMC Test Plan and was configured and operated in a manner consistent with its intended use. The EUT was connected to rated power and allowed to warm up to normal operating conditions. The placement of the EUT system components was guided by the test standard and selected to represent typical installation conditions.

In the case of a EUT that can operate in more than one configuration, preliminary testing was performed to determine the configuration that produced maximum radiation.

The final configuration was selected to produce worse case radiation and place the EUT in the most susceptible state. There were no deviations from the description of the Equipment Configuration given in the EMC Test Plan.

3.3 Operating Mode

A description and justification of the operation mode is given in the EMC Test Plan.

In the case of a EUT that can operate in more than one state, preliminary testing was performed to determine the operating mode that produced maximum radiation.

The final operating mode was selected to produce worse case radiation and place the EUT in the most susceptible state. There were no deviations from the description of the Operation Mode given in the EMC Test Plan.

3.4 Duty Cycle

Model 13.3" WMC: 187554-10x was measured for the duty cycle.

Calculation of transmit duty cycle. Duty cycle (%) = (ON time / Period) * 100%

3.4.1 Results

Table 2 – Duty Cycle

Operating Mode	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Factor (dB)	Remark
2.4GHz WiFi -802.11g	5.78	5.87	98.47	0.07	Conducted
5GHz WiFi -802.11nHT20	5.73	5.83	98.28	0.08	Conducted
Note: EUT configured and measured for duty cycle. Duty factor will be used toward RF measurement offset.					

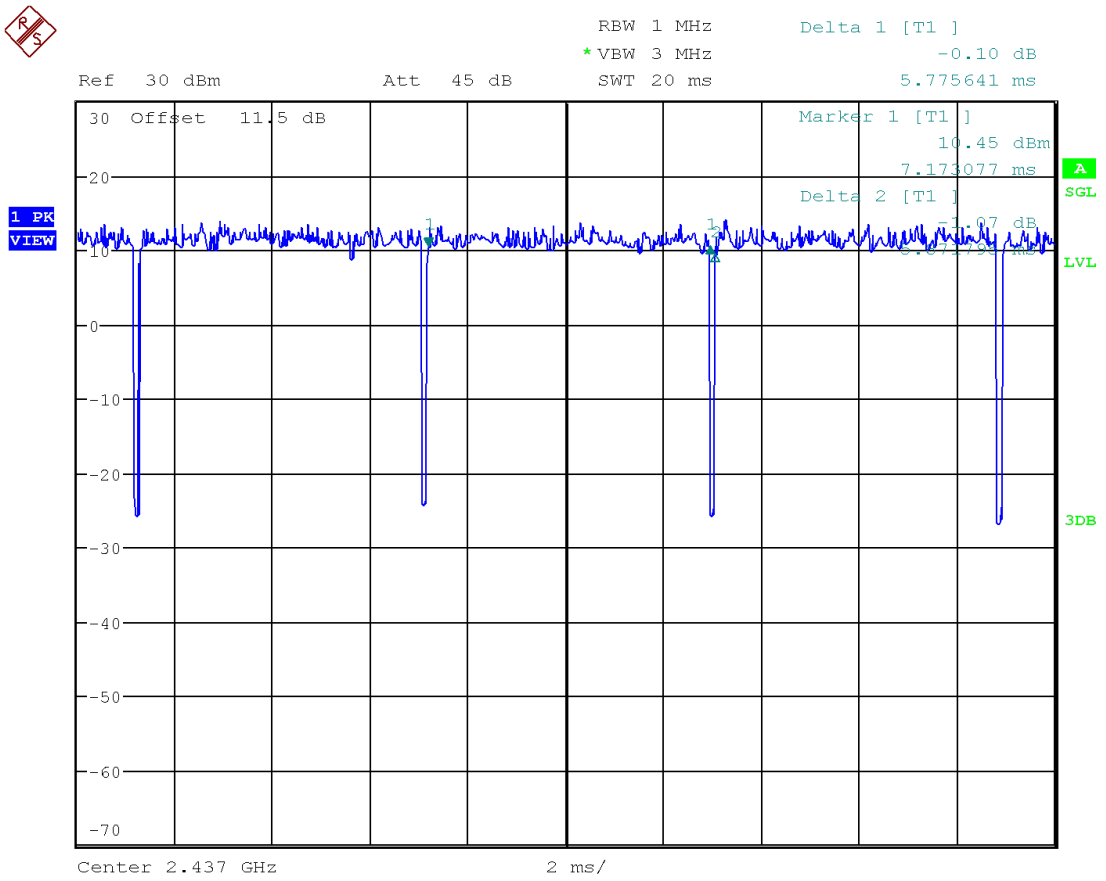


Figure 1: Duty Cycle for 802.11g

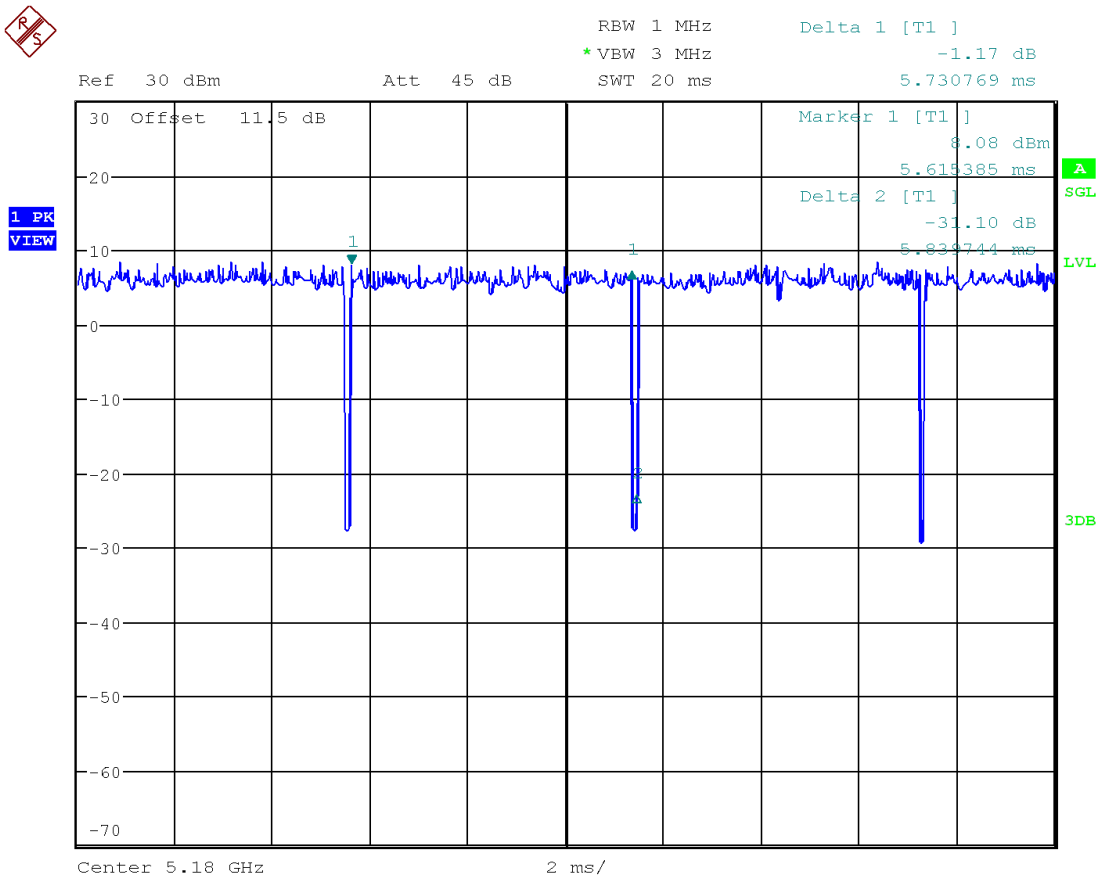


Figure 2: Duty Cycle for 802.11n HT20

4. Emissions

Testing was performed in accordance with CFR 47 Part 15.247: 2021, CFR 47 Part 15.407: 2021 and RSS 247 Issue 2, 2017. These test methods are listed under the laboratory's A2LA Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

4.1 Output Power Requirements

The maximum output power requirement is the maximum equivalent isotropic radiated power delivering at the transmitting antenna under specified conditions of measurements in the presence of modulation.

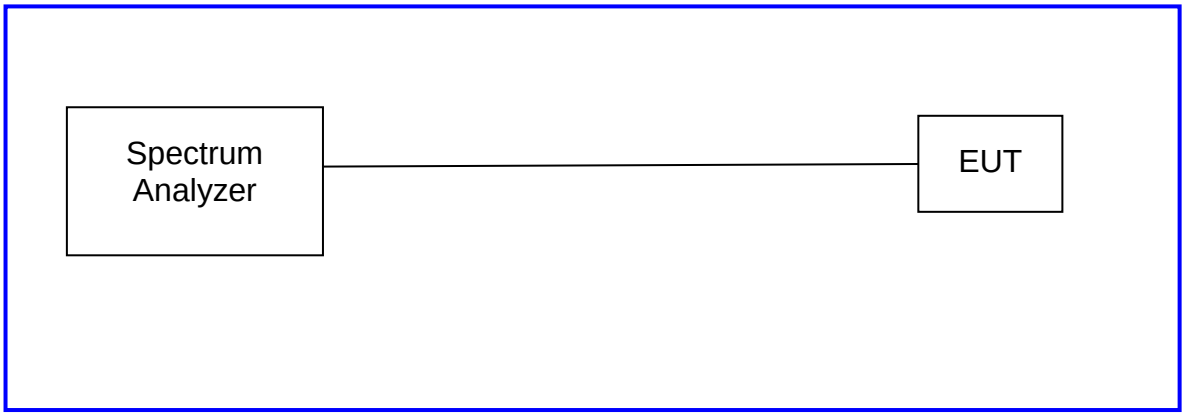
The maximum output power and harmonics shall not exceed CFR47 Part 15.247 (b) and RSS 247 Sect. 5.4.(d).
The maximum transmitted power in the frequency band 2400-2483.5 MHz: 1 W

The maximum transmitted power limits per CFR47 Part 15.407 and RSS-247 are
Part 15.407(a)(1)(iv) – Band 5150-5250 MHz:1 W.
Part 15.407(a)(2) – Band 5250-5350 MHz, 5470-5725 MHz:250 mW or 11 dBm + 10Log B.
Part 15.407(a)(3) – Band 5725-5825 MHz:1 W
RSS 247 Sect. 6.2.1.1 – Band 5150-5250 MHz (e.i.r.p.): 200 mW or 10 + 10Log(B)
RSS 247 Sect. 6.2.2.1, 6.2.3.1 – Band 5250-5350 MHz, 5470-5725 MHz: 250 mW or 11 dBm + 10Log B.
RSS 247 Sect. 6.2.2.3 (b) – Band 5250-5350 MHz (e.i.r.p.): 200 mW
RSS 247 Sect. 6.2.4.1 – Band 5725-5850 MHz: 1 W
Note: B is the 99% emission bandwidth.

4.1.1 Test Method

The ANSI C63.10-2013 Section 11.9.1.2, Section 11.9.2.2.2, Section 12.3.2.2 conducted method was used to measure the channel power output. Conducted method was used to measure the channel power output. The worst findings were conducted on worst channels in each operating range per CFR47 Part 15.247(b), RSS 247 Sect. 5.4(d), CFR47 Part 15.407(a) and RSS 247 Sect. 6.2.1.1. The worst mode results indicated below.

4.1.2 Test Setup: (Conducted)



4.1.3 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s). Worse case data for each mode reported below. Plots of highest power included for low, medium, and high channels.

Table 3: RF Output Power at the Antenna Port – BLE Test Results

Test Date: November 30, 2021		**Test By:** Rachana Khanduri		
Antenna Type: Flexible Monopole Antenna		**Peak Antenna Gain:** 3.6 dBi		
Ambient Temp.: 21 °C		**Relative Humidity:** 37%		
Bluetooth LE – RF Output Power				
Data Rate	**Operating Channel (MHz)**	**Measured Peak Output [dBm]**	**Limit [dBm]**	**Margin [dB]**
1Mbps	2402	1.55	30.00	-28.45
	2440	2.10	30.00	-27.90
	2480	**2.51**	30.00	-27.49
Note: Plots for all the measurements stated above were taken. Highlighted Plot is placed in the report.				

Table 4: RF Output Power at the Antenna Port – Test Results

Date: November 30, 2021			**Tested By:** Rachana Khanduri			
Antenna Type: Flexible Monopole Antenna			**Peak Antenna Gain:** 2.4GHz : 3.6dBi 5GHz: 1.3dBi			
Ambient Temp.: 22 - 23 °C			**Relative Humidity:** 35 - 38%			
802.11g at 6 Mbps (FCC Limit)						
Frequency (MHz)	**CH 0 Pout [dBm]**	**CH 1 Pout [dBm]**	**Duty Cycle [dB]**	**Max Power [dBm]**	**Limit [dBm]**	**Margin [dB]**
2412	16.09	16.02	0.07	19.14	30.00	-10.86
2437	15.89	16.31	0.07	19.19	30.00	-10.81
2462	**16.05**	**16.81**	0.07	19.53	30.00	-10.47
802.11n HT20 at MCS0 (FCC Limit)						
Frequency (MHz)	**CH 0 Pout [dBm]**	**CH 1 Pout [dBm]**	**Duty Cycle [dB]**	**Max Power [dBm]**	**Limit [dBm]**	**Margin [dB]**
5240	10.82	10.97	0.08	13.99	30.00	-16.01
5320	**11.49**	**11.03**	0.08	14.36	24.00	-9.64
5500	11.44	10.17	0.08	13.94	24.00	-10.06
5825	9.90	9.93	0.08	13.01	30.00	-16.99
Note: Plots for all the measurements stated above were taken. Highlighted Plots are placed in the report.						

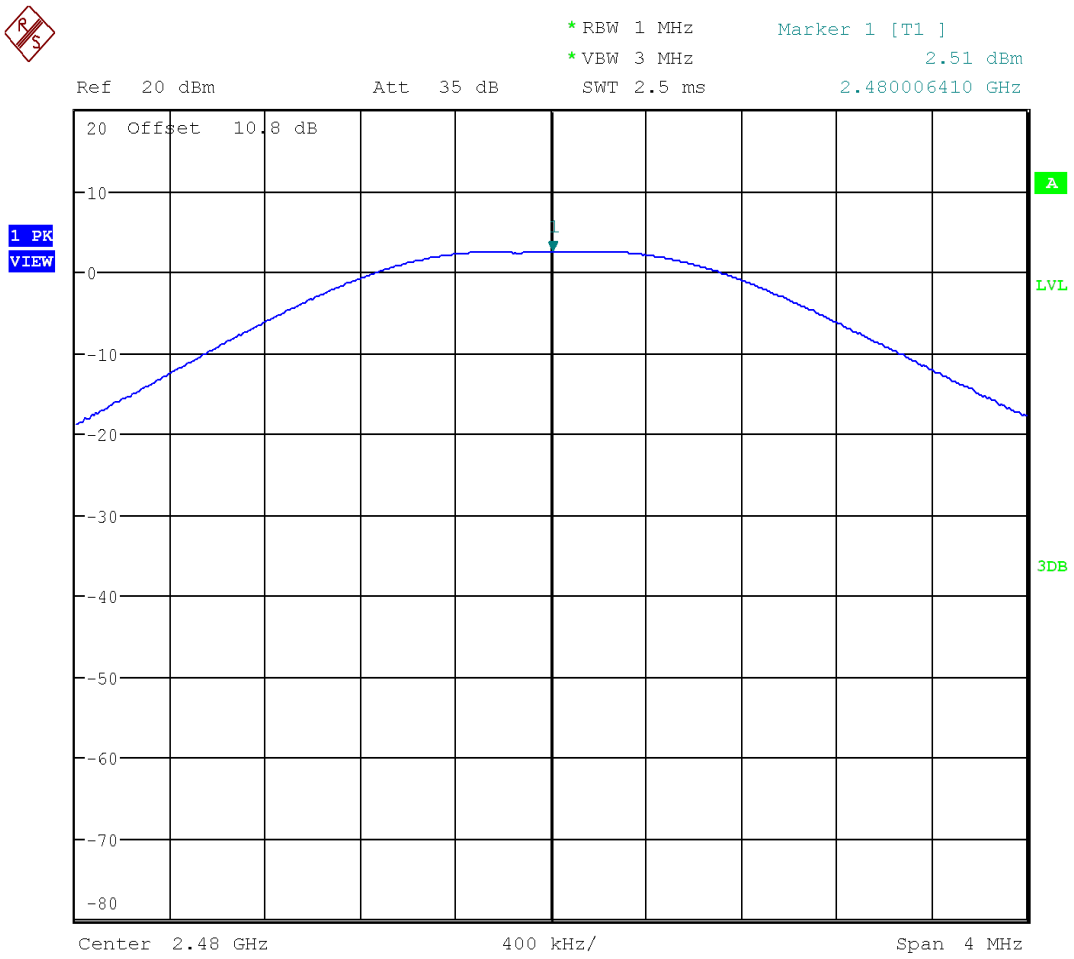


Figure 3: Maximum Conducted Power, 2480 MHz, 1Mbps

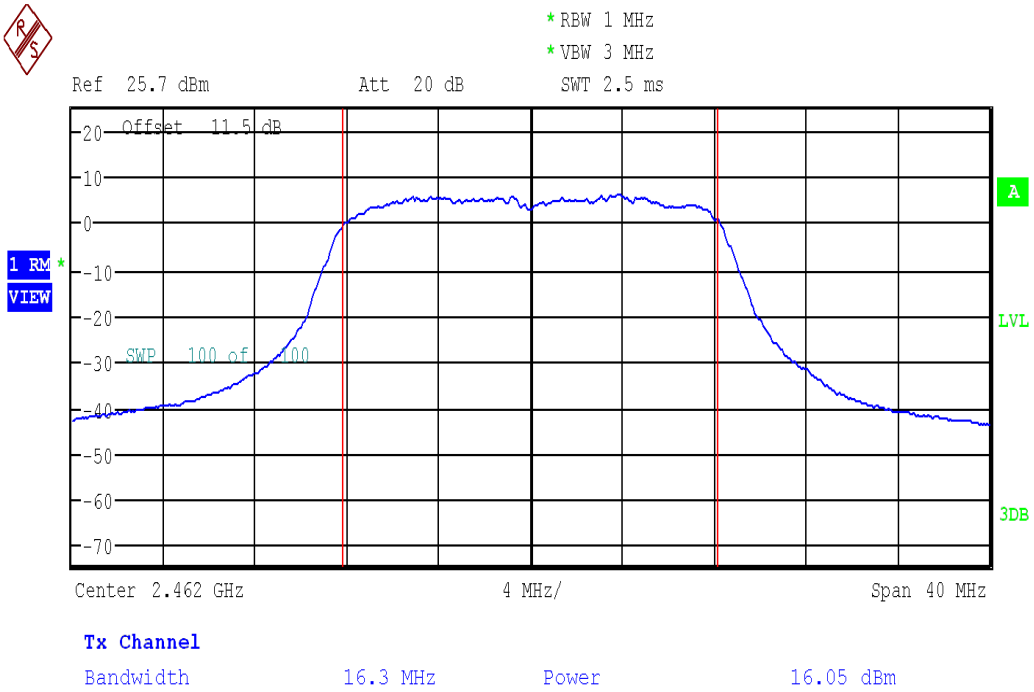


Figure 4: Max Conducted Power-2462 MHz-802.11g-6 Mbps-Ch0

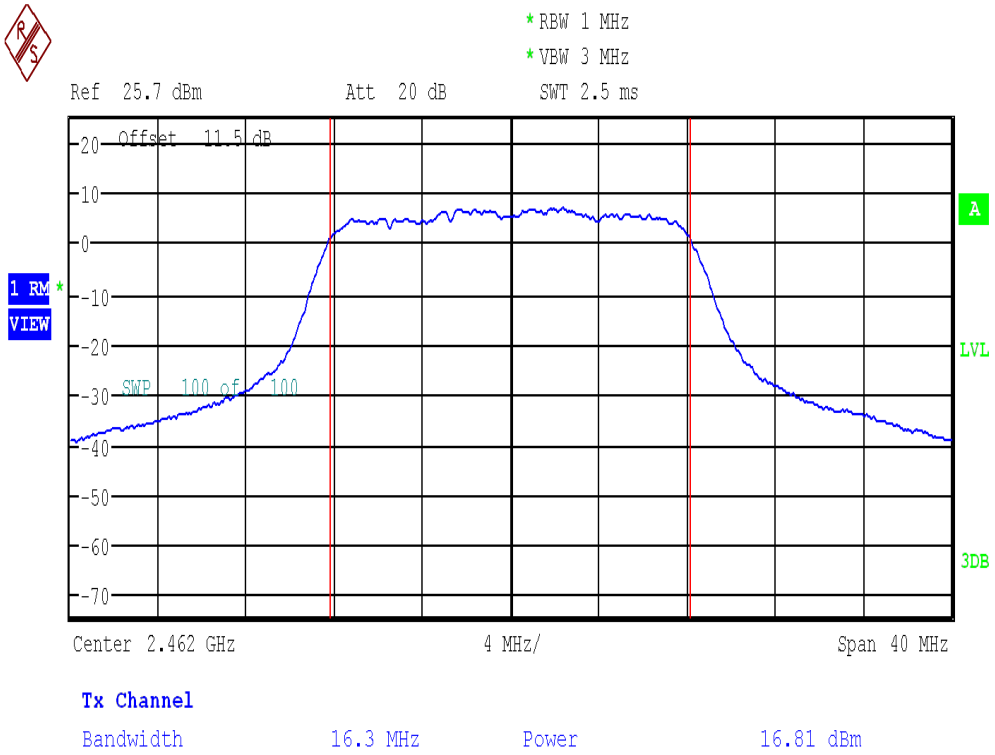


Figure 5: Max Conducted Power-2462 MHz-802.11g-6 Mbps-Ch1

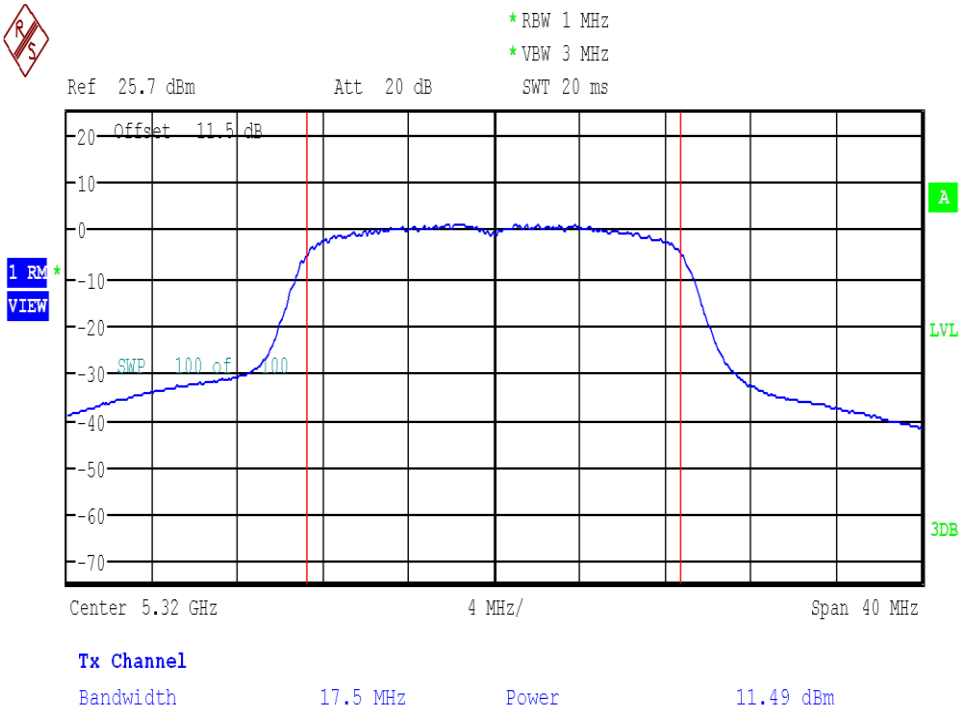


Figure 6: Max Conducted Power-5320 MHz-802.11nHT20 at MCS0-Ch0

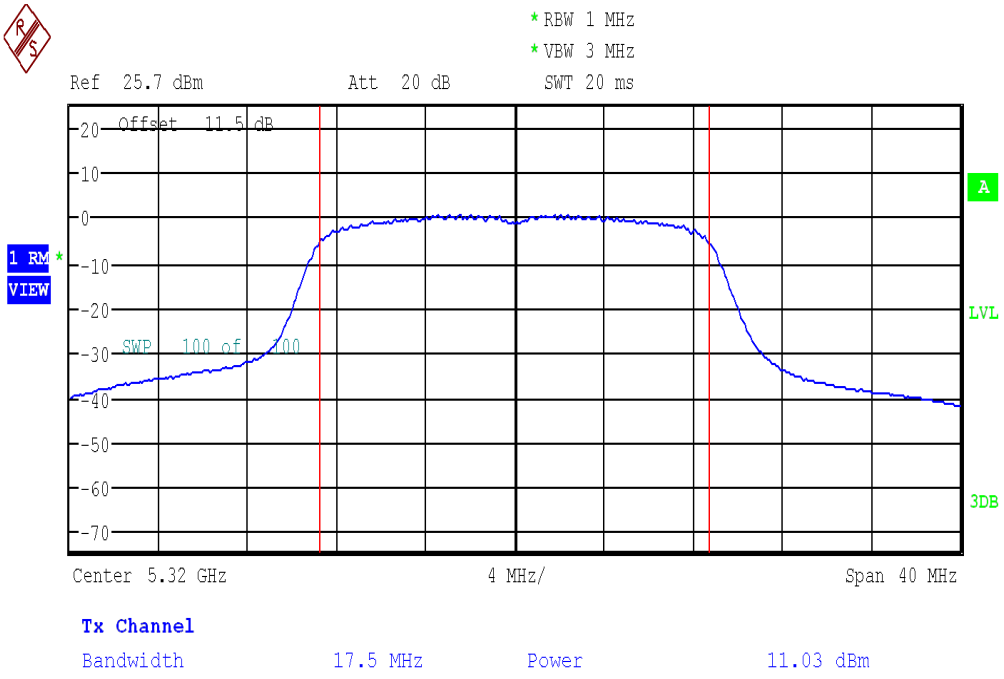


Figure 7: Max Conducted Power-5320 MHz-802.11nHT20 at MCS0-Ch1

4.2 Out of Band Emissions: Restricted Band Edge

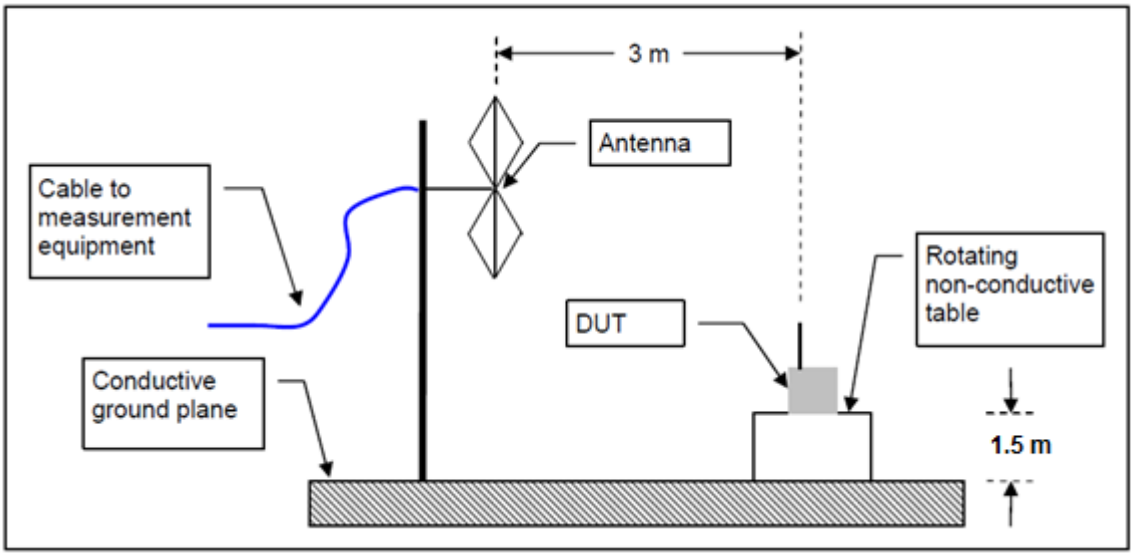
Transmitter spurious emissions are emissions outside the frequency range of the equipment when the equipment is in transmitting mode; per requirement of CFR47 15.205, 15.209, 15.247(d), RSS-247 Sect. 5.5, RSS-GEN Sect. 8.9 and 8.10.

4.2.1 Test Method

Radiated measurements per ANSI C63.10-2013 Section 6.10.5 were used to measure the undesirable emission requirement in restricted bands. Peak points were found and RMS Average was taken for each point found. The measurement was performed with modulation. high channels were tested at highest power settings.

RBW is set to 1MHz, VBW is set to 3MHz.

4.2.2 Test Setup



The DUT was stimulated by manufacturer provided test software that is not available to the end user.

4.2.3 Test Results

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2497.700600	---	28.60	54.00	25.40	1000.000	210.0	H	270.0	-2.2
2497.700600	45.29	---	74.00	28.71	1000.000	210.0	H	270.0	-2.2
2516.813600	---	28.54	54.00	25.46	1000.000	117.0	V	241.0	-2.4
2516.813600	44.13	---	74.00	29.87	1000.000	117.0	V	241.0	-2.4

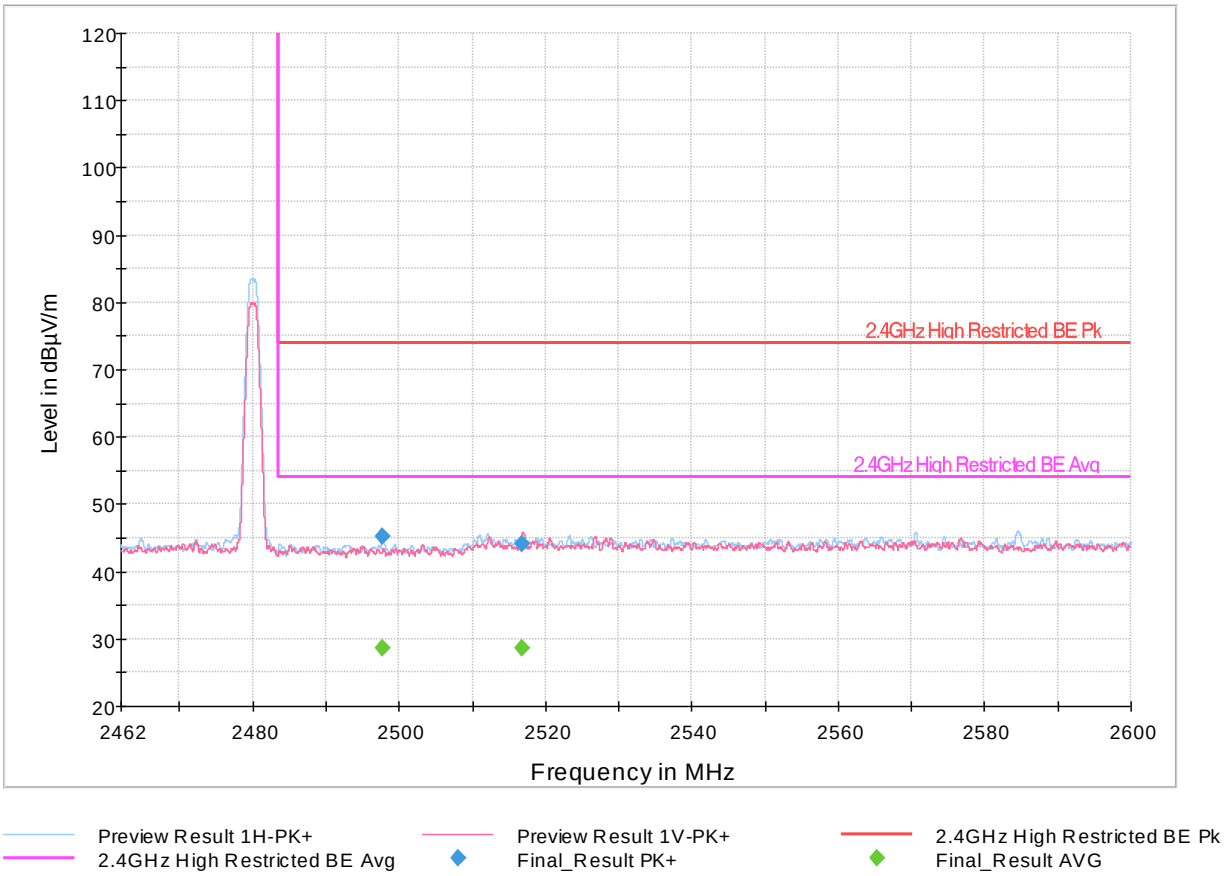


Figure 8: Restricted Band Edge, BLE- High Channel - 2480MHz, 1 Mbps

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.500400	---	43.77	54.00	10.23	1000.000	150.0	H	55.0	-2.2
2483.500400	63.36	---	74.00	10.64	1000.000	150.0	H	55.0	-2.2
2485.184000	55.82	---	74.00	18.18	1000.000	104.0	V	148.0	-2.6
2485.184000	---	39.50	54.00	14.50	1000.000	104.0	V	148.0	-2.6
2485.501400	57.56	---	74.00	16.44	1000.000	106.0	H	65.0	-2.2
2485.501400	---	40.18	54.00	13.82	1000.000	106.0	H	65.0	-2.2
2494.664600	---	34.45	54.00	19.55	1000.000	167.0	H	328.0	-2.2
2494.664600	49.26	---	74.00	24.74	1000.000	167.0	H	328.0	-2.2
2510.175800	---	36.26	54.00	17.74	1000.000	144.0	H	65.0	-2.1
2510.175800	49.48	---	74.00	24.52	1000.000	144.0	H	65.0	-2.1

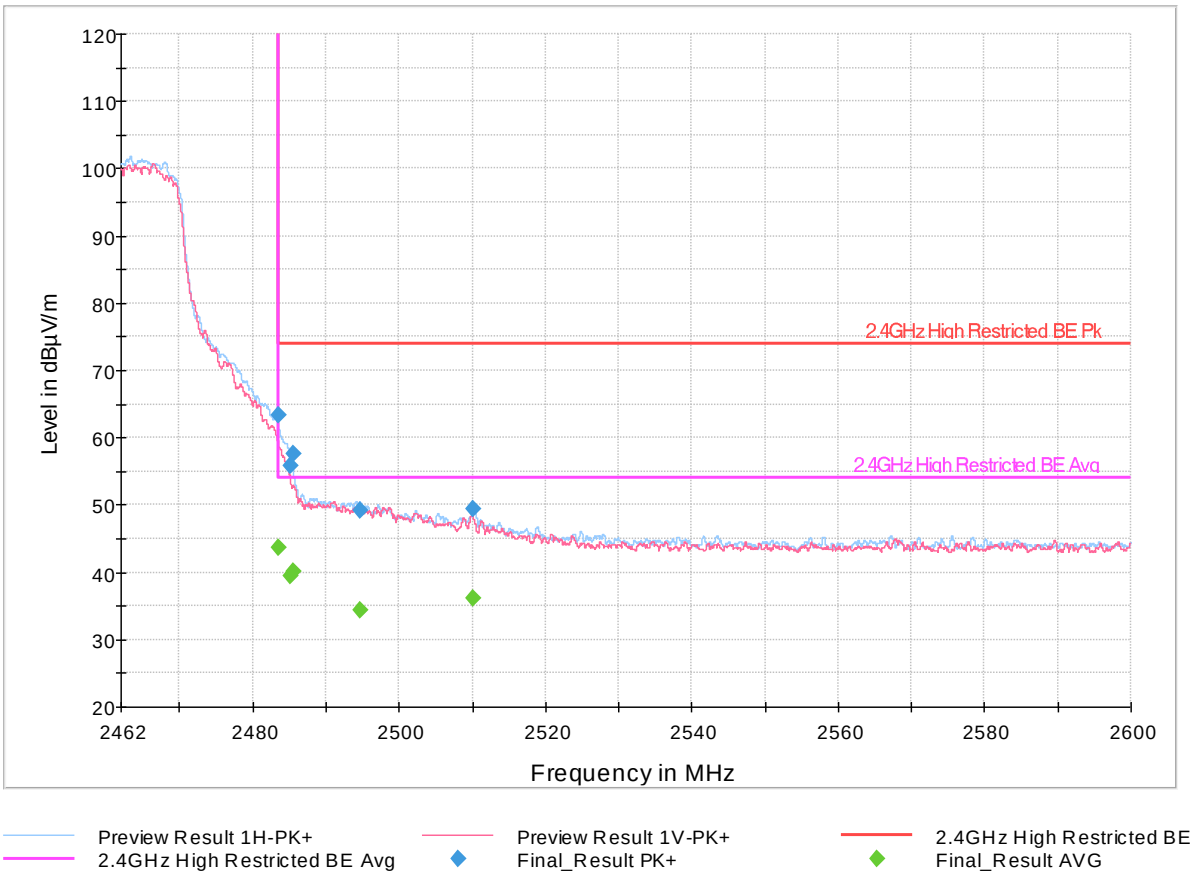


Figure 9: Restricted Band Edge, 802.11g- High Channel- 2462 MHz at 6 Mbps

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
5143.200000	---	34.88	54.00	19.12	10000.0	1000.0	100.	H	334.0
5143.200000	49.20	---	74.00	24.80	10000.0	1000.0	100.	H	334.0
5148.040000	---	33.70	54.00	20.30	10000.0	1000.0	154.	V	339.0
5148.040000	48.82	---	74.00	25.18	10000.0	1000.0	154.	V	339.0

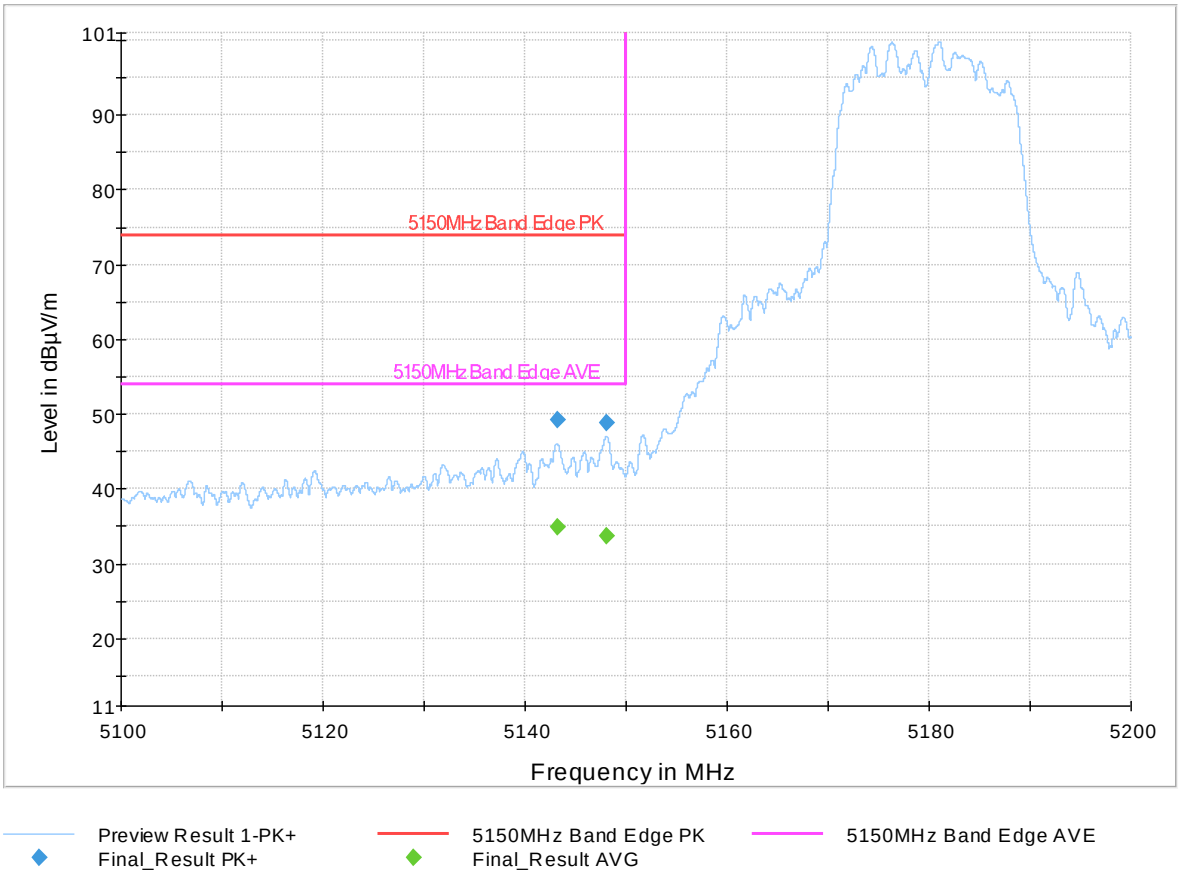


Figure 10: Restricted Band Edge,UNII-1- 802.11nHT20- Low Channel- 5180MHz at MCS0

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
5351.630000	---	42.89	54.00	11.11	10000.0	1000.000	100.0	H	2.0	5.8
5351.630000	60.05	---	74.00	13.95	10000.0	1000.000	100.0	H	2.0	5.8
5354.405000	---	39.13	54.00	14.87	10000.0	1000.000	104.0	H	355.0	5.8
5354.405000	57.12	---	74.00	16.88	10000.0	1000.000	104.0	H	355.0	5.8

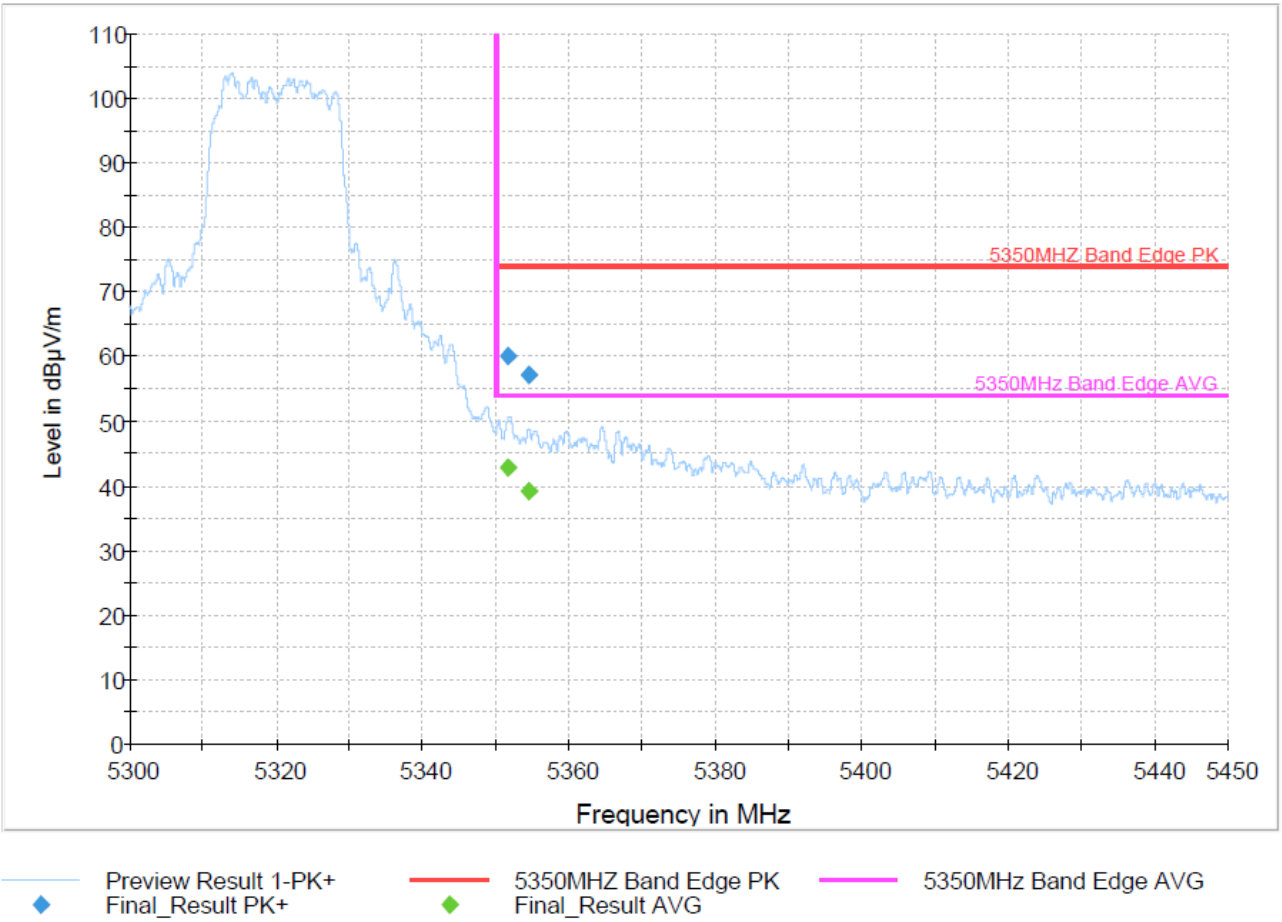


Figure 11: Restricted Band Edge, UNII-2A-802.11nHT20- High Channel- 5320MHz at MCS0

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
5452.602000	---	35.93	54.00	18.07	10000.0	1000.000	103.0	H	53.0	5.9
5452.602000	50.00	---	74.00	24.00	10000.0	1000.000	103.0	H	53.0	5.9
5457.827000	---	38.80	54.00	15.20	10000.0	1000.000	154.0	H	7.0	5.8
5457.827000	52.85	---	74.00	21.15	10000.0	1000.000	154.0	H	7.0	5.8
5464.020000	---	39.26	68.16	28.90	10000.0	1000.000	150.0	H	-2.0	5.8
5464.020000	53.42	---	160.00	106.58	10000.0	1000.000	150.0	H	-2.0	5.8
5468.992000	---	40.89	68.16	27.27	10000.0	1000.000	150.0	H	6.0	5.8
5468.992000	54.95	---	160.00	105.05	10000.0	1000.000	150.0	H	6.0	5.8

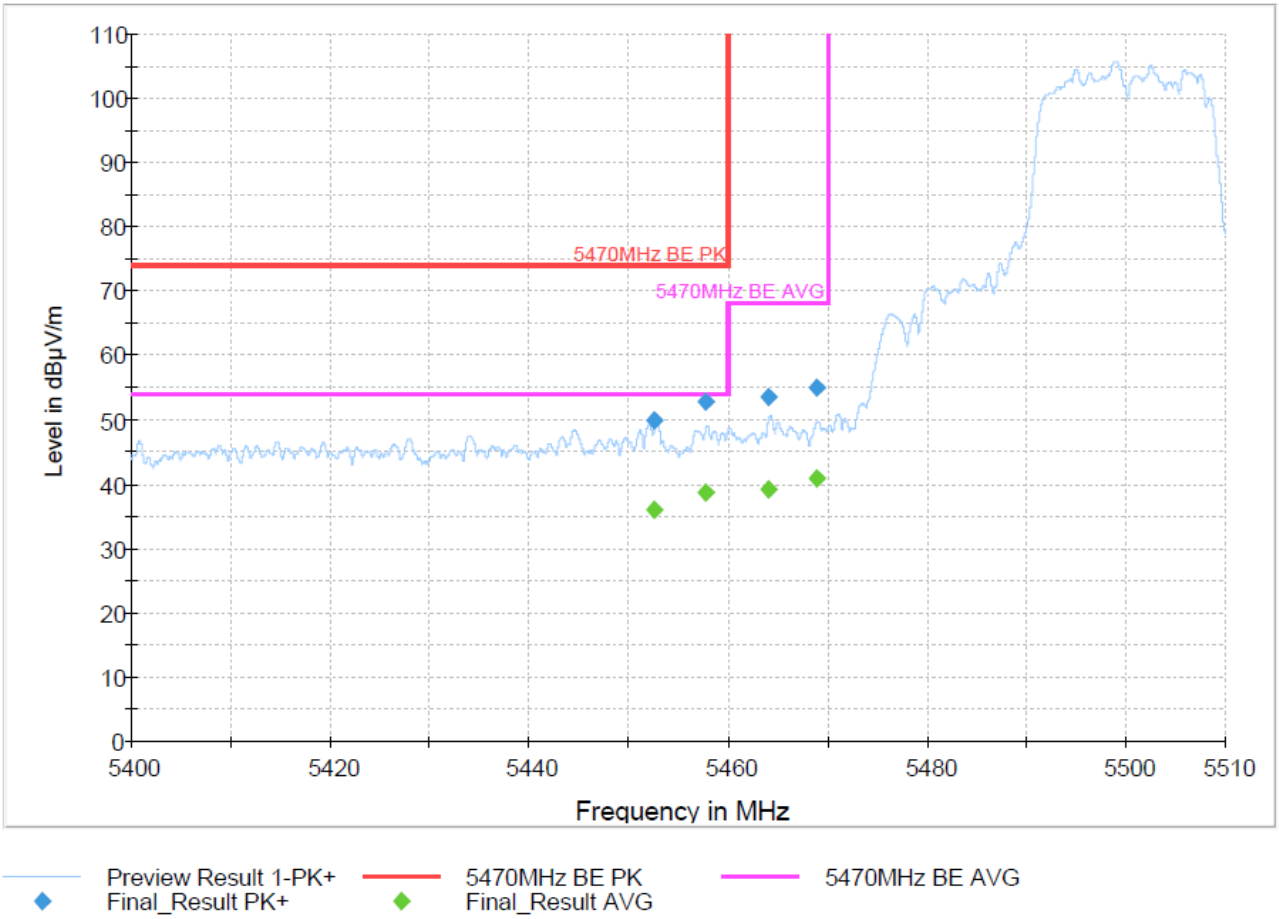


Figure 12: Restricted Band Edge, UNII-2C-802.11nHT20- Low Channel- 5500MHz at MCS0

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
5901.550000	53.13	---	85.55	32.42	1000.000	140.0	H	192.0	5.8
5901.550000	---	39.29	---	---	1000.000	140.0	H	192.0	5.8
5929.300000	53.39	---	68.20	14.81	1000.000	116.0	H	17.0	5.9
5929.300000	---	39.28	---	---	1000.000	116.0	H	17.0	5.9
5945.550000	52.06	---	68.20	16.14	1000.000	103.0	V	174.0	5.3
5945.550000	---	38.38	---	---	1000.000	103.0	V	174.0	5.3
5974.000000	53.19	---	68.20	15.01	1000.000	150.0	H	201.0	6.0
5974.000000	---	39.15	---	---	1000.000	150.0	H	201.0	6.0

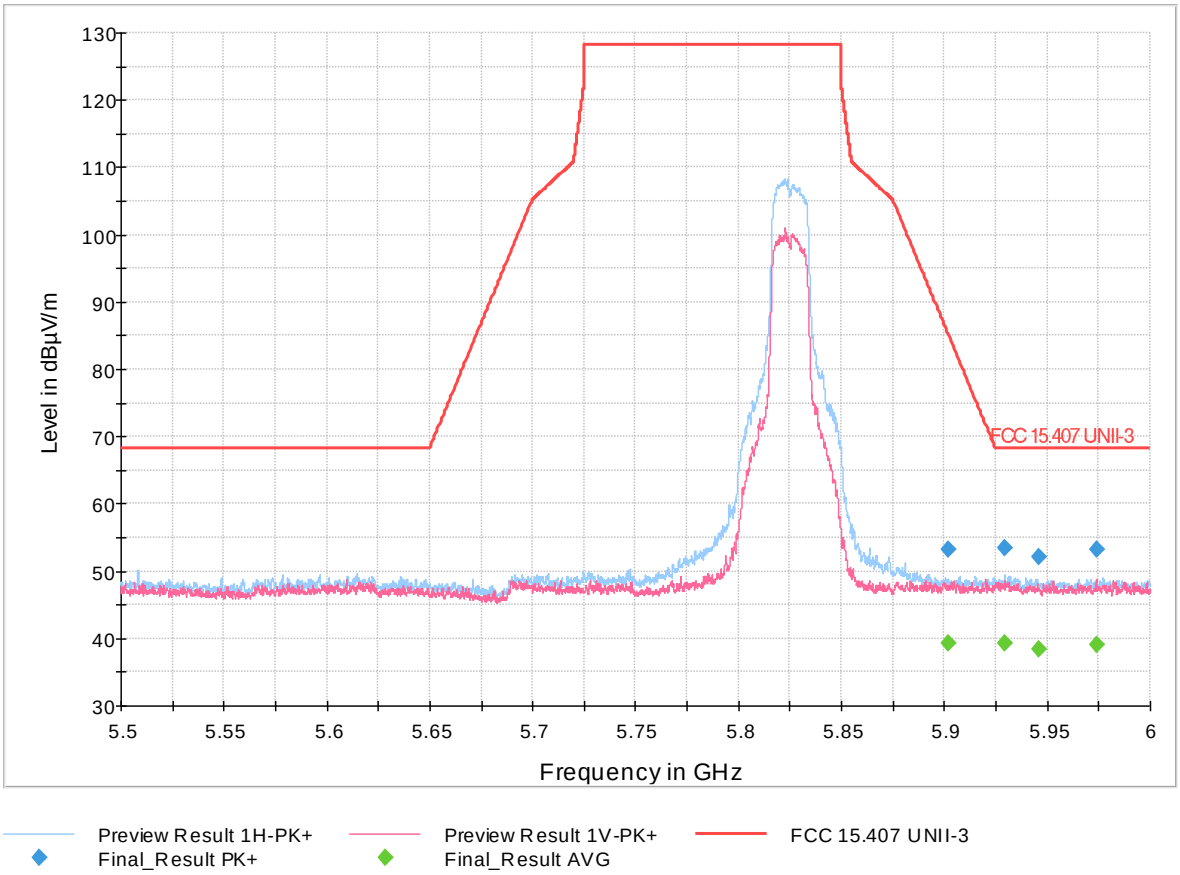


Figure 13: Restricted Band Edge, UNII-3-802.11nHT20- High Channel- 5825MHz at MCS0

4.3 Transmitter Spurious Emissions

Transmitter spurious emissions are emissions outside the frequency range of the equipment when the equipment is in transmit mode; per requirement of CFR47 15.205, 15.209, 15.247(d), RSS 247 Sect.5.5, RSS-GEN Sect. 8.9 and 8.10.

4.3.1 Test Methodology

4.3.1.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. The frequency range of interest was divided into sub-ranges to yield a frequency resolution of approximately 120 kHz and provide a reading at each frequency for no more than 12° of turntable rotation. For each frequency sub-range the turntable was rotated 360° while peak emission data was recorded and Figure 2: ted over the frequency range of interest in horizontal and vertical antenna polarization's.

Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm (<1 GHz) and 150cm (>1 GHz) above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m at a fixed height of 1m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT.

Pre-scans were performed to determine the worst data rate / chains.

4.3.1.2 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, than the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked.

Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm (<1 GHz) and 150cm (>1 GHz) above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

RBW is set to 200 Hz and VBW is set to 1 kHz for 9 kHz-150 kHz.
RBW is set to 9 kHz and VBW is set to 30 kHz for 150 kHz-30 MHz
RBW is set to 100 kHz, VBW is set to 300 kHz for 30 MHz-1 GHz.
RBW is set to 1 MHz, VBW is set to 3 MHz for above 1 GHz.

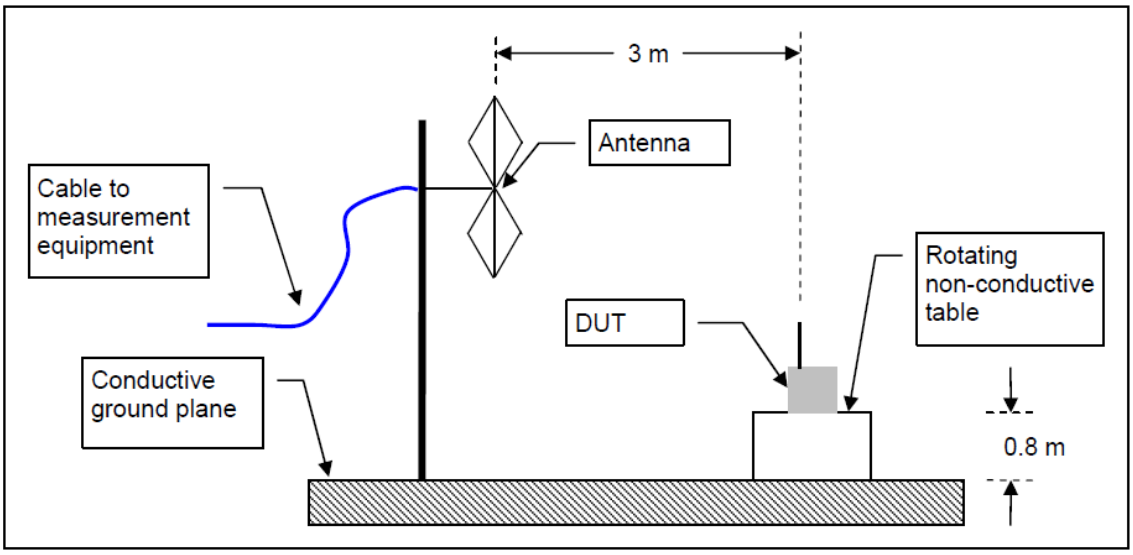
4.3.1.3 Deviations

None.

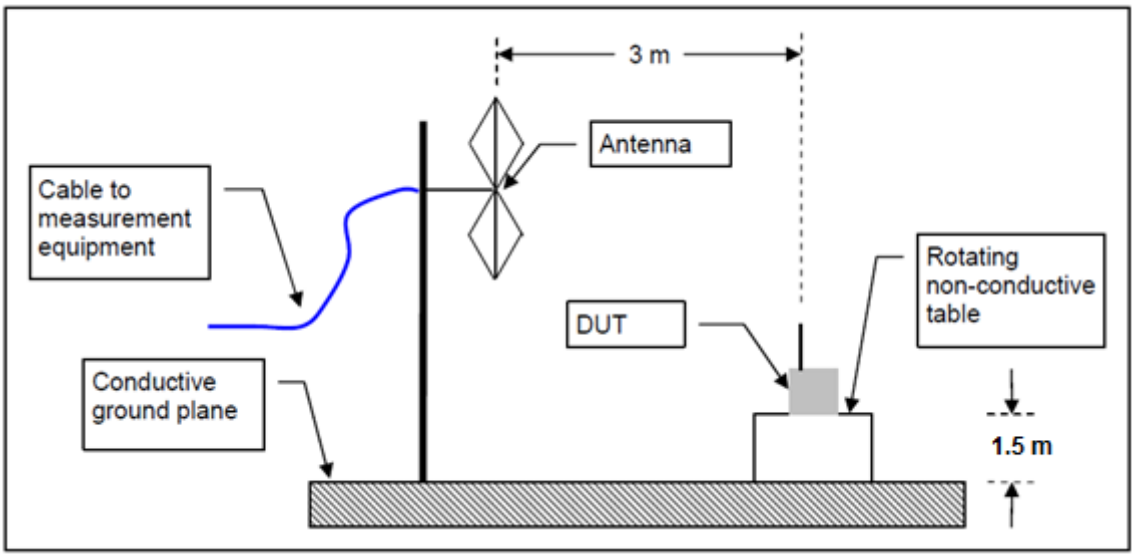
4.3.2 Test Setup:

All tests were conducted at full power on low, middle, and high channels. The DUT was stimulated by manufacturer provided test software that is not available to the end user.

30MHz-1GHz



1-40GHz



4.3.3 Transmitter Spurious Emission Limit

The spurious emissions of the transmitter shall not exceed the values in CFR47 Part 15.205, 15.209: 2015 and RSS Gen Sect. 8.9 and 8.10: 2014.

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

4.3.4 Test Results

The final measurement data was taken under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and test plan.

Frequencies below 30MHz and above 18GHz were investigated and no emissions were found above the noise floor. Both horizontal and vertical polarities were investigated. The results show only the worst case.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Note: The 2.4 GHz and 5GHz notch filter was used to protect the front end of the pre-amp.

4.3.4.1 Measurement Results:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
143.997920	34.90	43.52	8.62	10000.0	120.000	156.0	H	296.0	-16.9
237.765200	45.11	46.02	0.91	10000.0	120.000	104.0	H	314.0	-12.3
242.235600	41.90	46.02	4.12	10000.0	120.000	105.0	H	310.0	-12.2
263.395160	36.97	46.02	9.05	10000.0	120.000	100.0	H	295.0	-11.7
720.085760	40.25	46.02	5.77	10000.0	120.000	103.0	H	326.0	-3.4
743.221840	35.59	46.02	10.43	10000.0	120.000	100.0	H	322.0	-3.0

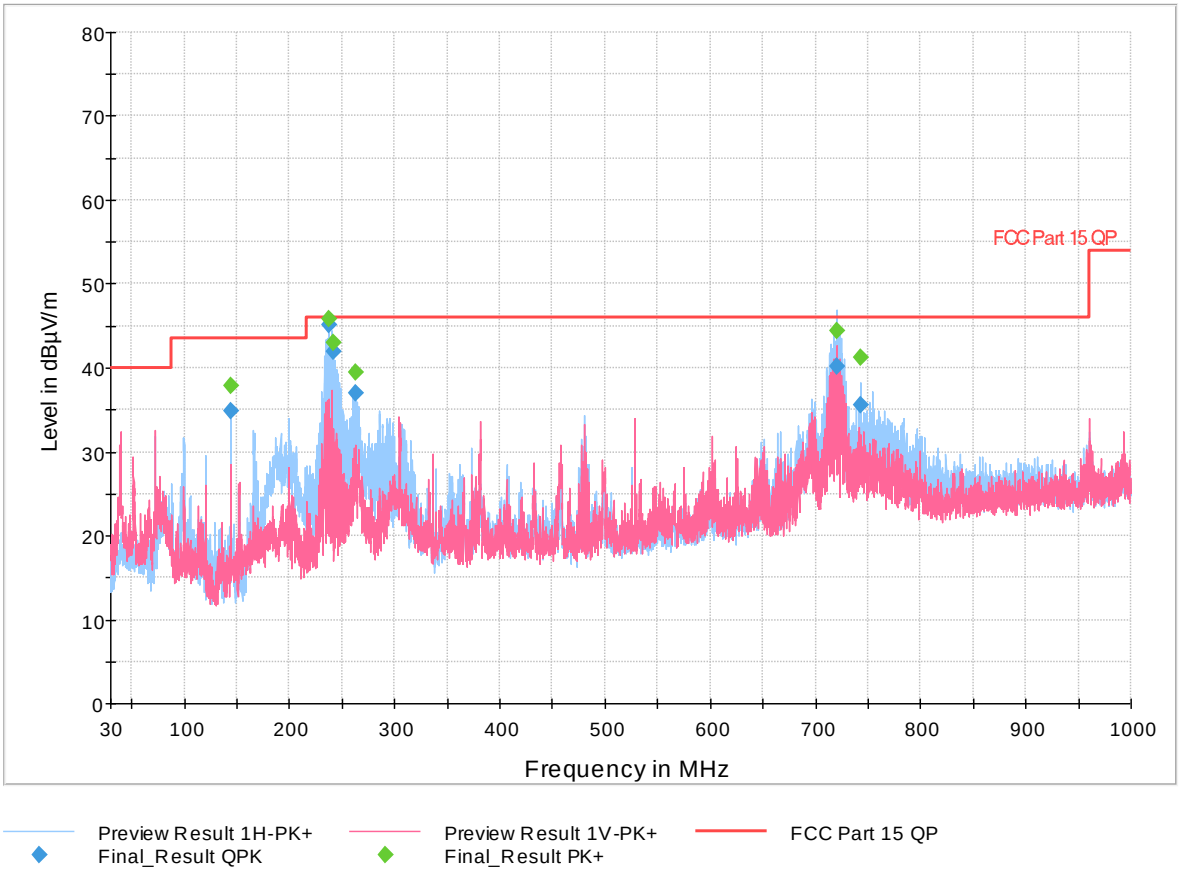


Figure 14: Radiated Spurious Emissions 30MHz – 1GHz, BLE-2440MHz, 1Mbps

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
39.318000	25.60	40.00	14.40	10000.0	120.000	103.0	V	340.0	-11.8
71.997400	31.05	40.00	8.95	10000.0	120.000	100.0	V	117.0	-16.2
237.770240	45.42	46.02	0.60	10000.0	120.000	107.0	H	323.0	-12.3
261.225600	35.18	46.02	10.84	10000.0	120.000	100.0	H	302.0	-11.7
696.492960	33.64	46.02	12.38	10000.0	120.000	106.0	H	328.0	-3.6
720.011680	44.66	46.02	1.36	10000.0	120.000	103.0	H	323.0	-3.4

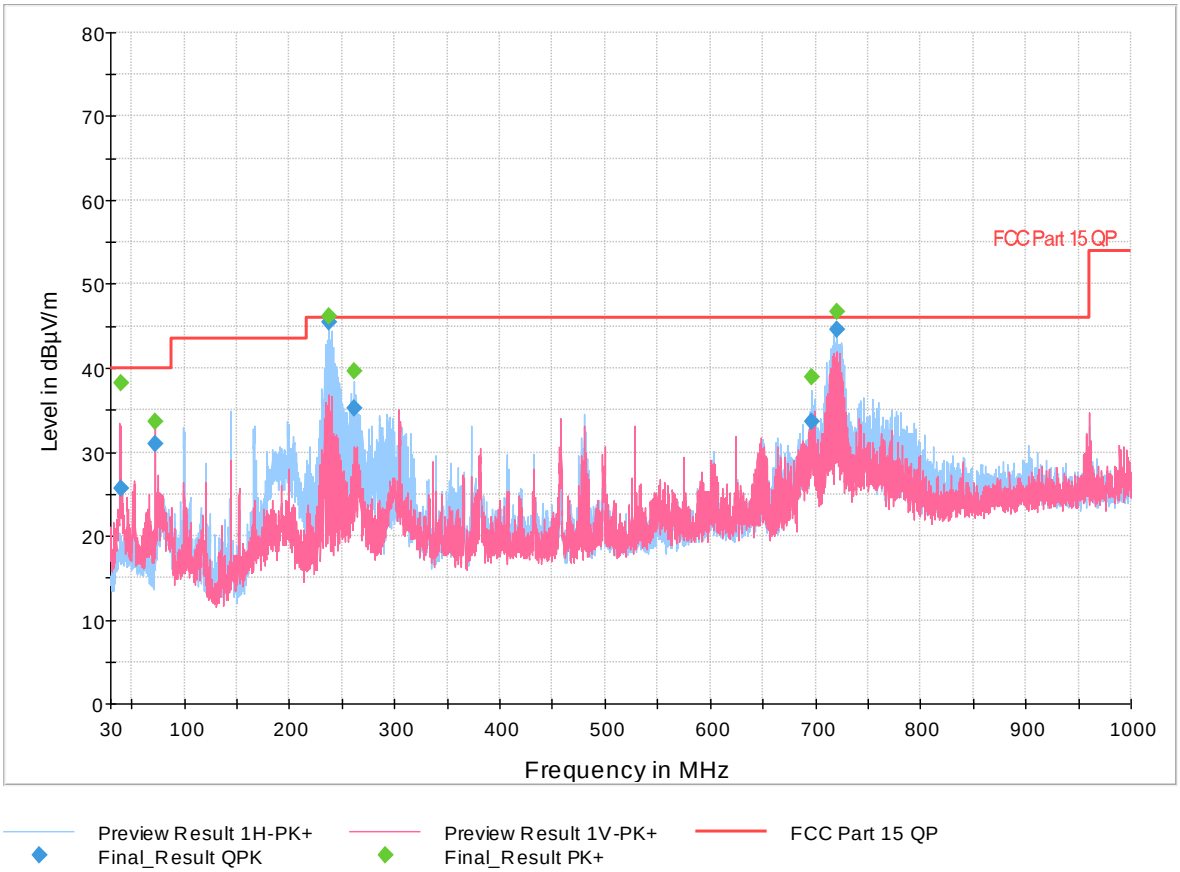


Figure 15: Radiated Spurious Emissions 30MHz – 1GHz, 802.11g at 6Mbps -2437MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.620600	33.21	40.00	6.79	10000.0	120.000	100.0	V	320.0	-14.5
33.823440	34.34	40.00	5.66	10000.0	120.000	100.0	V	180.0	-14.1
99.741800	39.92	43.52	3.60	10000.0	120.000	100.0	V	236.0	-12.9
166.279040	41.25	43.52	2.27	10000.0	120.000	150.0	H	270.0	-15.7
239.998840	44.06	46.02	1.96	10000.0	120.000	105.0	H	304.0	-12.2
720.007480	31.80	46.02	14.22	10000.0	120.000	155.0	H	295.0	-3.4

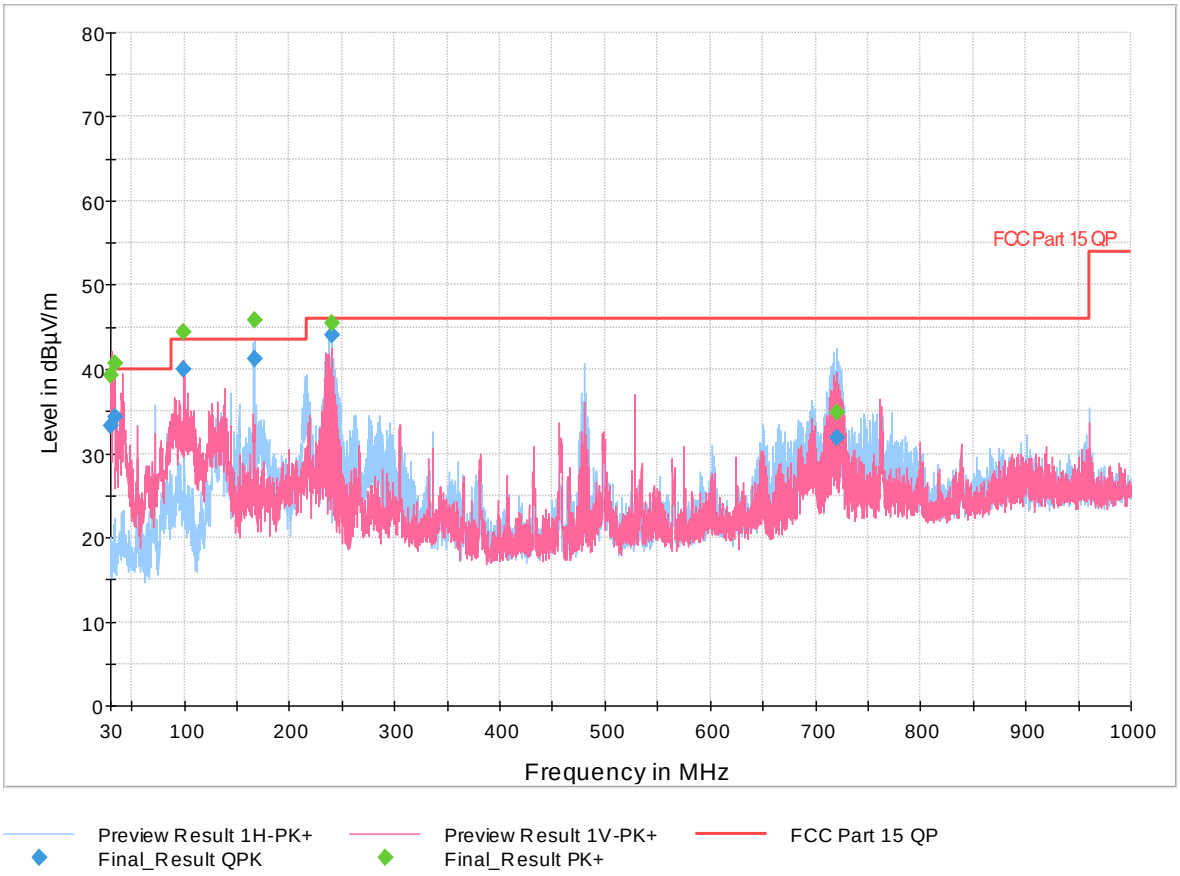


Figure 16: Radiated Spurious Emissions 30MHz – 1GHz, 802.11nHT20 at MCS0-5200MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
72.002320	32.60	40.00	7.40	10000.0	120.000	250.0	V	302.0	-16.2
237.767960	45.57	46.02	0.45	10000.0	120.000	103.0	H	321.0	-12.3
242.230680	42.23	46.02	3.79	10000.0	120.000	105.0	H	312.0	-12.2
260.994960	35.97	46.02	10.05	10000.0	120.000	100.0	H	292.0	-11.7
714.963560	43.52	46.02	2.50	10000.0	120.000	103.0	H	325.0	-3.7
720.050920	44.00	46.02	2.02	10000.0	120.000	103.0	H	326.0	-3.4

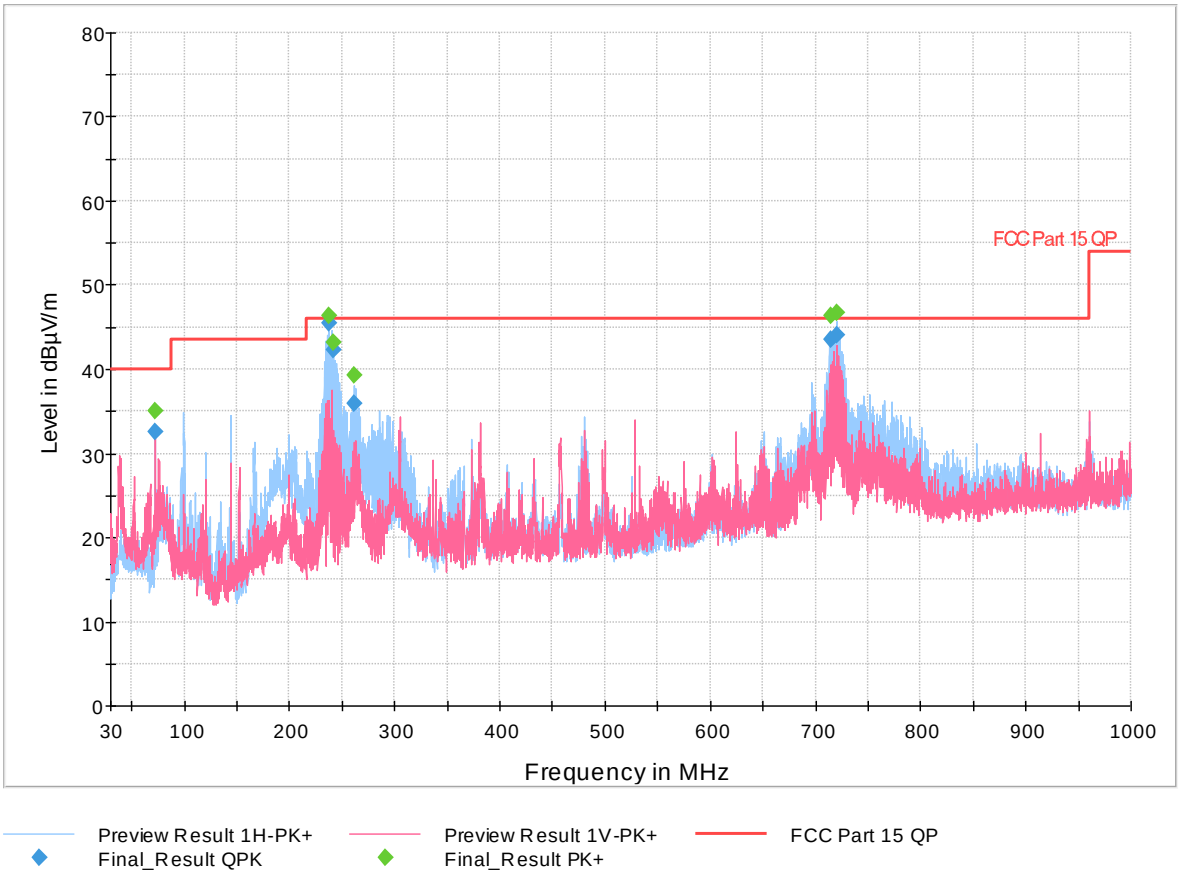


Figure 17: Radiated Spurious Emissions 30MHz – 1GHz, 802.11nHT20 at MCS0-5300MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
166.568040	36.33	43.52	7.19	10000.0	120.000	154.0	H	225.0	-15.7
237.773120	44.38	46.02	1.64	10000.0	120.000	103.0	H	304.0	-12.3
380.624840	33.59	46.02	12.43	10000.0	120.000	105.0	V	-5.0	-9.0
717.760840	43.83	46.02	2.19	10000.0	120.000	103.0	H	343.0	-3.6
724.471720	43.83	46.02	2.19	10000.0	120.000	100.0	H	44.0	-3.4
959.989440	39.45	46.02	6.57	10000.0	120.000	100.0	V	16.0	-0.5

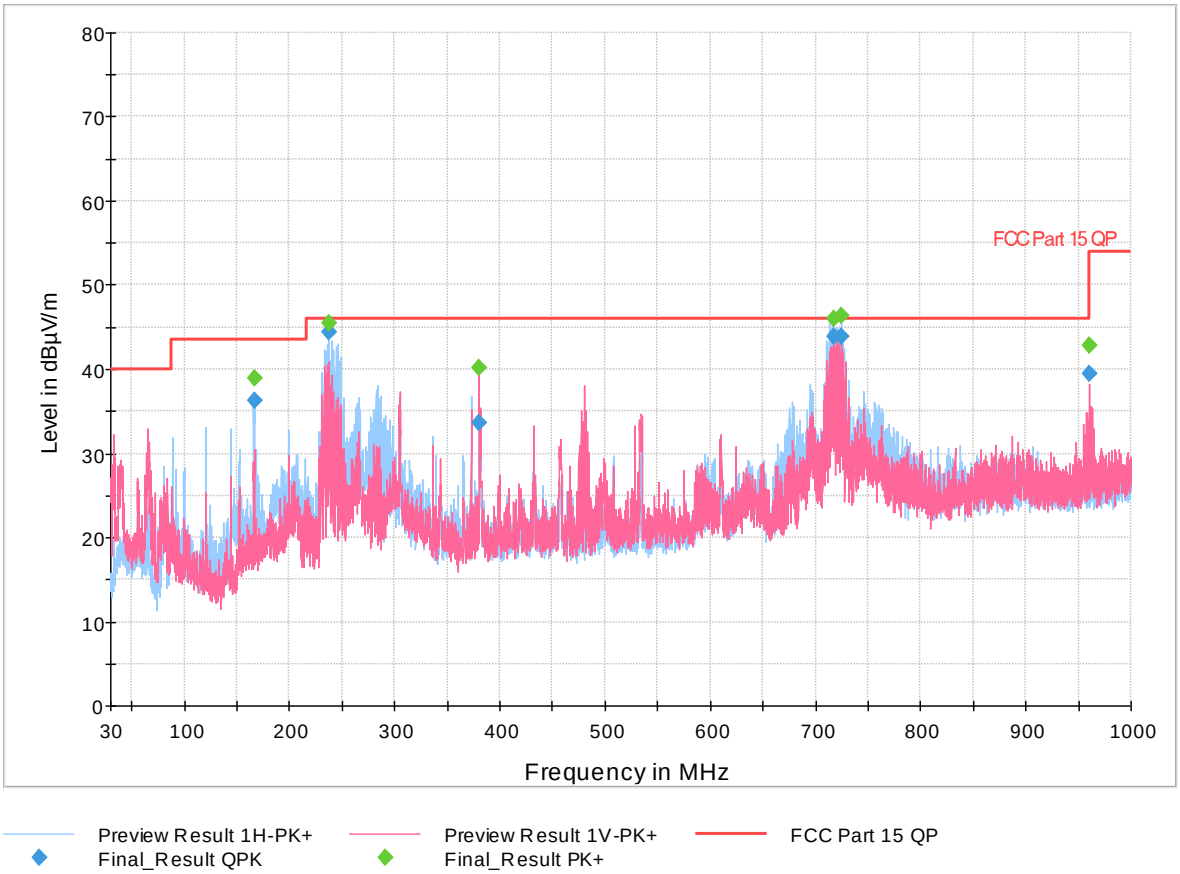


Figure 18: Radiated Spurious Emissions 30MHz – 1GHz, 802.11nHT20 at MCS0-5680MHz

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
33.394400	36.62	40.00	3.38	10000.0	120.000	100.0	V	218.0	-14.2
99.897960	40.05	43.52	3.47	10000.0	120.000	105.0	V	218.0	-12.9
166.279040	39.97	43.52	3.55	10000.0	120.000	105.0	H	293.0	-15.7
237.751640	43.53	46.02	2.49	10000.0	120.000	103.0	H	303.0	-12.3
479.996560	38.33	46.02	7.69	10000.0	120.000	154.0	H	254.0	-7.2
720.033640	35.54	46.02	10.48	10000.0	120.000	154.0	H	289.0	-3.4

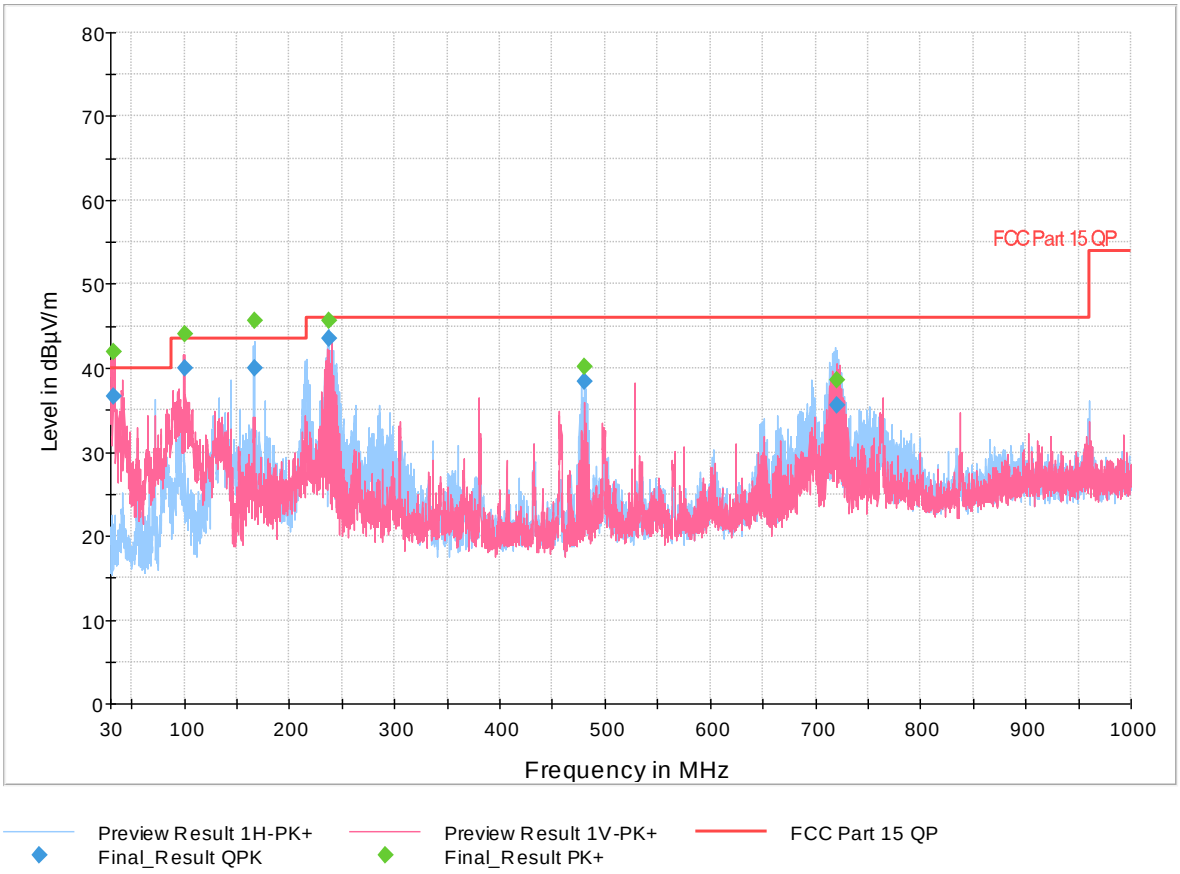


Figure 19: Radiated Spurious Emissions 30MHz – 1GHz, 802.11nHT20 at MCS0-5785MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4000.000000	---	36.76	54.00	17.24	1000.000	155.0	V	26.0	3.2
4000.000000	49.93	---	74.00	24.07	1000.000	155.0	V	26.0	3.2
13722.171000	---	40.66	54.00	13.34	1000.000	103.0	V	336.0	18.0
13722.171000	54.06	---	74.00	19.94	1000.000	103.0	V	336.0	18.0
14576.499029	---	40.14	54.00	13.87	1000.000	100.0	H	-1.0	18.5
14576.499029	53.52	---	74.00	20.48	1000.000	100.0	H	-1.0	18.5
17548.543000	---	44.19	54.00	9.81	1000.000	153.0	H	316.0	22.0
17548.543000	57.44	---	74.00	16.56	1000.000	153.0	H	316.0	22.0
17828.583971	---	45.58	54.00	8.42	1000.000	154.0	H	75.0	23.7
17828.583971	59.13	---	74.00	14.87	1000.000	154.0	H	75.0	23.7
17996.684971	---	44.52	54.00	9.48	1000.000	100.0	V	237.0	23.0
17996.684971	58.26	---	74.00	15.74	1000.000	100.0	V	237.0	23.0

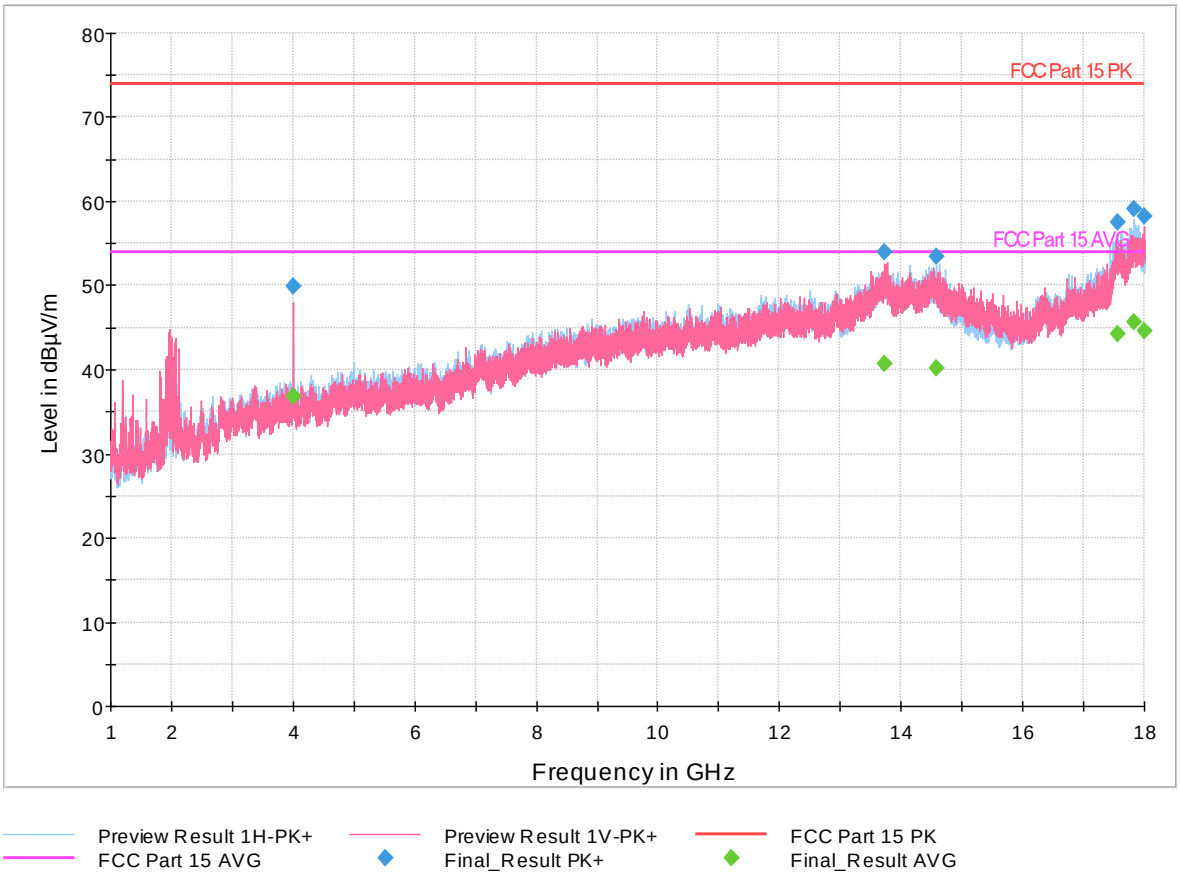


Figure 20: Radiated Spurious Emissions 1-18GHz, BLE-2440MHz, 1Mbps

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1968.000000	---	22.30	54.00	31.70	1000.000	152.0	V	15.0	-1.8
1968.000000	52.14	---	74.00	21.86	1000.000	152.0	V	15.0	-1.8
4000.090029	49.12	---	74.00	24.88	1000.000	100.0	V	-5.0	3.2
4000.090029	---	28.33	54.00	25.67	1000.000	100.0	V	-5.0	3.2
4873.829000	53.71	---	74.00	20.29	1000.000	100.0	H	288.0	4.8
4873.829000	---	39.21	54.00	14.79	1000.000	100.0	H	288.0	4.8
13767.499029	---	40.36	54.00	13.64	1000.000	150.0	V	244.0	17.9
13767.499029	53.62	---	74.00	20.38	1000.000	150.0	V	244.0	17.9
17588.499000	57.99	---	74.00	16.01	1000.000	156.0	H	132.0	22.3
17588.499000	---	44.78	54.00	9.22	1000.000	156.0	H	132.0	22.3
17841.000000	59.32	---	74.00	14.68	1000.000	150.0	H	69.0	23.8
17841.000000	---	45.55	54.00	8.45	1000.000	150.0	H	69.0	23.8

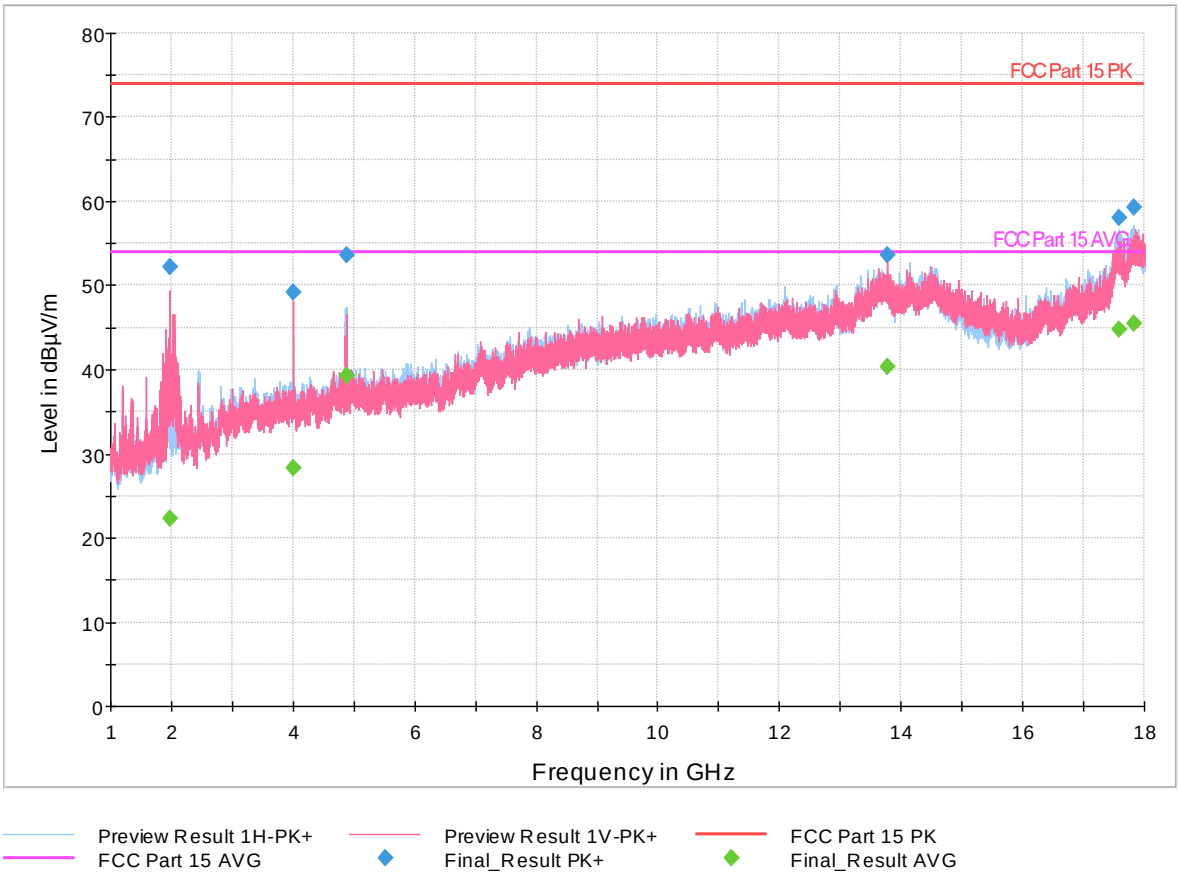


Figure 21: Radiated Spurious Emissions 1-18 GHz, 802.11g at 6Mbps -2437MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4853.000971	58.05	---	74.00	15.95	1000.000	105.0	H	34.0	4.8
4853.000971	---	26.26	54.00	27.74	1000.000	105.0	H	34.0	4.8
7280.247971	---	30.21	54.00	23.79	1000.000	100.0	H	225.0	8.8
7280.247971	43.71	---	74.00	30.29	1000.000	100.0	H	225.0	8.8
9788.499029	---	34.66	54.00	19.34	1000.000	155.0	V	278.0	12.2
9788.499029	48.47	---	74.00	25.53	1000.000	155.0	V	278.0	12.2
10390.533000	---	44.60	54.00	9.40	1000.000	100.0	H	-5.0	12.9
10390.533000	59.83	---	74.00	14.17	1000.000	100.0	H	-5.0	12.9
13723.000000	---	40.85	54.00	13.15	1000.000	100.0	V	155.0	18.0
13723.000000	54.24	---	74.00	19.76	1000.000	100.0	V	155.0	18.0
17892.498000	59.28	---	74.00	14.72	1000.000	250.0	H	10.0	23.5
17892.498000	---	45.51	54.00	8.49	1000.000	250.0	H	10.0	23.5

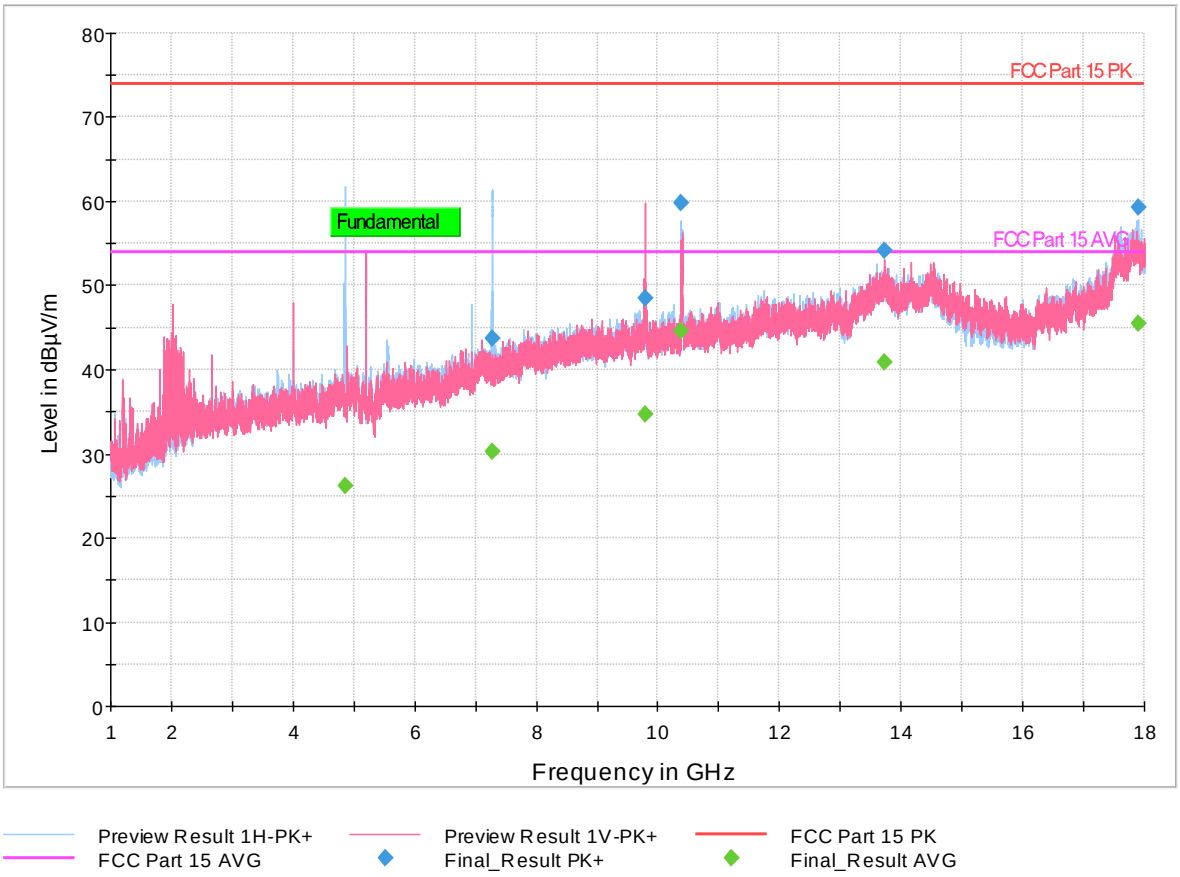


Figure 22: Radiated Spurious Emissions 1-18GHz, 802.11nHT20 at MCS0-5200MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
7066.616000	---	51.33	54.00	2.67	1000.000	155.0	H	17.0	9.3
7066.616000	55.98	---	74.00	18.02	1000.000	155.0	H	17.0	9.3
10600.440029	58.02	---	74.00	15.98	1000.000	105.0	H	81.0	13.1
10600.440029	---	43.12	54.00	10.88	1000.000	105.0	H	81.0	13.1
13755.500000	---	40.49	54.00	13.51	1000.000	235.0	H	25.0	18.1
13755.500000	55.00	---	74.00	19.00	1000.000	235.0	H	25.0	18.1
17842.000000	59.45	---	74.00	14.55	1000.000	100.0	H	344.0	23.8
17842.000000	---	45.35	54.00	8.65	1000.000	100.0	H	344.0	23.8

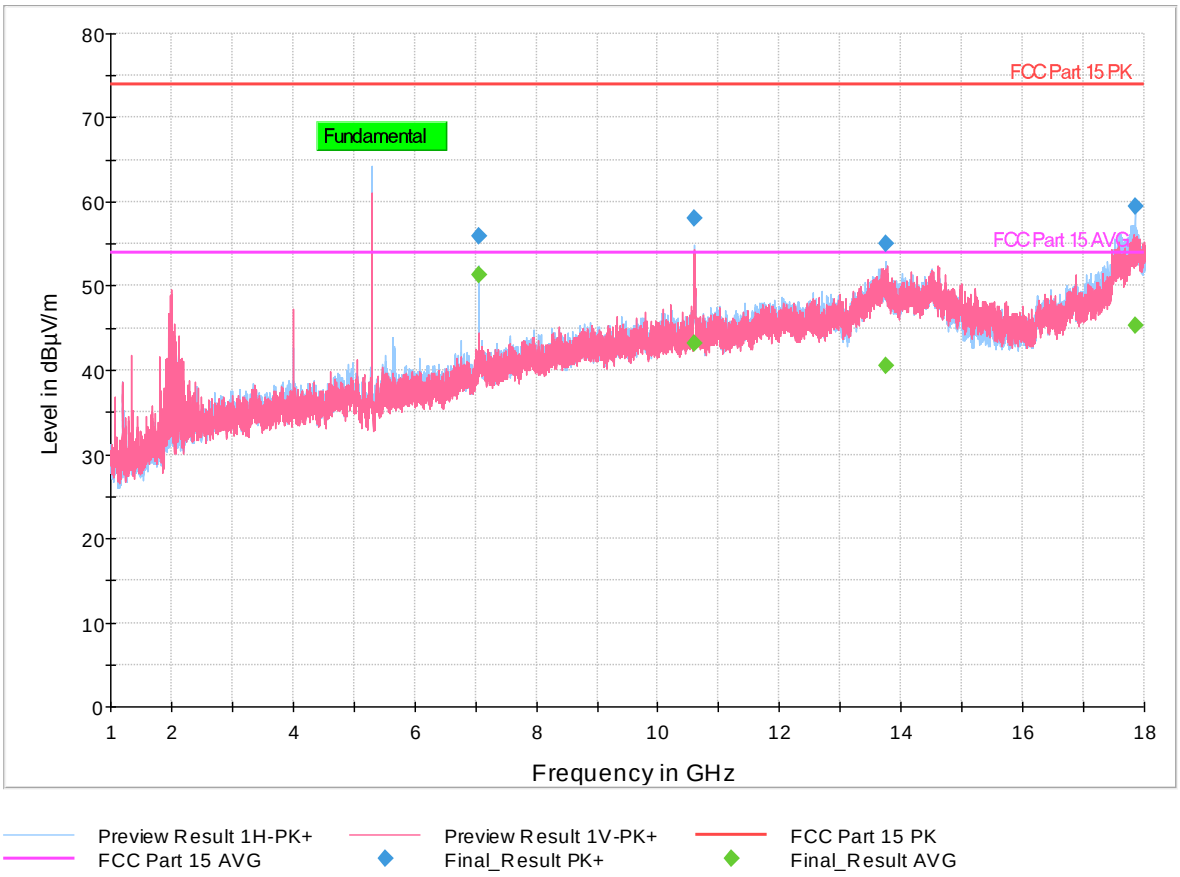


Figure 23: Radiated Spurious Emissions 1-18 GHz, 802.11nHT20 at MCS0-5300MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
8349.038971	46.93	---	74.00	27.07	1000.000	250.0	H	315.0	11.0
8349.038971	---	33.49	54.00	20.51	1000.000	250.0	H	315.0	11.0
11364.499029	---	39.29	54.00	14.71	1000.000	106.0	H	18.0	13.9
11364.499029	55.99	---	74.00	18.01	1000.000	106.0	H	18.0	13.9
13744.002971	53.49	---	74.00	20.51	1000.000	104.0	H	155.0	18.1
13744.002971	---	40.13	54.00	13.87	1000.000	104.0	H	155.0	18.1
17596.000000	---	44.65	54.00	9.35	1000.000	254.0	H	140.0	22.3
17596.000000	58.17	---	74.00	15.83	1000.000	254.0	H	140.0	22.3
17794.039000	---	45.24	54.00	8.76	1000.000	335.0	H	241.0	23.4
17794.039000	58.76	---	74.00	15.24	1000.000	335.0	H	241.0	23.4

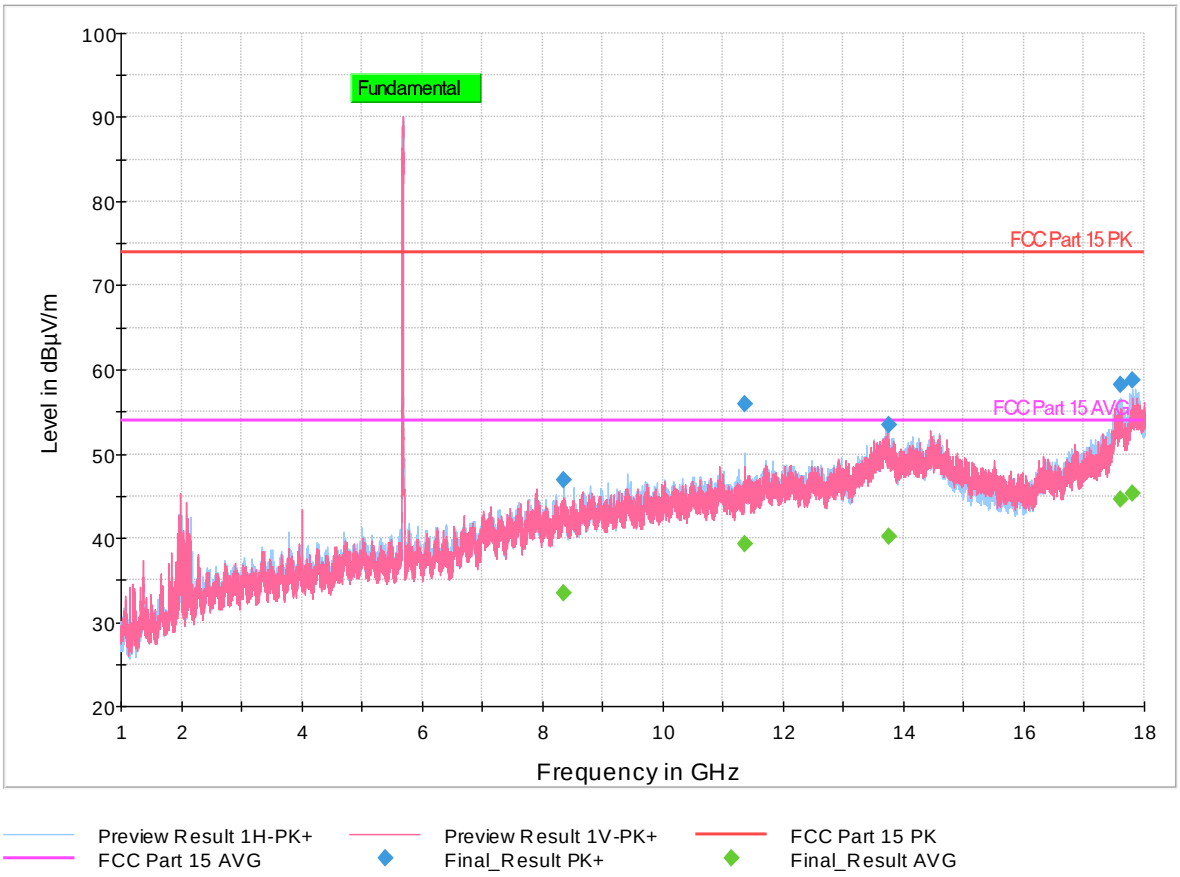


Figure 24: Radiated Spurious Emissions 1-18 GHz, 802.11nHT20 at MCS0-5680MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
5433.033000	54.23	---	74.00	19.77	1000.000	153.0	H	2.0	6.4
5433.033000	---	45.85	54.00	8.15	1000.000	153.0	H	2.0	6.4
11572.000971	---	40.93	54.00	13.07	1000.000	153.0	H	311.0	13.7
11572.000971	55.07	---	74.00	18.93	1000.000	153.0	H	311.0	13.7
13795.744029	53.64	---	74.00	20.36	1000.000	250.0	V	163.0	17.8
13795.744029	---	39.95	54.00	14.05	1000.000	250.0	V	163.0	17.8
14472.236971	---	40.23	54.00	13.77	1000.000	100.0	V	152.0	18.8
14472.236971	53.53	---	74.00	20.47	1000.000	100.0	V	152.0	18.8
17802.211971	---	45.55	54.00	8.45	1000.000	104.0	H	265.0	23.5
17802.211971	59.24	---	74.00	14.76	1000.000	104.0	H	265.0	23.5

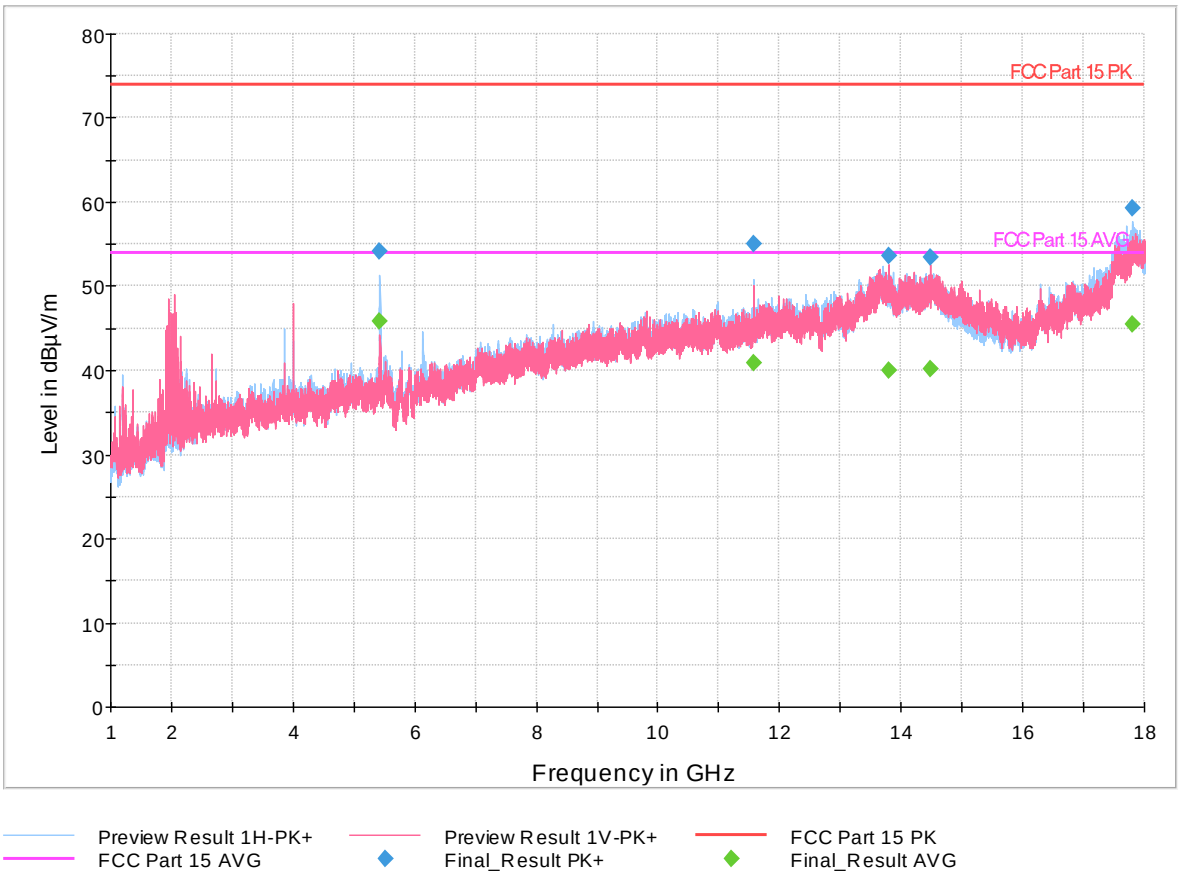


Figure 25: Radiated Spurious Emissions 1-18GHz, 802.11nHT20 at MCS0-5785MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
19997.911765	---	34.25	54.00	19.75	1000.000	105.0	V	141.0	-0.2
19997.911765	48.39	---	74.00	25.61	1000.000	105.0	V	141.0	-0.2
21978.146088	---	35.53	54.00	18.48	1000.000	153.0	V	116.0	0.8
21978.146088	49.46	---	74.00	24.54	1000.000	153.0	V	116.0	0.8
25650.794118	---	35.43	54.00	18.57	1000.000	150.0	V	344.0	4.5
25650.794118	49.40	---	74.00	24.60	1000.000	150.0	V	344.0	4.5

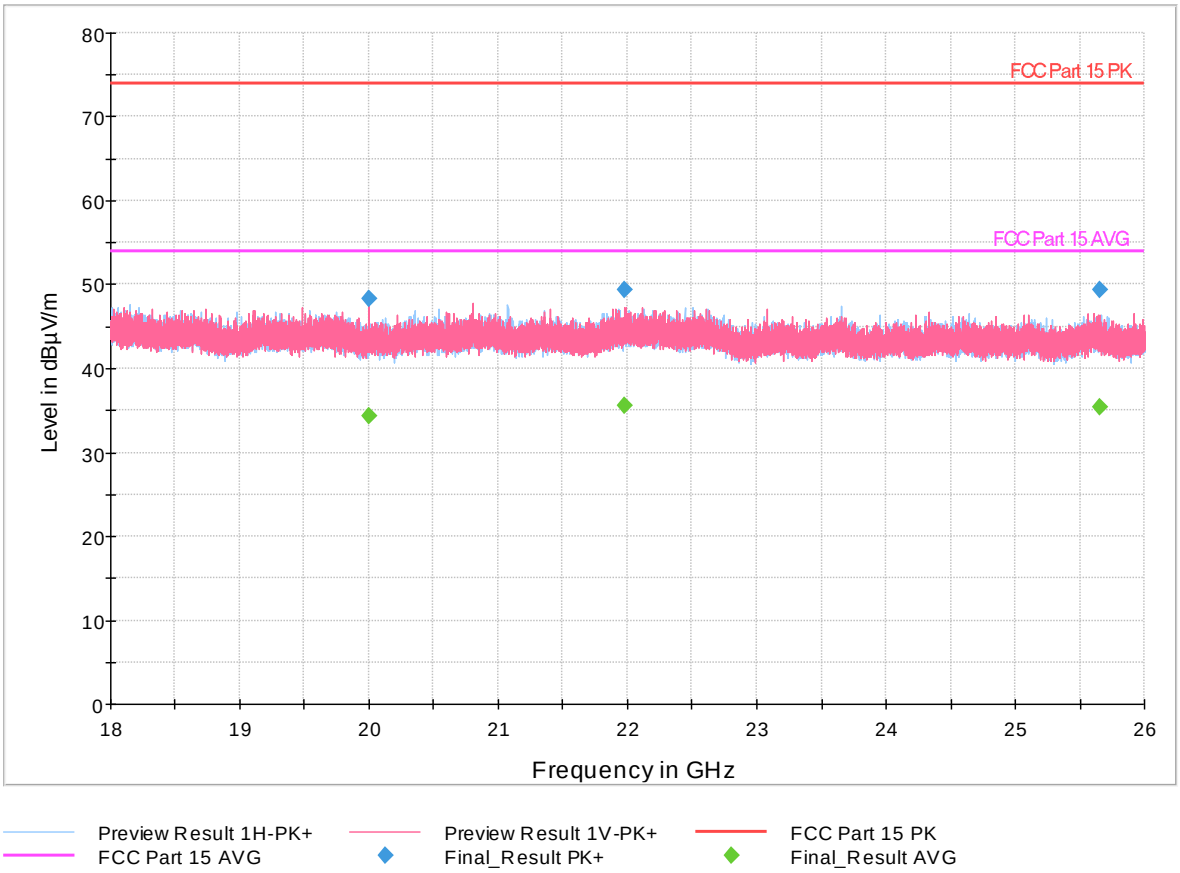


Figure 26: Radiated Spurious Emissions 18 -26 GHz, BLE-2440MHz, 1Mbps

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
18572.179265	---	34.72	54.00	19.28	1000.000	153.0	V	23.0	-2.4
18572.179265	48.28	---	74.00	25.72	1000.000	153.0	V	23.0	-2.4
19684.900442	47.87	---	74.00	26.13	1000.000	100.0	H	279.0	-0.8
19684.900442	---	34.63	54.00	19.37	1000.000	100.0	H	279.0	-0.8
25604.963882	49.00	---	74.00	25.00	1000.000	104.0	H	286.0	4.4
25604.963882	---	35.66	54.00	18.34	1000.000	104.0	H	286.0	4.4

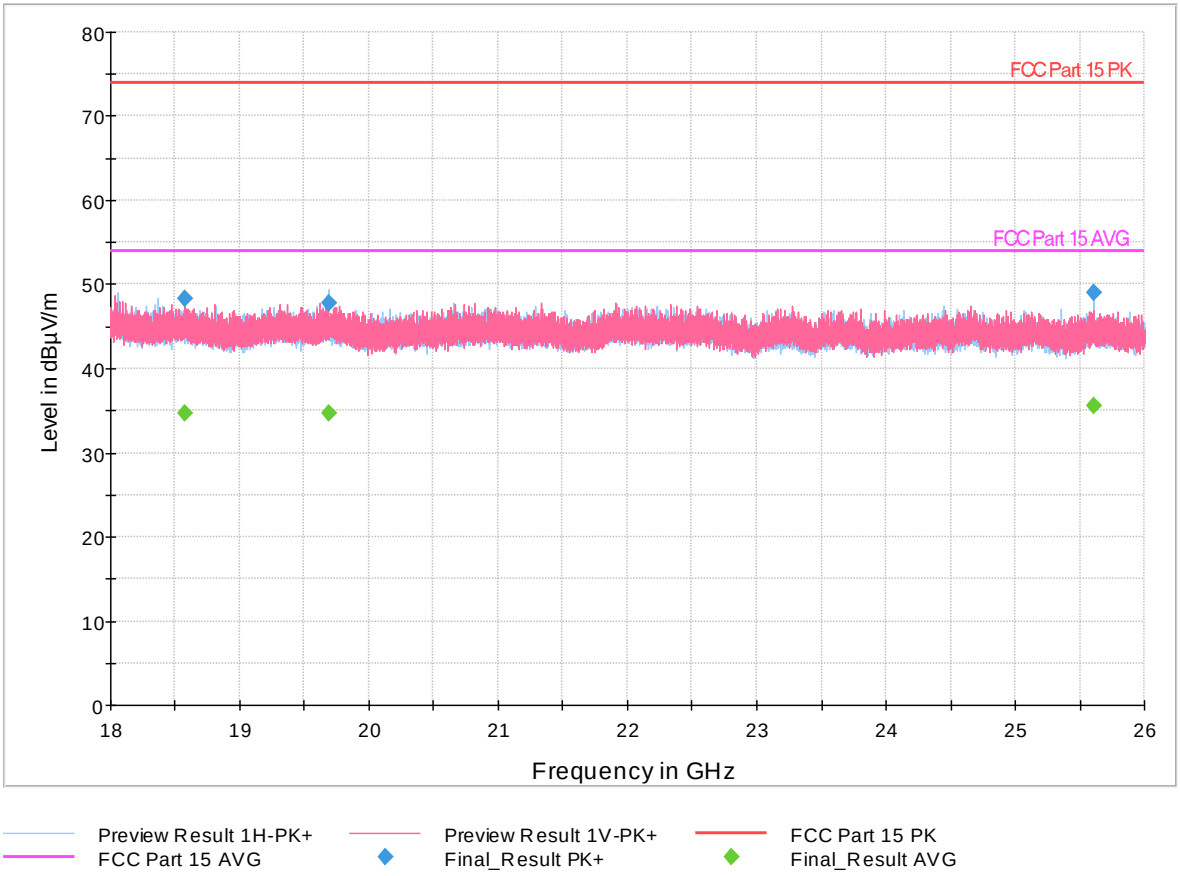


Figure 27: Radiated Spurious Emissions 18-26 GHz, 802.11g at 6Mbps -2437MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
20805.954088	---	35.25	54.00	18.75	1000.000	103.0	V	39.0	0.3
20805.954088	48.71	---	74.00	25.29	1000.000	103.0	V	39.0	0.3
29522.997588	---	36.09	54.00	17.91	1000.000	103.0	V	203.0	5.9
29522.997588	49.26	---	74.00	24.74	1000.000	103.0	V	203.0	5.9
35915.616676	---	39.01	54.00	14.99	1000.000	150.0	V	135.0	6.3
35915.616676	52.26	---	74.00	21.74	1000.000	150.0	V	135.0	6.3

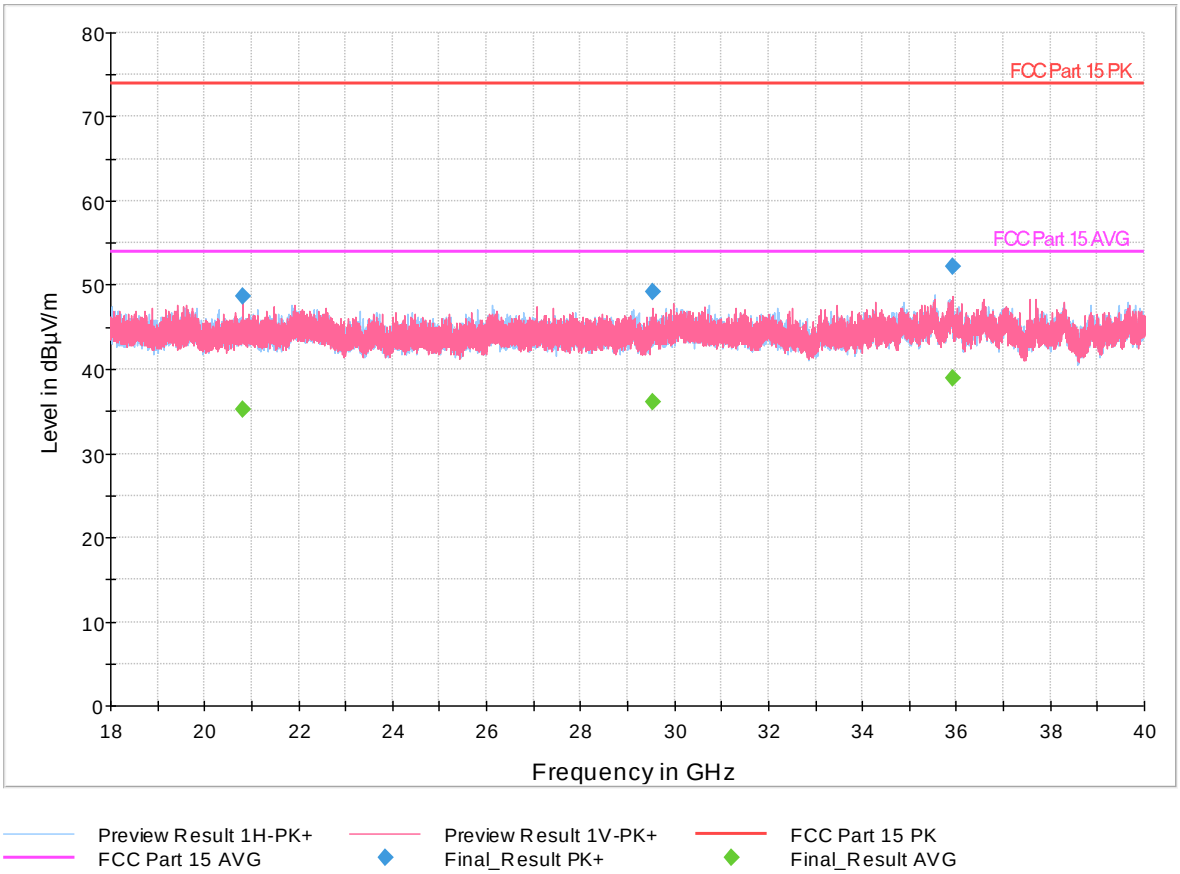


Figure 28: Radiated Spurious Emissions 18-40 GHz, 802.11nHT20 at MCS0-5200MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
21199.866882	---	40.99	54.00	13.01	1000.000	100.0	V	2.0	0.7
21199.866882	51.10	---	74.00	22.90	1000.000	100.0	V	2.0	0.7
29568.265677	---	36.13	54.00	17.87	1000.000	100.0	V	156.0	5.9
29568.265677	49.82	---	74.00	24.18	1000.000	100.0	V	156.0	5.9
38274.442147	---	37.73	54.00	16.27	1000.000	150.0	V	173.0	6.6
38274.442147	51.45	---	74.00	22.55	1000.000	150.0	V	173.0	6.6

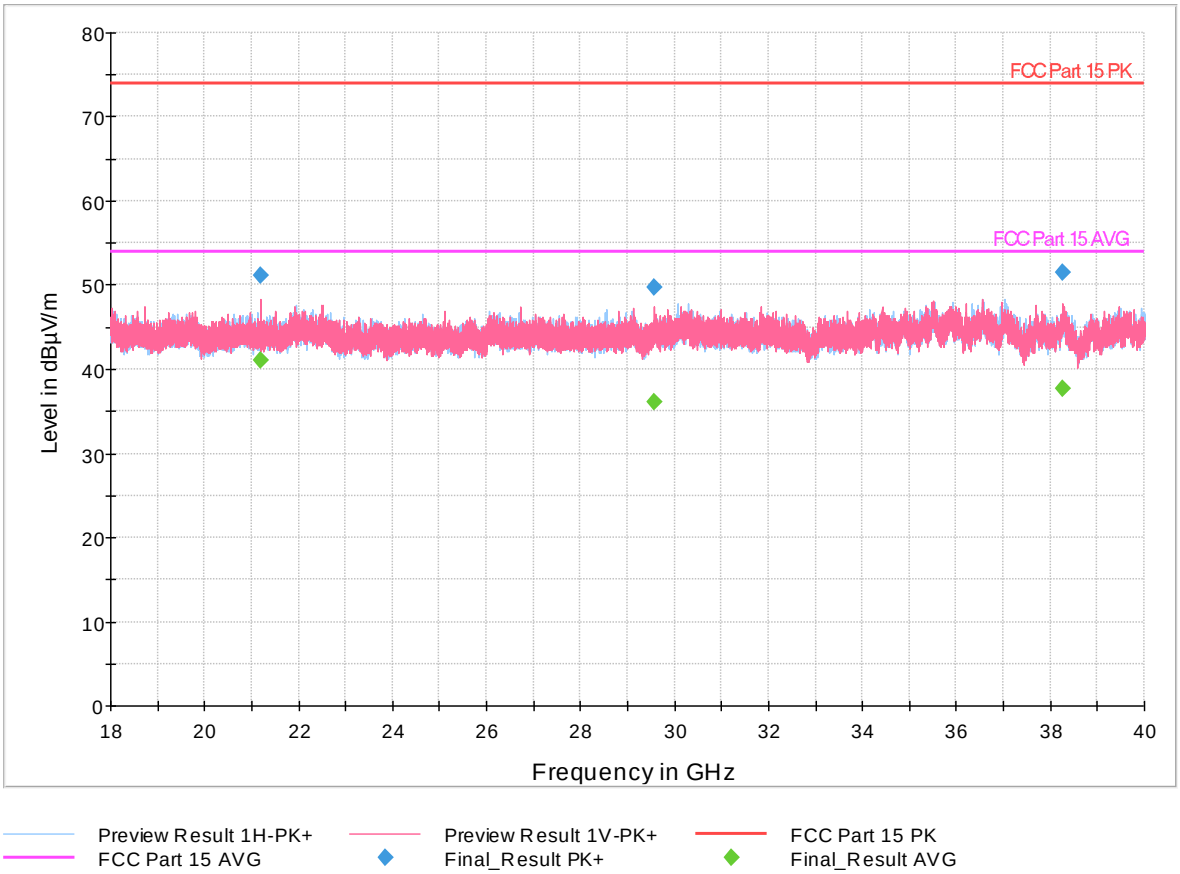


Figure 29: Radiated Spurious Emissions 18-40 GHz, 802.11nHT20 at MCS0-5300MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
22008.676471	49.05	---	74.00	24.95	1000.000	153.0	V	232.0	0.8
22008.676471	---	35.45	54.00	18.55	1000.000	153.0	V	232.0	0.8
30233.794118	---	36.18	54.00	17.82	1000.000	100.0	V	-2.0	6.5
30233.794118	50.16	---	74.00	23.84	1000.000	100.0	V	-2.0	6.5
36571.845353	51.99	---	74.00	22.01	1000.000	154.0	H	228.0	5.6
36571.845353	---	38.52	54.00	15.48	1000.000	154.0	H	228.0	5.6

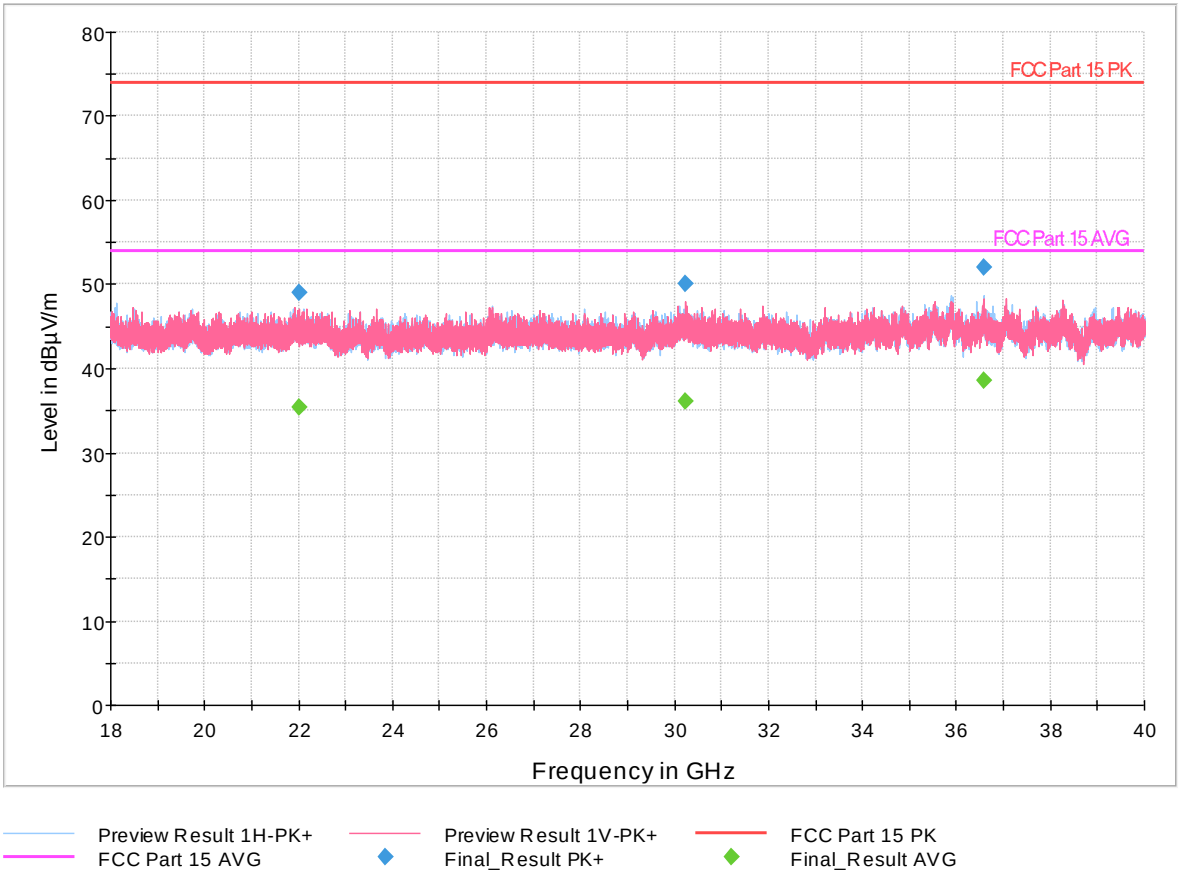


Figure 30: Radiated Spurious Emissions 18-40 GHz, 802.11nHT20 at MCS0-5680MHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
21895.794118	49.69	---	74.00	24.31	1000.000	150.0	V	310.0	0.9
21895.794118	---	35.47	54.00	18.53	1000.000	150.0	V	310.0	0.9
30131.914941	---	36.30	54.00	17.70	1000.000	150.0	V	34.0	6.5
30131.914941	50.55	---	74.00	23.45	1000.000	150.0	V	34.0	6.5
36528.685442	51.16	---	74.00	22.84	1000.000	104.0	H	316.0	5.2
36528.685442	---	38.00	54.00	16.00	1000.000	104.0	H	316.0	5.2

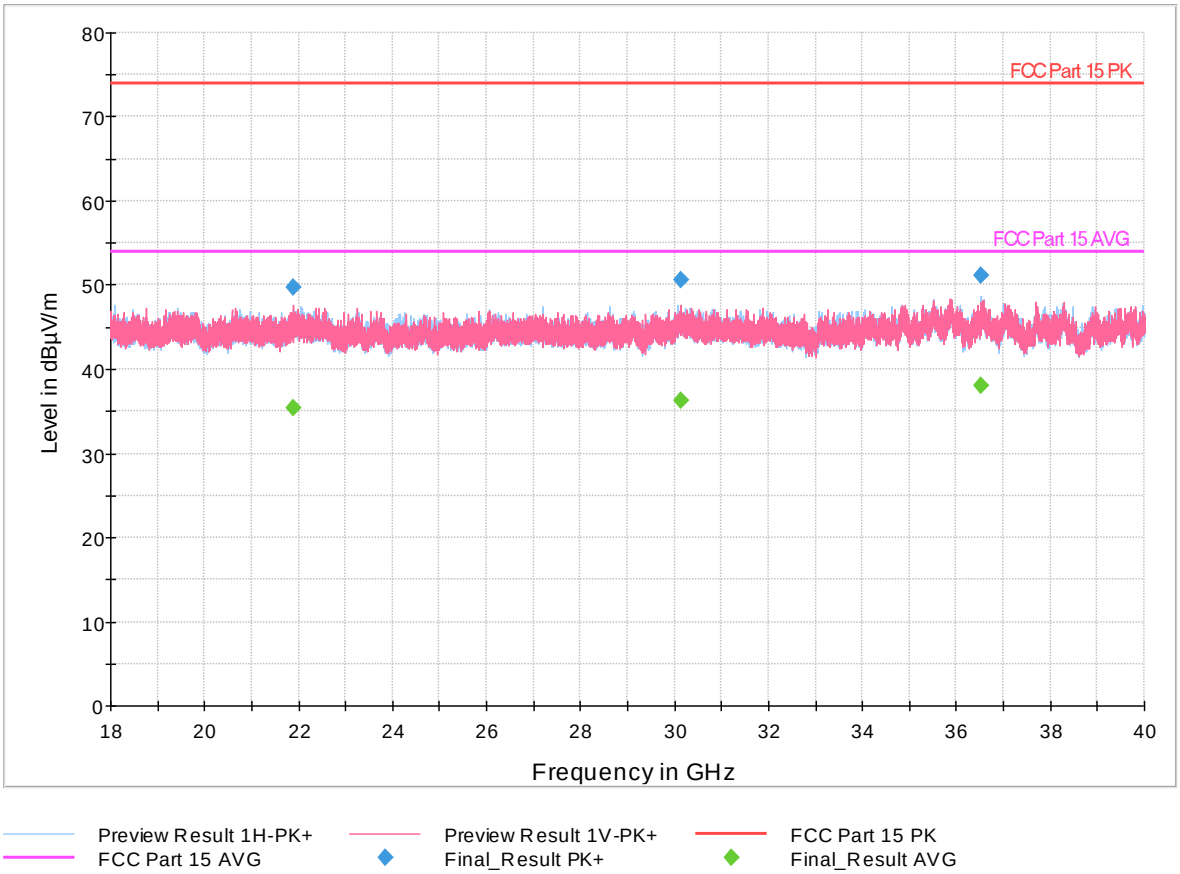


Figure 31: Radiated Spurious Emissions 18-40 GHz, 802.11nHT20 at MCS0-5785MHz

5 Test Equipment Use List

5.1 Equipment List

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal mm/dd/yyyy	Next Cal mm/dd/yyyy
Analyzer/EMI Receiver	Rohde & Schwarz	ESW44	101663	02/28/2021	02/28/2022
Bilog Antenna	Rohde & Schwarz	VULB 9162	A102606	02/27/2020	02/27/2022
Preamplifier, 30MHz – 8 GHz	Rohde & Schwarz	TS-PR8	102353	02/26/2021	02/26/2022
Horn Antenna	EMCO	3115	9602-4226	07/29/2021	07/29/2023
Preamp 1-18GHz	Rohde & Schwarz	TS-PR18	101649	10/19/2021	10/19/2022
Preamplifier, 18 – 40GHz	Rohde & Schwarz	TS-PR1840	100067	02/27/2020	02/27/2022
Horn Antenna, 18-40GHz	Narda	180-442-KF	132596-01	04/17/2020	04/17/2022
Spectrum Analyzer	Rohde & Schwarz	FSU26.5	200050	02/24/2021	02/24/2022
Note: Equipment is characterized before use					

6 EMC Test Plan

6.1 Introduction

This section provides a description of the Equipment Under Test (EUT), configurations, operating conditions, and performance acceptance criteria. It is an overview of information provided by the manufacturer (information supplied by the customer and can affect the validity of results) so that the test laboratory may perform the requested testing.

6.2 Customer

The information in the following tables is required, as it should appear in the final test report.

Table 5 – Customer Information

Company Name	Thales Avionics Inc
Address	51 Discovery
City, State, Zip	Irvine, CA 92618
Country	U.S.A.

Table 6 – Contact Information

Name	Terrance Xuan
E-mail	Terrance.xuan@us.thalesgroup.com
Phone	949-790-2633

6.3 Equipment Under Test (EUT)

The information provided in the following table should be listed as it should appear in the final report. For those products that have only a model name, list the model number as *non-applicable* and vice-versa.

Table 7 – EUT Designation

Product Name	Wireless Mode Controller - Lite (WMC-L)
Model No.	10.1” WMC: 186521-20x 13.3” WMC: 187554-10x
Product Description	The Wireless Mode Controller (WMC) product line includes the tablet devices and docking stations. The First-class (13.3” WMC) and business-class passengers (10.1” WMC) will use the tablet as the second screen device to: 1. Augment the primary screen 2. Deliver audio/video on Demand (AVDO) application and services 3. Application platform for Thales and third-party applications 4. Communication between the FC or BC passenger and flight screw 5. Control of on-wing subsystem. Model 13.3” WMC used for testing.

6.3.1 Product Specifications

The information provided in the following table should be listed as it should appear in the final report.

Table 8 – EUT Specifications*

EUT Specification	
DC Power Input	+28VDC/4.5A
Environment	Indoor
Operating Temperature Range:	-15 to +55 degrees C
Multiple Feeds:	☒ Yes and how many 2 ☐ No
Product Marketing Name (PMN)	Wireless Mode Controller - Lite (WMC-L)
Hardware Version Identification Number (HVIN)	186521-20x Rev A 187554-10x Rev A
Firmware Version Identification Number (FVIN)	ED258625-01
Operating Mode	Bluetooth : 2402 MHz ~ 2480 MHz, 2.4 – 2.4835 GHz, 5.15– 5.25 GHz, 5.25– 5.35 GHz, 5.47– 5.72 GHz, and 5.725– 5.85 GHz
Power Setting @ Operating Channel	BLE: Default 2.4GHz 802.11g : 18dBm 5GHz 802.11nHT20: 12.5dBm
Antenna Type	Flexible Monopole Antenna
Peak Antenna Gain (dBi)	2.4GHz : 3.6dBi and 5GHz : 1.3dBi
Modulation Type	☐ AM ☐ FM ☒ DSSS ☒ OFDM ☒ Other describe: GFSK
TX/RX Chain (s)	MIMO (2X2)
Directional Gain Type	☒ MIMO ☐ No Beam-Forming ☐ Other describe:
Type of Equipment	☐ Table Top ☐ Wall-mount ☐ Floor standing cabinet ☒ Other: Tablet
Note: *All EUT specifications are provided by the manufacturer or the TUV direct customer. Information supplied by the customer and can affect the validity of results.	

Table 9: Antenna Information

Number	Antenna Type	Description	Max Gain (dBi)
2	Flexible Monopole Antenna	Integrated FPCB	2.4GHz- 3.6dBi 5GHz- 1.3dBi

Table 10: Interface Specifications

Interface Type	Cabled with what type of cable?	Is the cable shielded?	Maximum potential length of the cable?	Metallic (M), Coax (C), Fiber (F), or Not Applicable?
USB Cable	Micro USB	☐ Yes	☒ Metric: <3.0m	☒ N/A
Note: Cable required for EUT configuration for regulatory test mode. 3pin to USB cable not utilized within final product. EUT powered by battery during test.				

Table 11: Accessory Equipment

Equipment	Manufacturer	Model	Serial	Comment
Micro USB	N/A (generic)	N/A (generic)	N/A	Used between test cases to configure EUT operational test mode.
Ethernet cable RJ45 CAT5/6	N/A (generic)	N/A (generic)	N/A (generic)	Used between test cases to configure EUT operational test mode.
Note: None.				

Table 12: Ancillary Equipment (used for test purposes only)

Equipment	Manufacturer	Model	Serial	Used for
Laptop	Dell	LatitudenE5520	N/A	Setup EUT operating channels via micro USB and RJ45 connection to EUT
Note: None.				

6.3.2 Configuration(s)

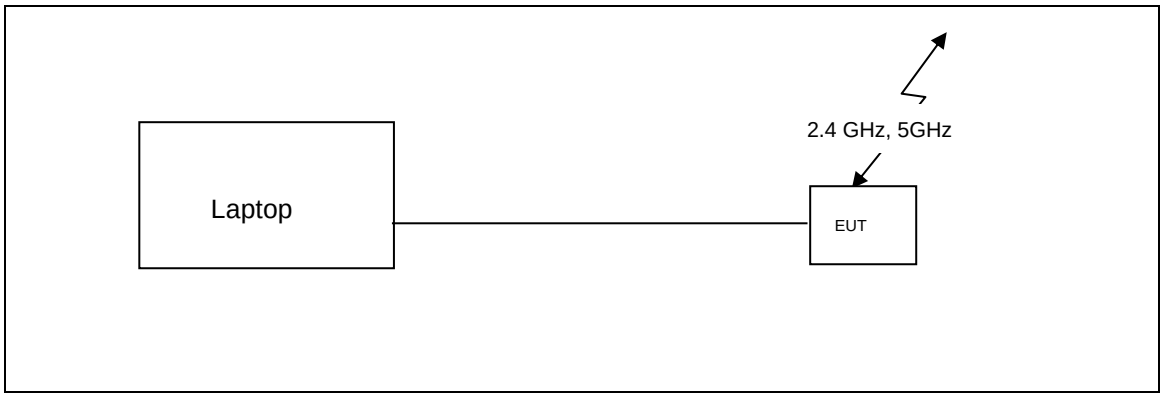


Figure 32: Block Diagram of EUT Setup - Radiated

Note: 1. The EUT was connected to the USB and RJ45 Port of the supporting laptop for configuration and control.
2. SMA cable was in place of the antenna for conducted measurement test purposes only.

Table 13: Description of Sample used for Testing

Device	Serial no.	Configuration	Used For
13.3” WMC	A2018460	Radiated Sample	Radiated Emissions, Radiated Band Edge
	A2018443	Conducted Sample	Transmit Power

Table 14: Description of Test Configuration used for Radiated Measurement.

Device	Antenna	Mode	Setup Description
13.3” WMC	Flexible Monopole Antenna	Transmit	X-Axis
Note: EUT was tested on its X-Axis as this was worse case			

--- Ende des Prüfberichts / *End of Test Report* ---