



FCC LISTED, REGISTRATION
NUMBER: 2764.01

ISED LISTED REGISTRATION
NUMBER: 23595-1

Test Report No:

3817ERM.006A1

Test Report

USA FCC Part 15.247, 15.209, 15.207; & CANADA RSS-247, RSS-Gen

Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz

Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE-LAN) Devices.

(*) Identification of item tested	Automotive infotainment System
(*) Trademark	BMW
(*) Model and /or type reference	MGU21A
Other identification of the product	FCC ID: T8GMGU21A IC: 6434A-MGU21A
(*) Features	USB 2.0 (including support for Apple Devices), Bluetooth, WLAN Modul 2.4 / 5 GHz, GNSS, AR-CAM input, Video-out APIX3, CAN, 100Base-T1 and 1000Base-T1. HW Version: 2.1 SW Version: 22w36.5-1
Manufacturer	HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH. Becker-Goering-Str. 16; 76307 Karlsbad, Germany
Test method requested, standard	USA FCC Part 15.247 (10-1-21 Edition): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (10-1-21 Edition): Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 amendment 1 (March 2019). Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid Systems Devices Operating Under Section 15.247 of the FCC Rules. 558074 D01 Meas Guidance v05r02 dated April 2, 2019. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Domingo Galvez EMC&RF Lab Manager
Date of issue	01-24-2023
Report template No	FDT08_23 (*) "Data provided by the client"

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Acronyms

Acronym ID	Acronym Description
# of Tx Chains	Number of Transmission Chains
26Ebw	Emission Bandwidth
Avg COT	Average Channel Occupancy Time
BW	Bandwidth
Equipment	Equipment Type
Freq	Frequency
Freq Sep	Frequency Separation
Inband Peak Lvl	Inband Peak Level
Lvl	Level
MP	Measurement Point
Mod	Modulation
NHC	Number of Hopping Channels
NHp	Number of hops over the period
Occ Ch BW	Occupied Channel Bandwidth
Peak Power	Maximum Peak Conducted Output Power
Port	Active Port

Competences and guarantees

DEKRA Certification Inc. is a testing laboratory accredited by A2LA (The American Association for Laboratory Accreditation), to perform the tests indicated in the Certificate 2764.01

DEKRA Certification Inc. is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, DEKRA Certification Inc. has a calibration and maintenance program for its measurement equipment.

DEKRA Certification Inc. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Certification at the time of performance of the test.

DEKRA Certification Inc. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

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General conditions

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3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Certification Inc.
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Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Certification internal document PODT000.

Test case	Frequency (MHz)	U ($k=2$)	Units
RF Power and PSD	5150-5850	0.88	dB
Occupied Bandwidth		1.87	%
Dwell Time		0.01	%
Band Edge		0.64	dB
Radiated Spurious Emission	30-180	4.27	dB
	180-1000	3.14	dB
	1000-18000	3.30	dB
	18000-40000	3.49	dB

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample consists of an Automotive infotainment System to be installed in cars.
3. The main functionalities: Navigation, USB, voice recognition, and several interfaces to the vehicle and Bluetooth / WLAN.
4. The Head-unit provides different interfaces like: AR-CAM input, Video-out APIX3 (for the connection of an external Display), 3 USB interfaces (including support for Apple devices), CAN, 100BaseT1, and 1000Base-T1.

DEKRA declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: The client.

Sample S/01 is composed of the following elements, accessories and auxiliary equipment:

Id	Control Number	Description	Manufacturer/ Model	Serial N°	Date of Reception	Application
S/01	3817/02	Infotainment Head Unit	Harman / MGU21A	B38229N181000014	10/07/2022	Element Under Test
S/01	3817/17	BR-Adapter	-	-	10/07/2022	Accessory
S/01	3817/22	HSD (male) to OABR cable	-	-	10/07/2022	Accessory
S/01	3817/23	Quad mate AXZ - High speed Fakra to SMA (male)	-	-	10/07/2022	Accessory
S/01	3817/24	Plug cable for BR-Adapter	-	-	10/07/2022	Accessory
S/01	3817/25	Harness	-	-	10/07/2022	Accessory
S/01	3669/44	Ethernet to USB Adapter	TP-Link / UE300	220B191005905	04/07/2022	Accessory
S/01	3810/17	Ethernet Cable RJ45 to RJ45	-	-	04/07/2022	Accessory
S/01	1482	Dekra Laptop	Lenovo / V14 G2 ITL	PF3QAFFH	-	Auxiliary

1. Sample S/01 was used for the test(s): All Conducted test(S) indicated in appendix A, B, and C.

Sample S/02 is composed of the following elements, accessories and auxiliary equipment:

Id	Control Number	Description	Manufacturer/ Model	Serial N°	Date of Reception	Application
S/02	3817/03	Infotainment Head Unit	Harman / MGU21A	B38229N181000014	10/07/2022	Element Under Test
S/02	3817/05	Harness	-	-	10/07/2022	Accessory
S/02	3817/06	Quad mate AXZ - High speed Fakra to SMA (male)	-	-	10/07/2022	Accessory
S/02	3817/07	Plug cable for BR-Adapter	-	-	10/07/2022	Accessory
S/02	3817/08	HSD (male) to OABR cable	-	-	10/07/2022	Accessory
S/02	3817/09	BT/WLAN Antenna with SMA (male) connector			10/07/2022	Element Under Test
S/02	3817/10	BT/WLAN Antenna with SMA (male) connector			10/07/2022	Element Under Test
S/02	3817/12	BR-Adapter	-	-	10/07/2022	Accessory
S/02	3669/44	Ethernet to USB Adapter	TP-Link / UE300	220B191005905	04/07/2022	Accessory
S/02	3810/17	Ethernet Cable RJ45 to RJ45	-	-	04/07/2022	Accessory
S/02	1484	Dekra Laptop	Lenovo / V14 G2 ITL	PF3Q2NKL	-	Auxiliary

Sample S/02 was used for the test(s): All Radiated test(S) indicated in appendix A, B, and C.

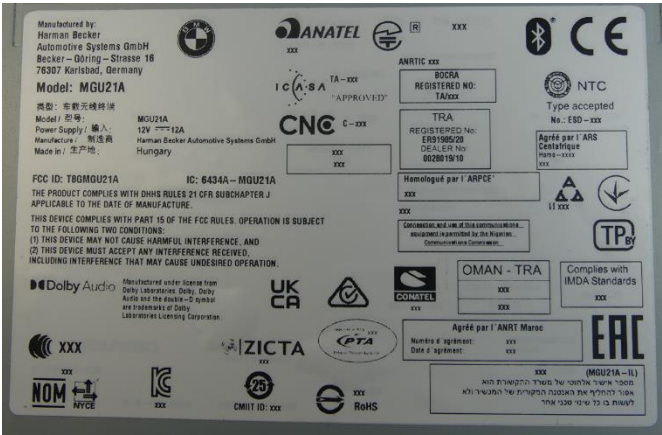
Test sample description

Test Sample description (compulsory information for EMC and RF testing services).

Ports.....:	Port name and description		Cable				
			Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾	
	BT/WIFI connector – 2X 1 POL ROS 59S2BT40MA5-1			[X]	[]	[]	
	USB1 connector – CONM-SM 4POL ROS D4S20Y-40MA5-B			[X]	[]	[]	
	USB2 connector – CONM-SM 4POL ROS D4S20Y-40MA5-C			[X]	[X]	[]	
	USB3 connector – CONM-SM 4POL ROS D4S20Y-40MA5-E			[X]	[X]	[]	
	APIX3 connector – CONM-SM 4+2POL ROS 99S22A-40MA5-D			[X]	[]	[]	
	Car Main-connector – ONM 16POL TYC 2300483-s			[X]	[X]	[]	
	AR-CAM connector – CONM 1POL ROS 59S2FT-40MA5-K			[X]	[X]	[]	
	Ethernet BroadR- Reach, 100 BASE-T1			[X]	[X]	[]	
	Ethernet, 1000 BASE- T1			[X]	[X]	[]	
GNSS connector 1 POL ROS 59S2BT40MA5-C			[X]	[X]	[]		
Supplementary information to the ports..... :	No Data Provided						
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	[]	AC:	[]	[]	[]	[]	[]
	[]	AC:	[]	[]	[]	[]	[]
	[X]	DC: 13.2 V					
Rated Power	No Data Provided						
Clock frequencies..... :	No Data Provided						
Other parameters	No Data Provided						
Software version	22w36.5-1						
Hardware version	2.1						
Dimensions in cm (W x H x D)	No Data Provided						

Mounting position	[]	Table top equipment	
	[]	Wall/Ceiling mounted equipment	
	[]	Floor standing equipment	
	[]	Hand-held equipment	
	[X]	Other: Automotive Infotainment Head Unit	
Modules/parts.....	Module/parts of test item	Type	Manufacturer
	N/A		
			
Accessories (not part of the test item).....	Description	Type	Manufacturer
	HARMANeco (with Display or headless)		HBAS
	Cable harness		HBAS
	Display		L.G.
	BT/WLAN-Antenna		HIRSCHMANN
Documents as provided by the applicant.....	Description	File name	Issue date
	Declaration Equipment Data	FDT30_18 Declaration Equipment Data - MGU21A 2022.10.12	10/13/2022

Copy of marking plate:



Identification of the client

HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH.
Becker-Goering-Str. 16; 76307 Karlsbad,
Germany

Testing period and place

Test Location	DEKRA Certification Inc.
Date (start)	11-19-2022
Date (finish)	11-30-2022

Document history

Report number	Date	Description
3817ERM.006	12-14-2022	First release.
3817ERM.006A1	01-24-2023	Second release. Pag. 43, Typographical error, modified the modulation, and add a new statement (test performed in WC); Pag. 47, 104, 109, 158, & 162, new statement was added (test performed in WC). Pag. 46, 104, 150, 158, & 162 Typographical error, modified the test case name. This modification of test report cancels and replaces the test report 3817ERM.006.

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: Lakshmi Gollamudi, Juliana Cherry, Yuri Barone, Koji Nishimoto, and Victor Albrecht.

Testing verdicts

Fail	F
Inconclusive	I
Not applicable	N/A
Not measured	N/M
Pass	P

Summary

Bluetooth Low Energy 5.1 (1M, 2M)

Requirement – Test case	FCC PART 15 PARAGRAPH / RSS-247	Verdict	Remark
RSS-247 5.2 (a) / FCC 15.247 (a) (2) 6 dB Bandwidth		Pass	N/A
FCC 2.1049 / 99dBW Occupied Channel Bandwidth 99%		Pass	N/A
RSS-247 5.2 (b) / FCC 15.247 (e) Power spectral density		Pass	N/A
RSS-247 5.4 (d) / FCC 15.247 (b) (3) Maximum Peak Conducted output power		Pass	N/A
RSS-247 5.5 / FCC 15.247 (d) Band-edge emissions compliance (Transmitter)		Pass	N/A
RSS-247 5.5 / FCC 15.247 (d) Emissions compliance (Transmitter) - Conducted		Pass	N/A
RSS-247 5.5 / FCC 15.247 (d) Emissions compliance (Transmitter) - Radiated		Pass	N/A
<u>Supplementary information and remarks:</u> None			

Bluetooth EDR (GFSK, $\pi/4$ DQPSK, 8DPSK)

FCC PART 15 PARAGRAPH / RSS-247			
Requirement	Test case	Verdict	Remark
RSS-247 5.1 (b) / FCC 15.247 (a) (1)	20 dB Bandwidth	Pass	N/A
FCC 2.1049 / 99dBW	Occupied Channel Bandwidth 99%	Pass	N/A
RSS-247 5.1 (b) / FCC 15.247 (a) (1)	Carrier Frequency Separation	Pass	N/A
RSS-247 5.1 (d) / FCC 15.247 (a) (1) (iii)	Time of Occupancy (Dwell Time)	Pass	N/A
RSS-247 5.1 (d) / FCC 15.247 (a) (1) (iii)	Number of hopping channels	Pass	N/A
RSS-247 5.4 (b) / FCC 15.247 (b) (1)	Maximum Peak Conducted output power & Antenna gain	Pass	N/A
RSS-247 5.5 / FCC 15.247 (d)	Band-edge emissions compliance (Transmitter) – Conducted	Pass	N/A
RSS-247 5.5 / FCC 15.247 (d)	Emissions compliance (Transmitter) - Conducted	Pass	N/A
RSS-247 5.5 / FCC 15.247 (d)	Emissions compliance (Transmitter) - Radiated	Pass	N/A
<u>Supplementary information and remarks:</u> None			

Wi-Fi 2.4GHz (802.11b/g/n)

FCC PART 15 PARAGRAPH / RSS-247			
Requirement	Test case	Verdict	Remark
RSS-247 5.2 (a) / FCC 15.247 (a) (2)	6 dB Bandwidth	Pass	N/A
FCC 2.1049 / 99dBw	Occupied Channel Bandwidth 99%	Pass	N/A
RSS-247 5.2 (b) / FCC 15.247 (e)	Power spectral density	Pass	N/A
RSS-247 5.4 (d) / FCC 15.247 (b) (1)	Maximum Average Conducted Output Power	Pass	N/A
RSS-247 5.5 / FCC 15.247 (d)	Band-edge emissions compliance (Transmitter) - Conducted	Pass	N/A
RSS-247 5.5 / FCC 15.247 (d)	Emissions compliance (Transmitter) - Conducted	Pass	N/A
RSS-247 5.5 / FCC 15.247 (d)	Emissions compliance (Transmitter) - Radiated	Pass	N/A
<u>Supplementary information and remarks:</u>			
None			

List of equipment used during the test

Conducted Measurements

CONTROL NUMBER	DESCRIPTION	Serial No	LAST CALIBRATION	NEXT CALIBRATION
897	AMETEK PROG DC Power supply	1707A01906	N/A	N/A
1014	FSV40 Signal Analyzer 40GHz	101626	2021-05-19	2023-05-19
1107	Ethernet SNMP Thermometer-RF1 Room	60038026952	2022-10-18	2024-10-18
1313	Wireless Measurement Software R&S EMC32	-	N/A	N/A

Radiated Measurements

CONTROL NUMBER	DESCRIPTION	Serial No	LAST CALIBRATION	NEXT CALIBRATION
878	AMETEK PROG DC Power supply	1707A01783	N/A	N/A
1012	ESR26 EMI Test Receiver	101478	2022-04-12	2024-04-12
1014	FSV40 Signal Analyzer 40GHz	101626	2021-05-19	2023-05-19
1056	3116C Double-Ridged Waveguide Horn Antenna 19-40 GHz	213179	2020-01-10	2023-01-10
1057	3115 Double-Ridged Waveguide Horn Antenna 1-18 GHz	211373	2020-06-03	2023-06-03
1065	3142E Biconilog Antenna	208587	2020-08-13	2023-08-13
1108	Ethernet SNMP Thermometer-CR Room	60038026954	2022-10-18	2024-10-18
1111	Ethernet SNMP Thermometer-SAC	60038026577	2022-10-18	2024-10-18
1179	Semi anechoic Absorber Lined Chamber	F169021	N/A	N/A
1314	Wireless Measurement Software R&S EMC32	-	N/A	N/A
1461	Low Noise Preamplifier	2213857B	2022-06-01	2024-06-01

Appendix A: Test results. Bluetooth Low Energy 5.0 (1M, 2M)

Appendix A

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 RSS-247 5.5 / FCC 15.247 (d) Emissions compliance (Transmitter) - Radiated46

PRODUCT INFORMATION

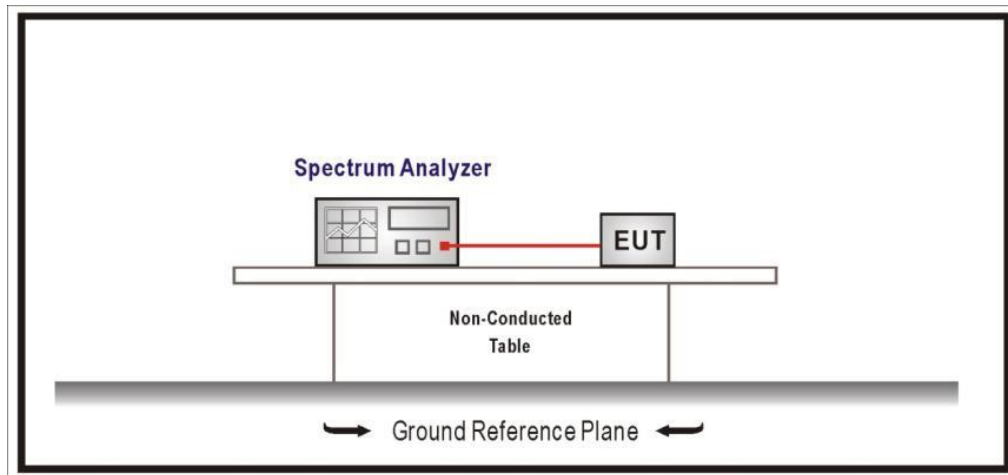
Information	Description
Modulation	GFSK
Operation mode 1: Single Antenna Equipment	
Operating Frequency Range	2402 – 2480 MHz
Nominal Channel Bandwidth	1 MHz, 2 MHz
RF Output Power	10 dBm
Antenna type	External Antenna
Antenna gain	-2.5 dBi
Nominal Voltage	
Supply Voltage	13.2 Vdc
Type of power source	DC voltage
Equipment type	Bluetooth Low Energy

TEST CONDITIONS

(*): Data provided by the client.

TEST CONDITIONS	DESCRIPTION
TC/01 (1 Mbps)	<u>Power supply (V):</u> V_{nominal}: 13.2 Vdc <u>Temperature:</u> T_{nominal}: +15 to +35 °C Data Rate: 1 Mbps Bandwidth: 1 MHz <u>Test Frequencies for Conducted/ Radiated tests:</u> Lowest channel: 2402 MHz Middle channel: 2440 MHz Highest channel: 2480 MHz
TC/02 (2 Mbps)	<u>Power supply (V):</u> V_{nominal}: 13.2 Vdc <u>Temperature:</u> T_{nominal}: +15 to +35 °C Data Rate: 2 Mbps Bandwidth: 2 MHz <u>Test Frequencies for Conducted/ Radiated tests:</u> Lowest channel: 2402 MHz Middle channel: 2440 MHz Highest channel: 2480 MHz

CONDUCTED MEASUREMENTS:



RADIATED MEASUREMENTS:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at 3 m for the frequency range 30-1000 MHz (Bilog antenna) and 1-18 GHz (Double ridge horn antenna), and 1m for the frequency range 18 GHz- 26 GHz (Double ridge horn antenna).

For radiated emissions in the range 18 - 26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

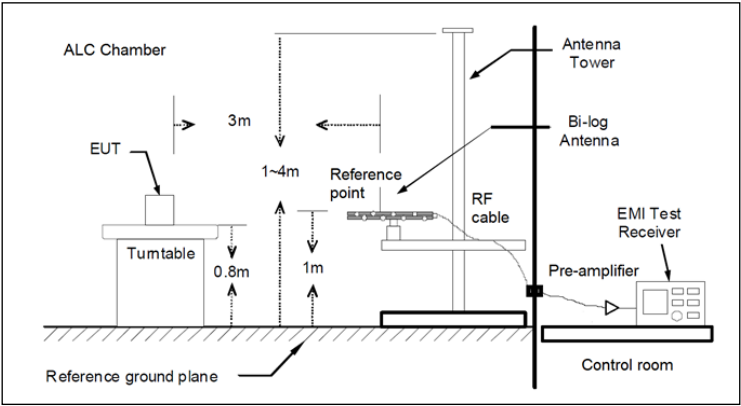


Fig A1: Radiated measurements Setup $f < 1$ GHz

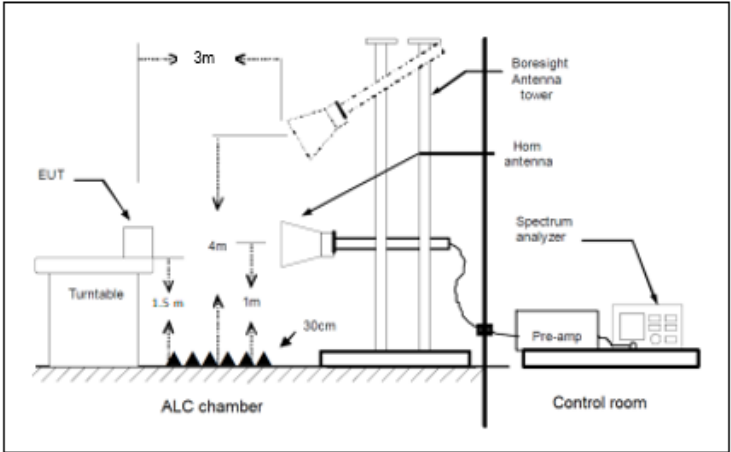


Fig A2: Radiated measurements setup $f > 1-18$ GHz

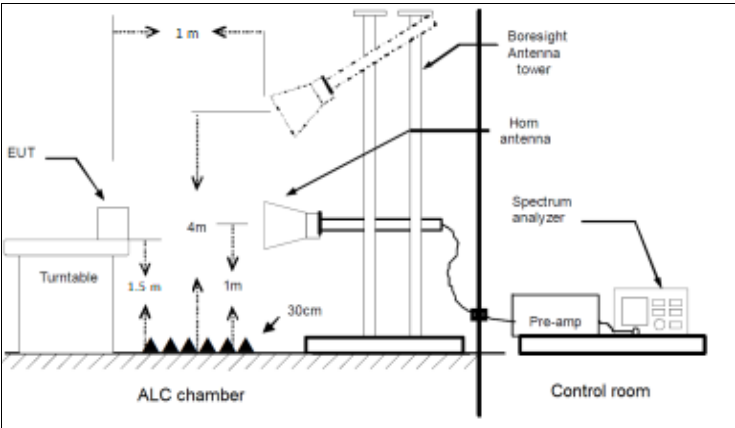


Fig A3: Radiated measurements setup $f > 18$ GHz

TEST CASES DETAILS

RSS-247 5.2 (a) / FCC 15.247 (a) (2) [6dBw] 6 dB Bandwidth

Limits

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

Modulation: BTLE 5.1 (GFSK 1 Mbit/s)

Results

Freq (MHz)	BW (MHz)	Emission Bandwidth (MHz)
2402.00000	1	0.733
2440.00000	1	0.733
2480.00000	1	0.733

Modulation: BTLE 5.1 (GFSK 2 Mbit/s)

Results

Freq (MHz)	BW (MHz)	Emission Bandwidth (MHz)
2402.00000	2	1.228
2440.00000	2	1.228
2480.00000	2	1.228

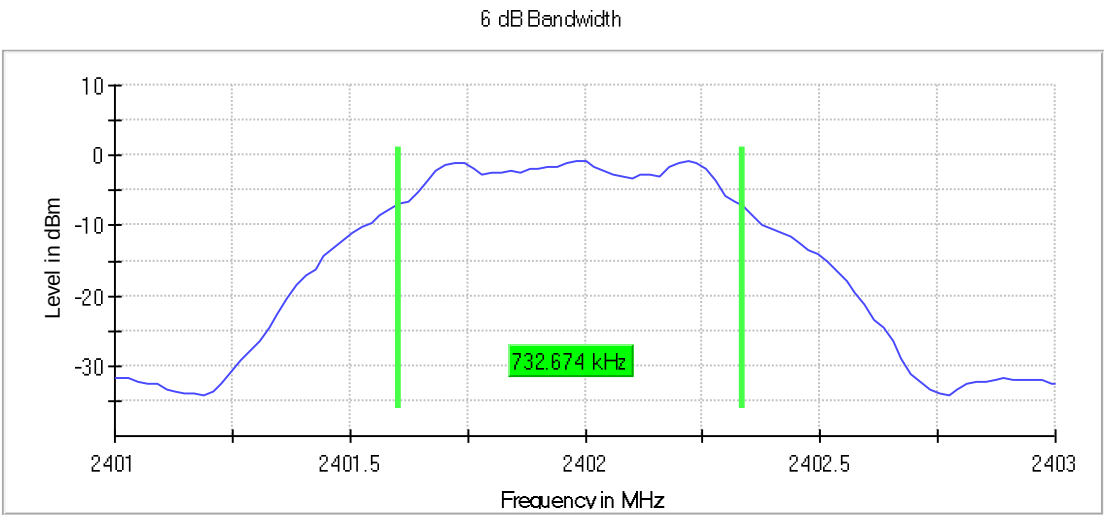
Verdict

Pass

Attachments

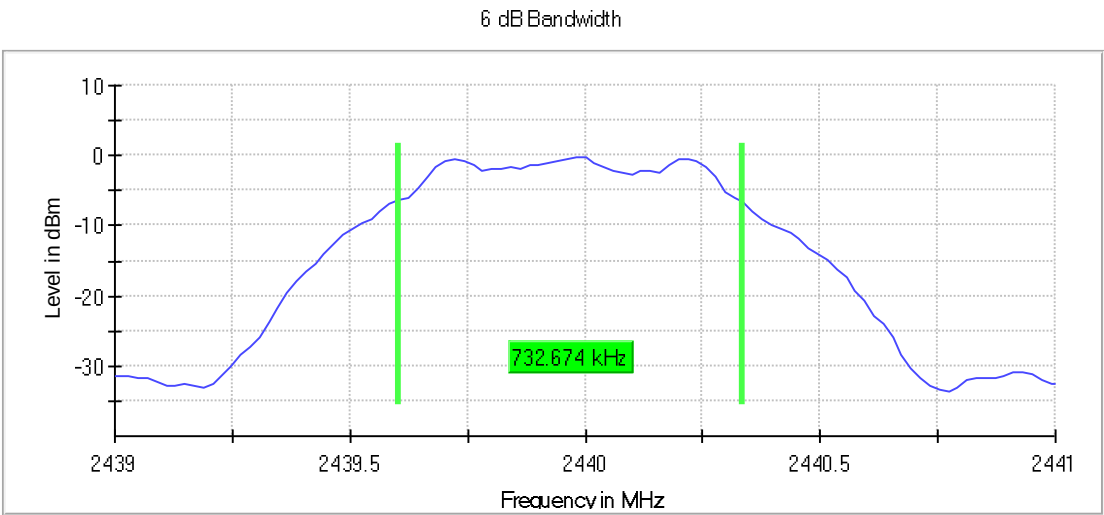
Frequency MHz = 2402.00000, Bandwidth MHz = 1, Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



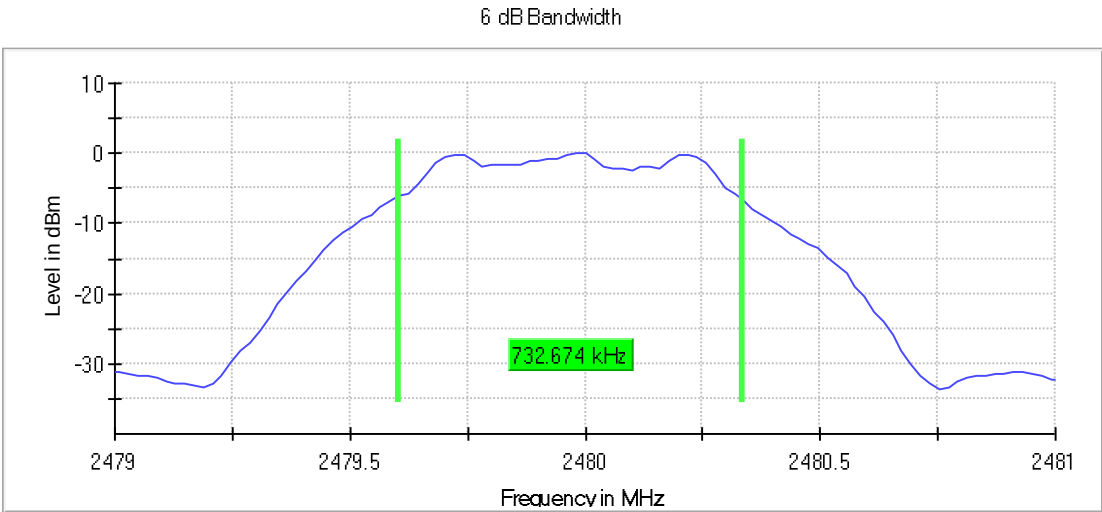
Frequency MHz = 2440.00000, Bandwidth MHz = 1, Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



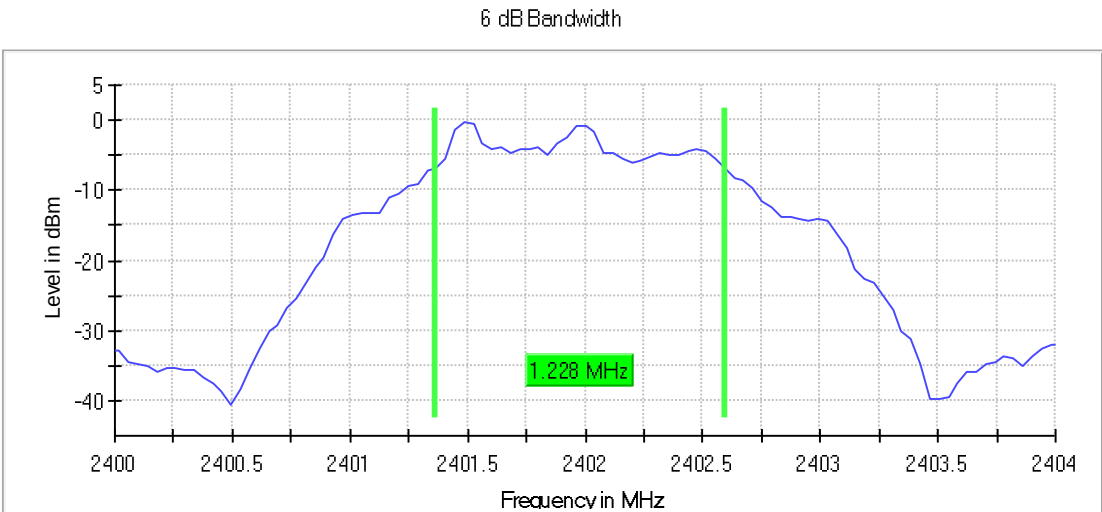
Frequency MHz = 2480.00000, Bandwidth MHz = 1, Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



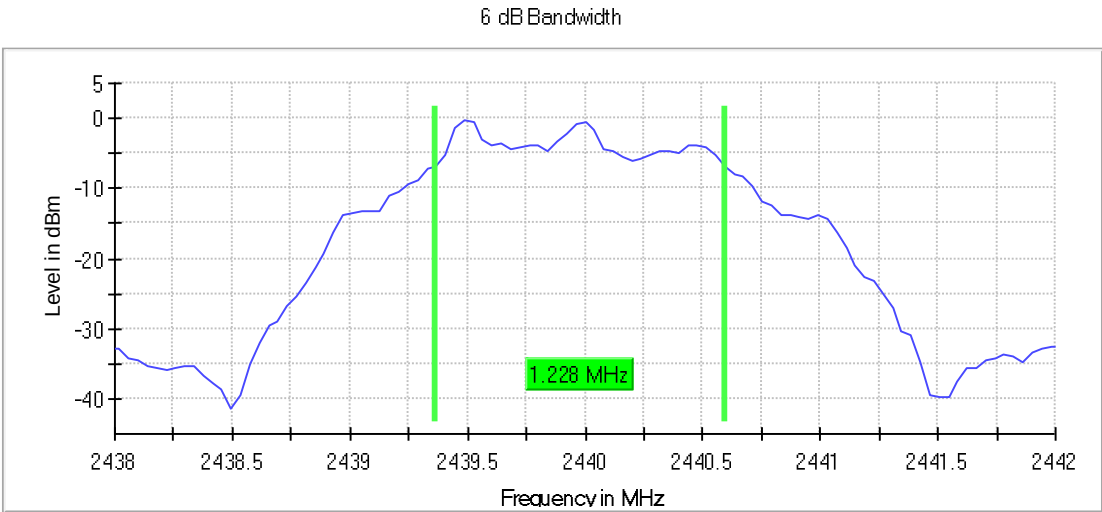
Frequency MHz = 2402.00000, Bandwidth MHz = 2, Modulation = BTLE 5.1 (GFSK 2 Mbit/s)

Images:



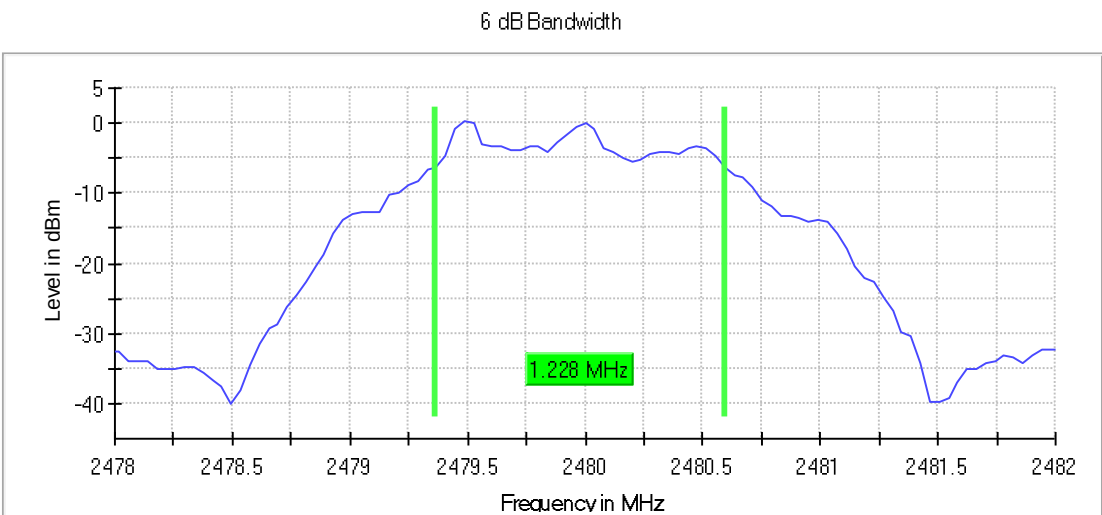
Frequency MHz = 2440.00000, Bandwidth MHz = 2, Modulation = BTLE 5.1 (GFSK 2 Mbit/s)

Images:



Frequency MHz = 2480.00000, Bandwidth MHz = 2, Modulation = BTLE 5.1 (GFSK 2 Mbit/s)

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value
Start Frequency	2.40100 GHz
Stop Frequency	2.40300 GHz
Span	2.000 MHz
RBW	100.000 kHz
VBW	300.000 kHz
SweepPoints	101
Sweeptime	18.938 μ s
Reference Level	0.000 dBm
Attenuation	20.000 dB
Detector	MaxPeak
SweepCount	100
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	FFT
Preamp	off
Stablemode	Trace
Stablevalue	0.50 dB
Run	9 / max. 150
Stable	5 / 5
Max Stable Difference	0.28 dB

99dBw Occupied Channel Bandwidth 99%

Limits

No Limit has been set to this test case

Modulation: BTLE 5.1 (GFSK 1 Mbit/s)

Results

Freq (MHz)	Equipment	BW (MHz)	Occ Ch BW (MHz)
2402.00000	Digital Transmission System (DTS)	1	1.003
2440.00000	Digital Transmission System (DTS)		1.003
2480.00000	Digital Transmission System (DTS)		1.003

Modulation: BTLE 5.1 (GFSK 2 Mbit/s)

Results

Freq (MHz)	Equipment	BW (MHz)	Occ Ch BW (MHz)
2402.00000	Digital Transmission System (DTS)	2	2.040
2440.00000	Digital Transmission System (DTS)		2.040
2480.00000	Digital Transmission System (DTS)		2.040

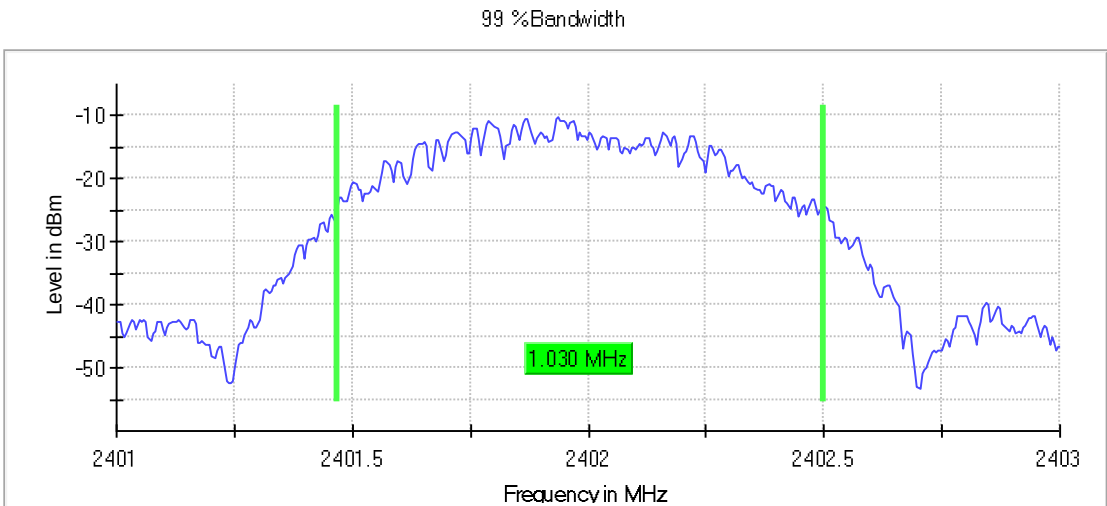
Verdict

Pass

Attachments

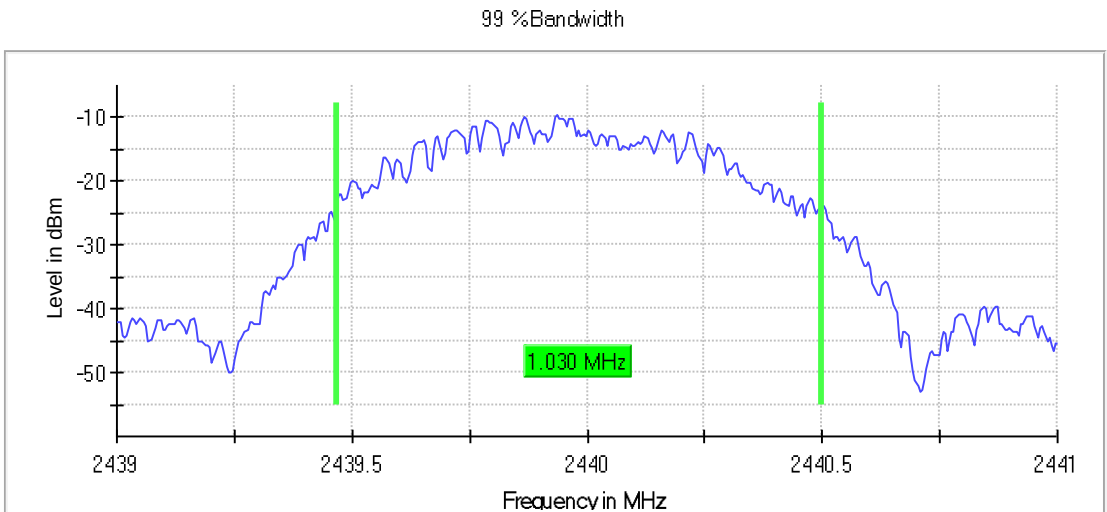
Frequency MHz = 2402.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 1,
Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



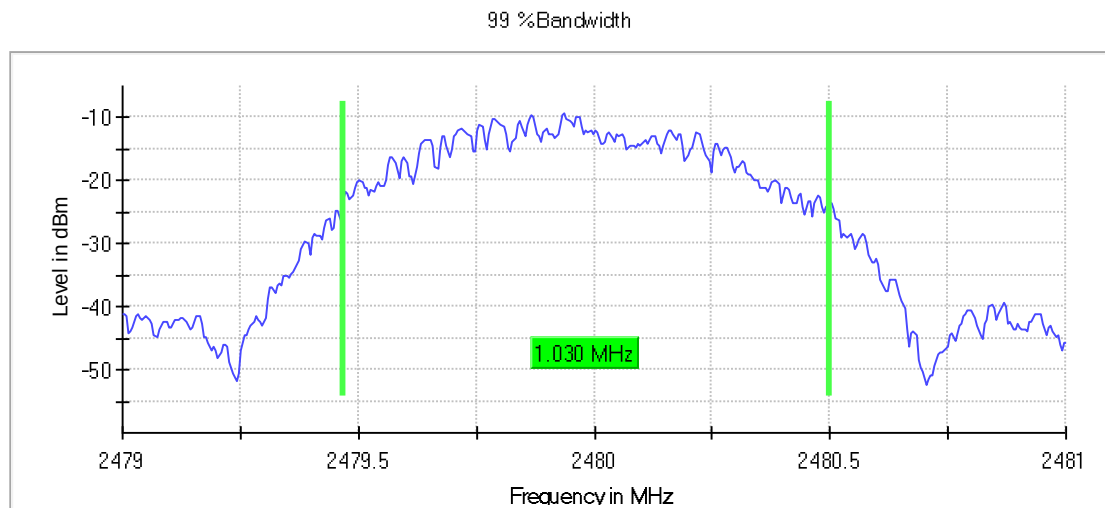
Frequency MHz = 2440.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 1,
Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



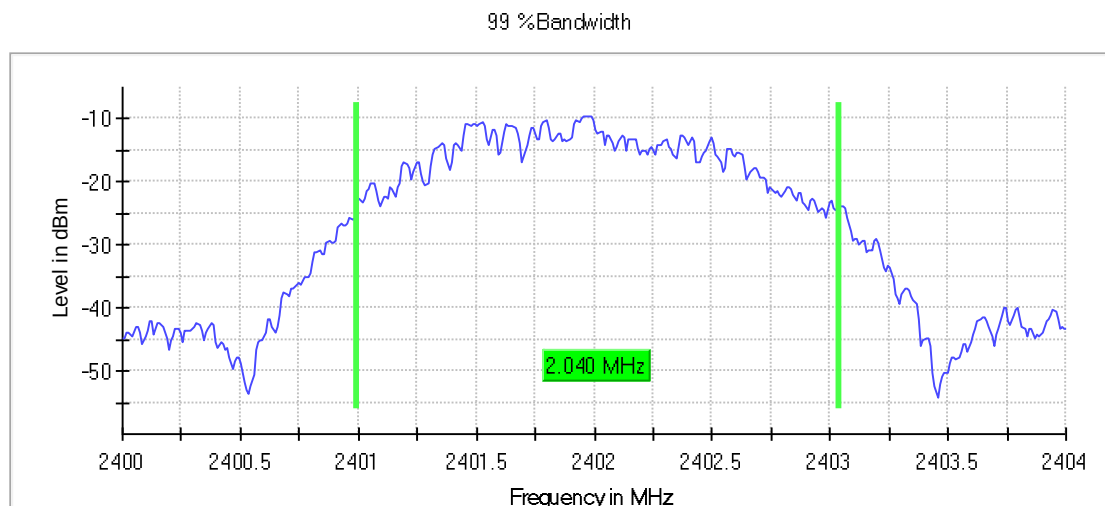
**Frequency MHz = 2480.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 1,
Modulation = BTLE 5.1 (GFSK 1 Mbit/s)**

Images:



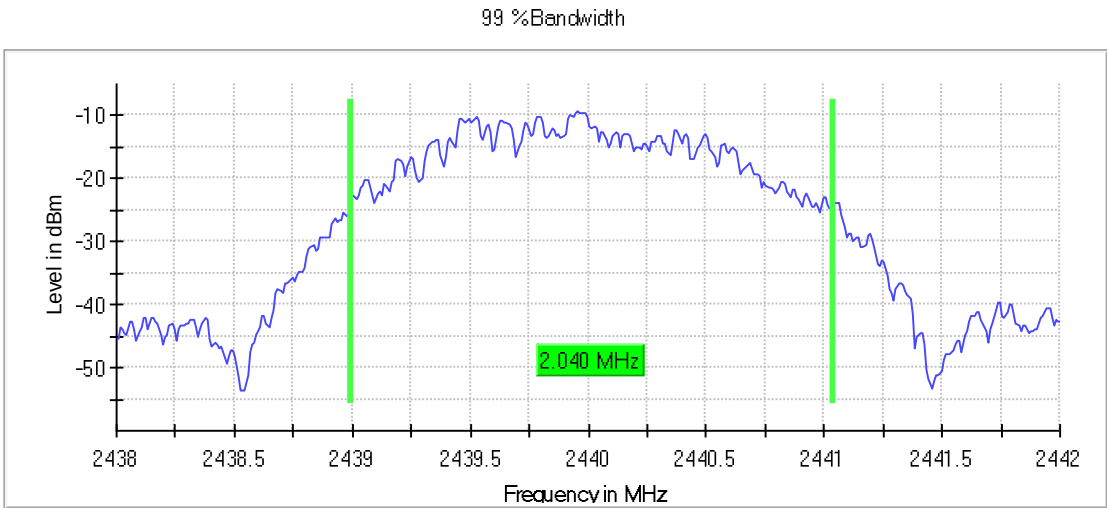
**Frequency MHz = 2402.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 2,
Modulation = BTLE 5.1 (GFSK 2 Mbit/s)**

Images:



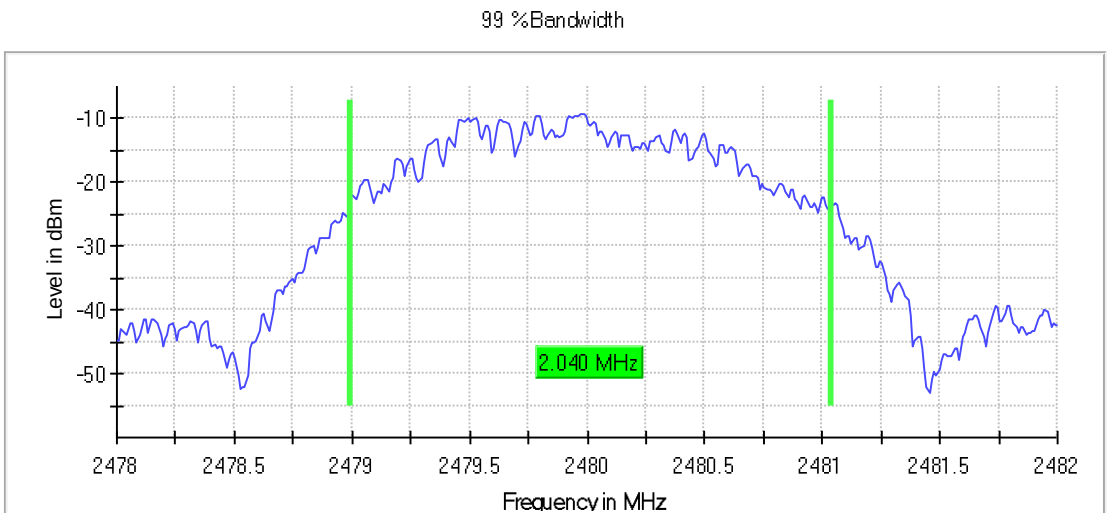
Frequency MHz = 2440.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 2,
Modulation = BTLE 5.1 (GFSK 2 Mbit/s)

Images:



Frequency MHz = 2480.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 2,
Modulation = BTLE 5.1 (GFSK 2 Mbit/s)

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value
Start Frequency	2.40100 GHz
Stop Frequency	2.40300 GHz
Span	2.000 MHz
RBW	10.000 kHz
VBW	30.000 kHz
SweepPoints	400
SweepTime	189.648 μ s
Reference Level	0.000 dBm
Attenuation	20.000 dB
Detector	MaxPeak
SweepCount	100
Filter	3 dB
Trace Mode	Max Hold
SweepType	FFT
Preamplifier	off
Stablemode	Trace
Stablevalue	0.30 dB
Run	5 / max. 150
Stable	3 / 3
Max Stable Difference	0.07 dB

RSS-247 5.2 (b) / FCC 15.247 (e) [Psd] Power spectral density

Limits

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Modulation: BTLE 5.1 (GFSK 1 Mbit/s)

Results

Freq (MHz)	Equipment	BW (MHz)	PSD (dBm)
2402.00000	Digital Transmission System (DTS)	1	-10.01
2440.00000	Digital Transmission System (DTS)		-9.41
2480.00000	Digital Transmission System (DTS)		-9.12

Modulation: BTLE 5.1 (GFSK 2 Mbit/s)

Results

Freq (MHz)	Equipment	BW (MHz)	PSD (dBm)
2402.00000	Digital Transmission System (DTS)	2	-12.46
2440.00000	Digital Transmission System (DTS)		-12.36
2480.00000	Digital Transmission System (DTS)		-12.25

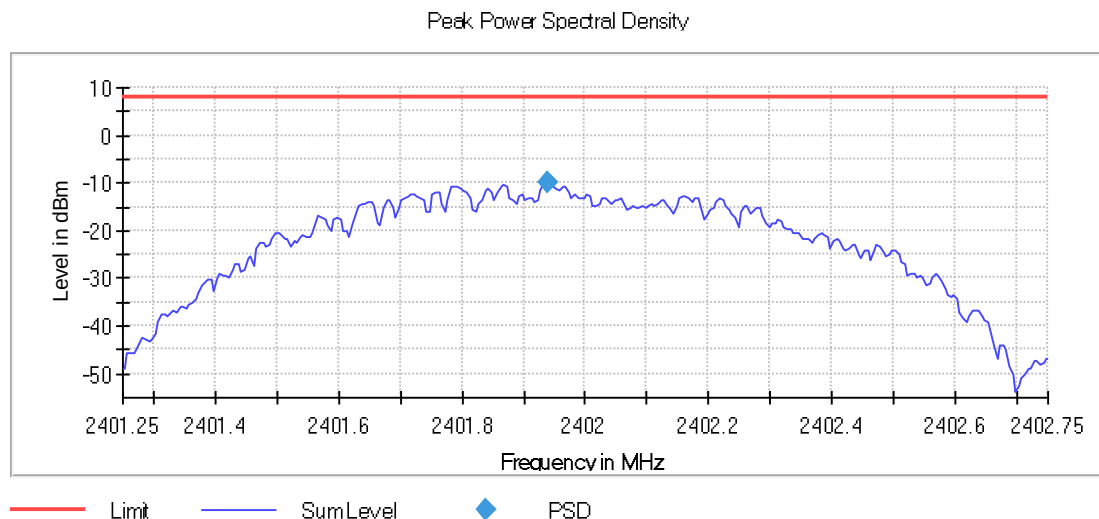
Verdict

Pass

Attachments

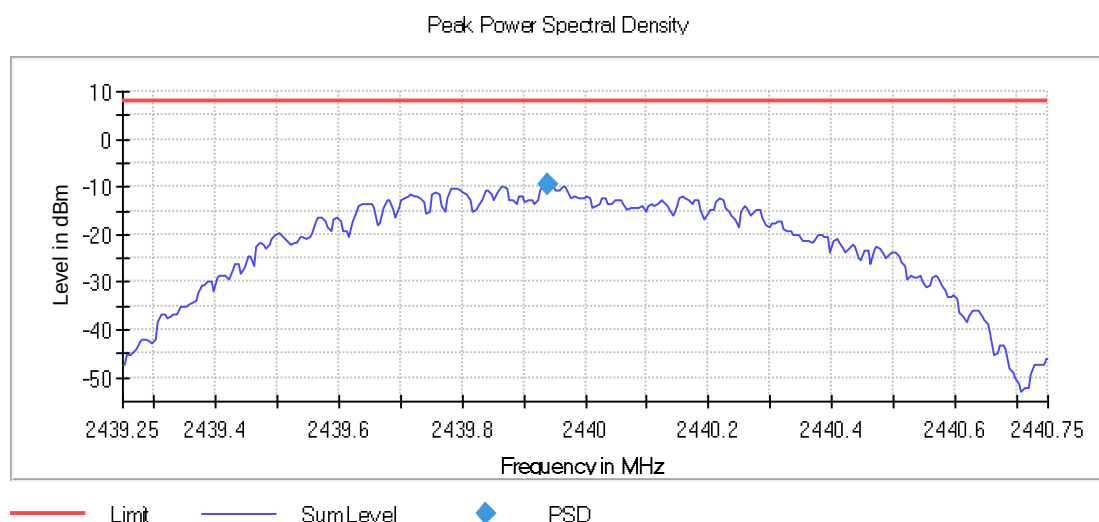
Frequency MHz = 2402.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 1,
Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



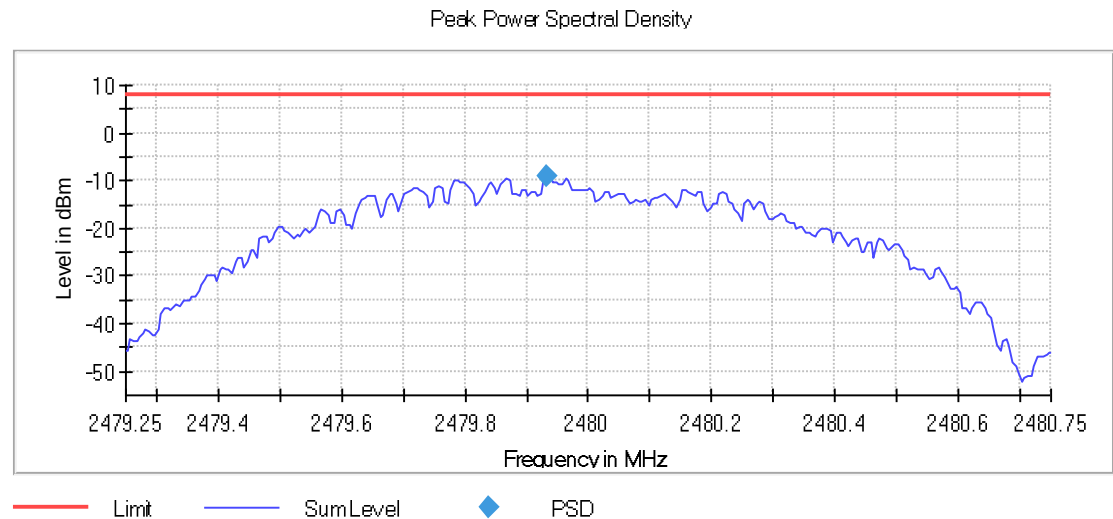
Frequency MHz = 2440.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 1,
Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



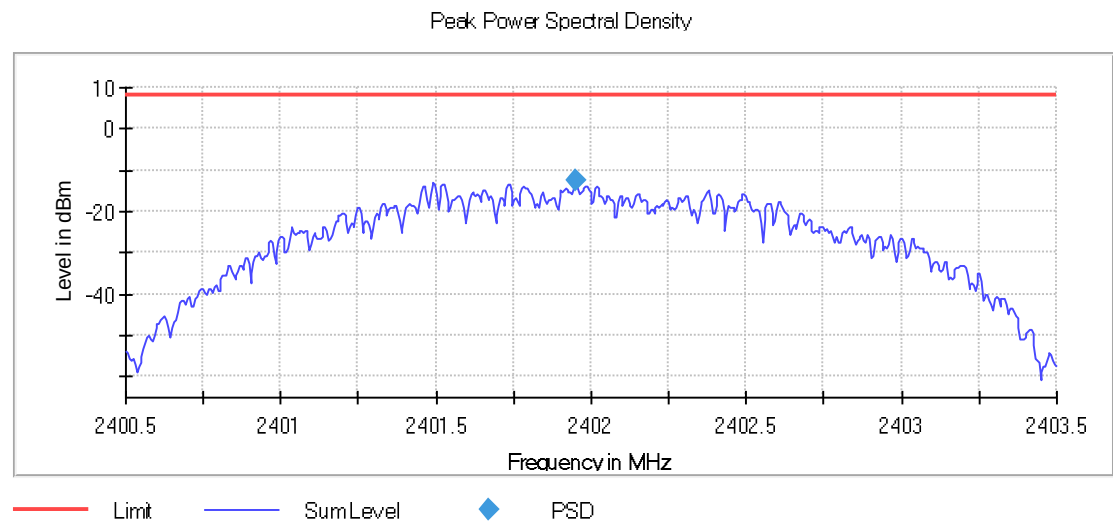
Frequency MHz = 2480.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 1,
Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



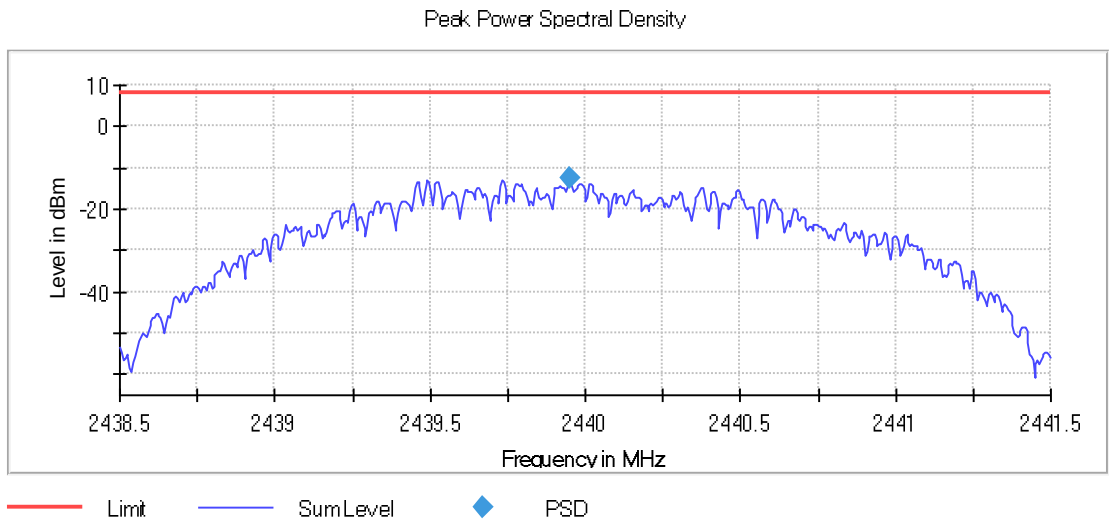
Frequency MHz = 2402.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 2,
Modulation = BTLE 5.1 (GFSK 2 Mbit/s)

Images:



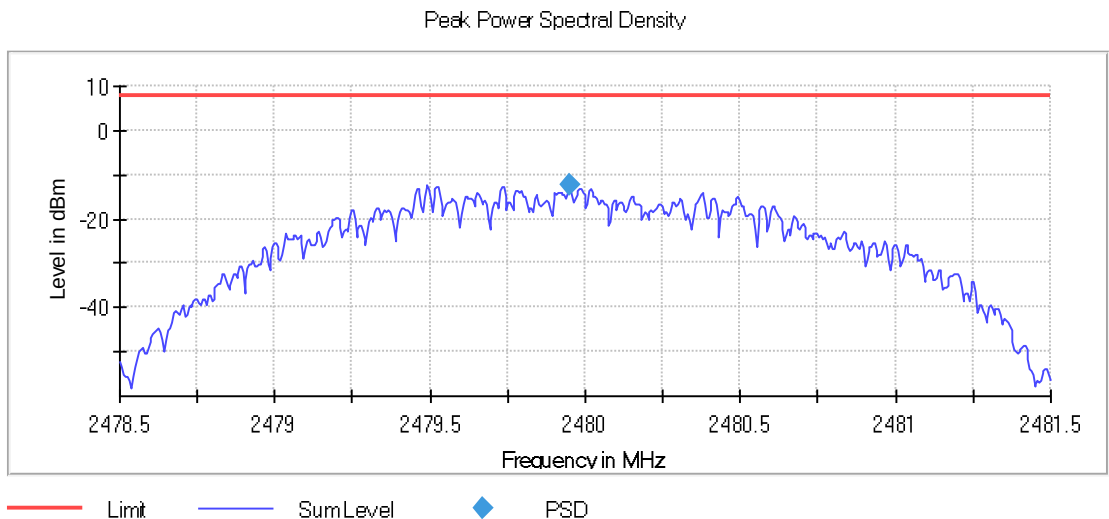
Frequency MHz = 2440.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 2,
Modulation = BTLE 5.1 (GFSK 2 Mbit/s)

Images:



Frequency MHz = 2480.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 2,
Modulation = BTLE 5.1 (GFSK 2 Mbit/s)

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value
Start Frequency	2.40125 GHz
Stop Frequency	2.40275 GHz
Span	1.500 MHz
RBW	10.000 kHz
VBW	30.000 kHz
SweepPoints	300
Sweeptime	1.500 ms
Reference Level	0.000 dBm
Attenuation	20.000 dB
Detector	MaxPeak
SweepCount	100
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.50 dB
Run	3 / max. 150
Stable	2 / 2
Max Stable Difference	0.15 dB

RSS-247 5.4 (d) / FCC 15.247 (b) (3) Maximum Peak Conducted output power

Limits

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).

The e.i.r.p. shall not exceed 4 W (36 dBm) (Canada).

The maximum peak conducted output power level in the fundamental emission was measured using the method according to point 11.9.1.1 "RBW ≥ DTS bandwidth" of ANSI C.63.10-2013.

Maximum declared antenna gain: -2.5 dBi

Modulation: BTLE 5.1 (GFSK 1 Mbit/s)

Results

Freq (MHz)	BW (MHz)	Peak Power (dBm)	Maximum EIRP power (dBm)
2402.00000	1	-0.1	-2.6
2440.00000		0.4	-2.1
2480.00000		0.7	-1.8

Modulation: BTLE 5.1 (GFSK 2 Mbit/s)

Results

Freq (MHz)	BW (MHz)	Peak Power (dBm)	Maximum EIRP power (dBm)
2402.00000	2	0.1	-2.4
2440.00000		0.2	-2.3
2480.00000		0.8	-1.7

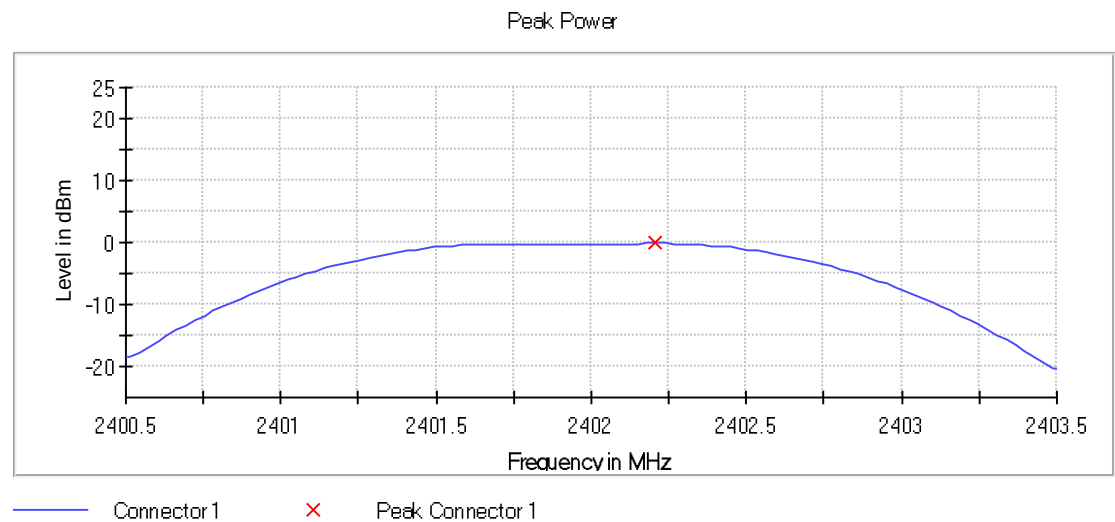
Verdict

Pass

Attachments

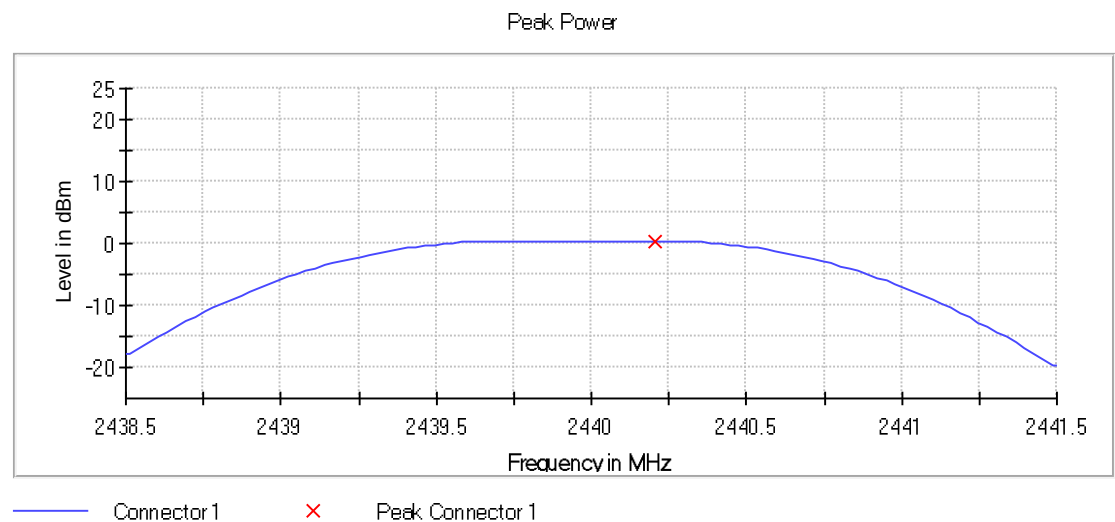
Frequency MHz = 2402.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 1,
Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



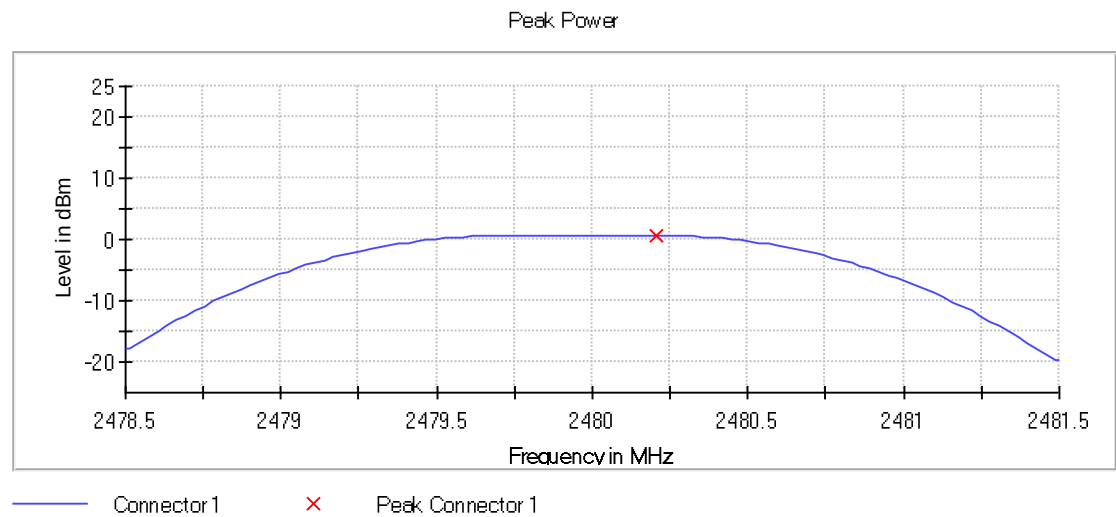
Frequency MHz = 2440.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 1,
Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



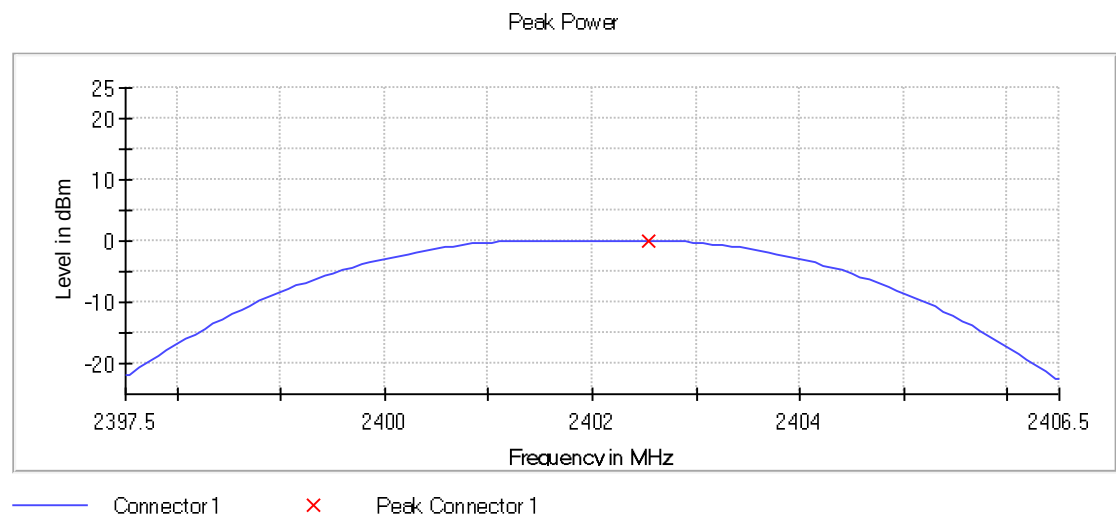
Frequency MHz = 2480.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 1,
Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



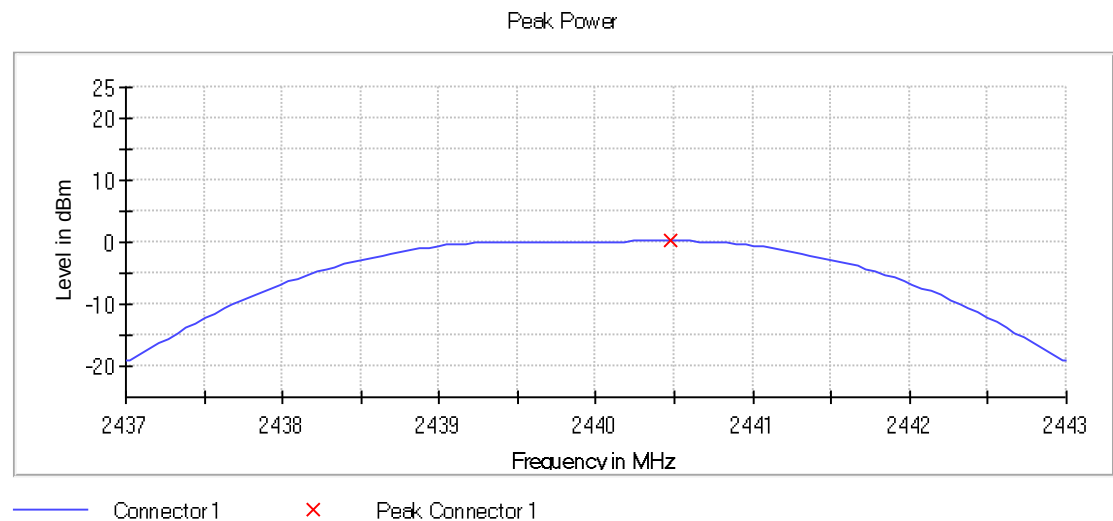
Frequency MHz = 2402.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 2,
Modulation = BTLE 5.1 (GFSK 2 Mbit/s)

Images:



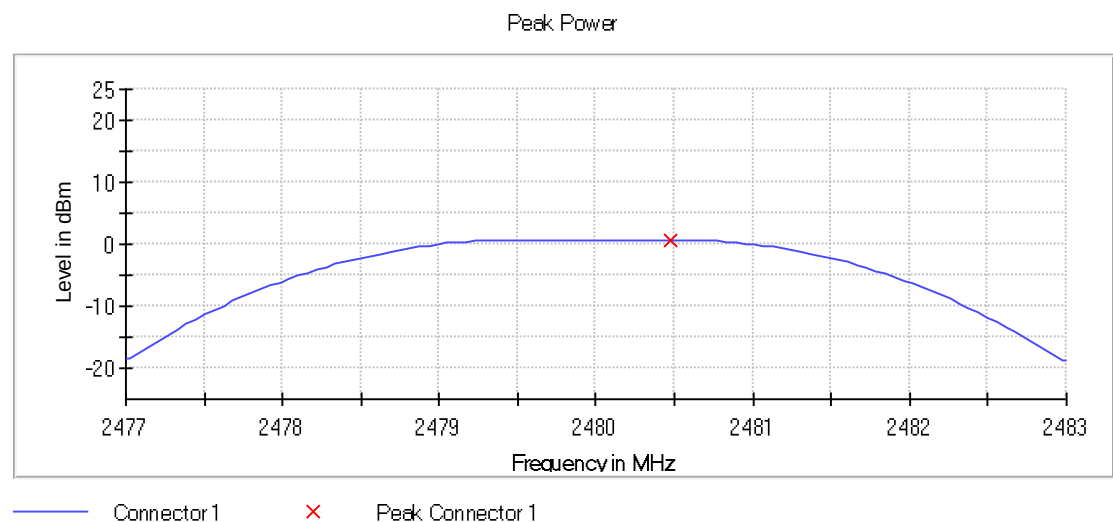
Frequency MHz = 2440.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 2,
Modulation = BTLE 5.1 (GFSK 2 Mbit/s)

Images:



Frequency MHz = 2480.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 2,
Modulation = BTLE 5.1 (GFSK 2 Mbit/s)

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value
Start Frequency	2.40050 GHz
Stop Frequency	2.40350 GHz
Span	3.000 MHz
RBW	1.000 MHz
VBW	3.000 MHz
SweepPoints	101
Sweeptime	1.907 μ s
Reference Level	10.000 dBm
Attenuation	30.000 dB
Detector	MaxPeak
SweepCount	100
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	FFT
Preamp	off
Stablemode	Trace
Stablevalue	0.50 dB
Run	4 / max. 150
Stable	3 / 3
Max Stable Difference	0.06 dB

RSS-247 5.5 / FCC 15.247 (d) [Bndedge] Band-edge emissions compliance (Transmitter)

Limits

In any 100 kHz bandwidths outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. 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.

Modulation: BTLE 5.1 (GFSK 1 Mbit/s)

Results

DUT Frequency	Result
2402.000000	PASS

DUT Frequency	Result
2480.000000	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2335.675000	-49.8	29.0	-20.8	PASS
2335.725000	-49.9	29.1	-20.8	PASS
2335.625000	-50.8	30.1	-20.8	PASS
2346.725000	-51.2	30.4	-20.8	PASS
2346.775000	-51.7	30.9	-20.8	PASS
2346.675000	-51.7	30.9	-20.8	PASS
2346.425000	-52.3	31.5	-20.8	PASS
2335.775000	-52.4	31.6	-20.8	PASS
2346.375000	-52.5	31.7	-20.8	PASS
2335.575000	-52.5	31.7	-20.8	PASS
2346.475000	-52.6	31.8	-20.8	PASS
2346.325000	-52.9	32.1	-20.8	PASS
2346.825000	-53.2	32.4	-20.8	PASS
2346.275000	-53.8	33.0	-20.8	PASS
2346.625000	-54.1	33.3	-20.8	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2488.375000	-52.4	32.4	-19.9	PASS
2488.325000	-52.5	32.6	-19.9	PASS
2488.425000	-53.3	33.4	-19.9	PASS
2488.525000	-53.4	33.4	-19.9	PASS
2488.475000	-53.4	33.5	-19.9	PASS
2487.575000	-53.5	33.6	-19.9	PASS
2487.525000	-53.6	33.6	-19.9	PASS
2487.475000	-53.6	33.7	-19.9	PASS
2488.075000	-53.9	34.0	-19.9	PASS
2487.425000	-54.0	34.0	-19.9	PASS
2486.875000	-54.1	34.2	-19.9	PASS
2488.125000	-54.1	34.2	-19.9	PASS
2489.325000	-54.5	34.6	-19.9	PASS
2486.925000	-54.6	34.7	-19.9	PASS
2488.025000	-54.6	34.7	-19.9	PASS

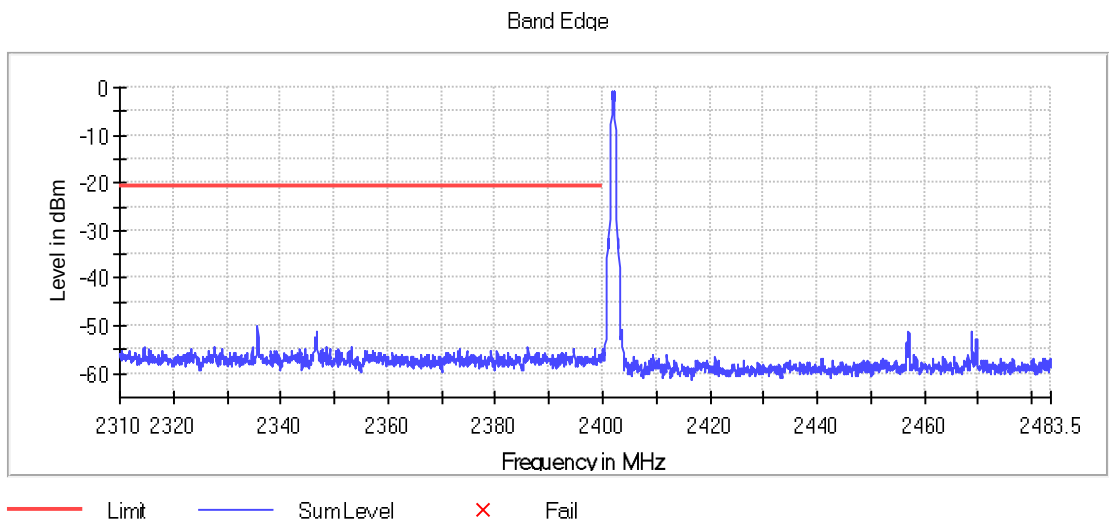
Verdict

Pass

Attachments

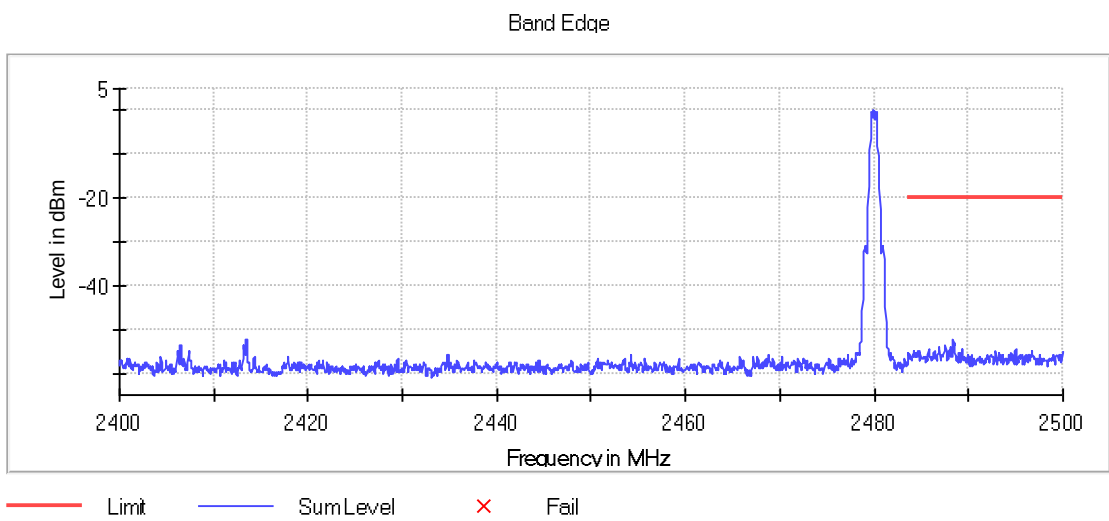
Frequency MHz = 2402.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 1,
Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



Frequency MHz = 2480.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 1,
Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



Modulation: BTLE 5.1 (GFSK 2 Mbit/s)

Results

DUT Frequency	Result
2402.000000	PASS

DUT Frequency	Result
2480.000000	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.975000	-30.3	10.0	-20.4	PASS
2399.925000	-31.9	11.5	-20.4	PASS
2399.875000	-34.8	14.4	-20.4	PASS
2399.825000	-38.2	17.8	-20.4	PASS
2399.775000	-38.7	18.3	-20.4	PASS
2399.725000	-40.3	20.0	-20.4	PASS
2399.675000	-43.5	23.1	-20.4	PASS
2340.575000	-45.0	24.6	-20.4	PASS
2341.175000	-45.2	24.8	-20.4	PASS
2340.525000	-45.3	24.9	-20.4	PASS
2399.625000	-45.4	25.0	-20.4	PASS
2341.225000	-45.7	25.4	-20.4	PASS
2341.125000	-46.3	26.0	-20.4	PASS
2340.625000	-47.0	26.7	-20.4	PASS
2399.575000	-47.1	26.7	-20.4	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2487.025000	-51.9	32.3	-19.6	PASS
2486.975000	-52.0	32.4	-19.6	PASS
2489.525000	-53.3	33.7	-19.6	PASS
2487.075000	-53.3	33.7	-19.6	PASS
2489.475000	-53.4	33.8	-19.6	PASS
2486.925000	-53.7	34.1	-19.6	PASS
2495.875000	-53.9	34.3	-19.6	PASS
2494.975000	-54.1	34.5	-19.6	PASS
2484.275000	-54.1	34.5	-19.6	PASS
2495.025000	-54.2	34.6	-19.6	PASS
2483.675000	-54.3	34.7	-19.6	PASS
2488.575000	-54.4	34.8	-19.6	PASS
2495.925000	-54.5	34.9	-19.6	PASS
2483.725000	-54.5	34.9	-19.6	PASS
2483.825000	-54.5	34.9	-19.6	PASS

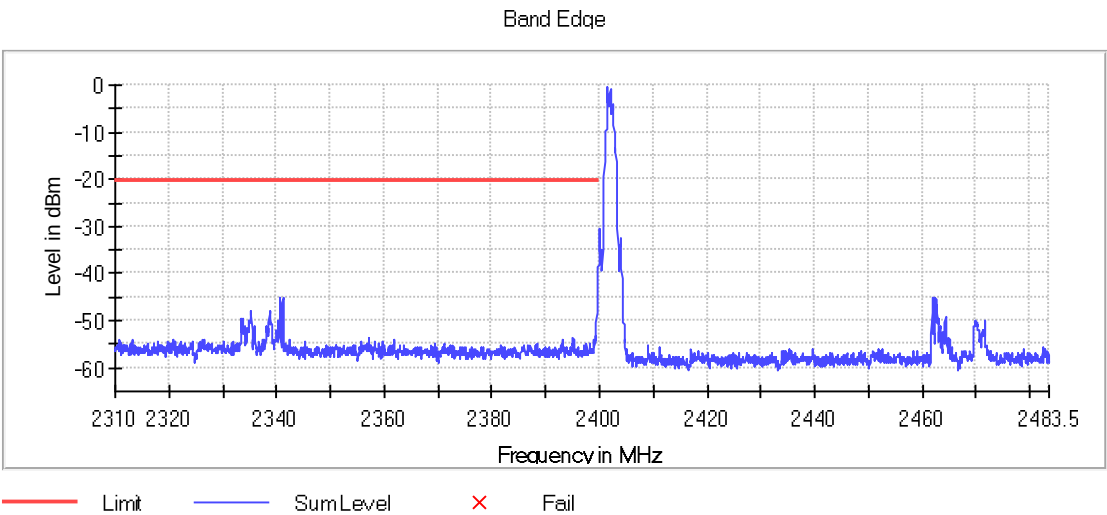
Verdict

Pass

Attachments

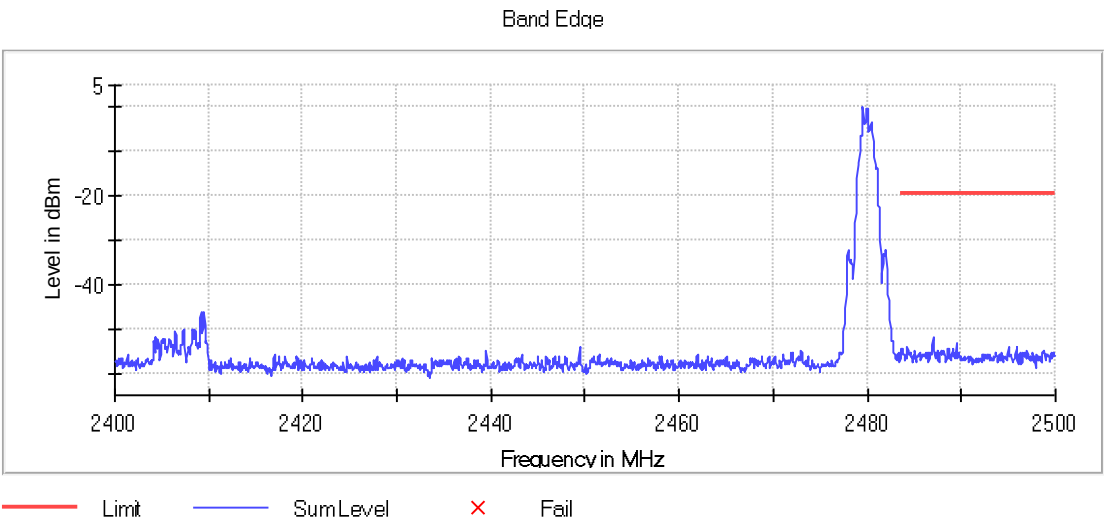
Frequency MHz = 2402.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 2, Modulation = BTLE 5.1 (GFSK 2 Mbit/s)

Images:



Frequency MHz = 2480.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 2, Modulation = BTLE 5.1 (GFSK 2 Mbit/s)

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value 1	Instrument Value 2
Start Frequency	2.31000 GHz	2.40000 GHz
Stop Frequency	2.40000 GHz	2.48350 GHz
Span	90.000 MHz	83.500 MHz
RBW	100.000 kHz	100.000 kHz
VBW	300.000 kHz	300.000 kHz
SweepPoints	1800	1670
SweepTime	113.672 μ s	94.727 μ s
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	20.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	FFT
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	4 / max. 150	8 / max. 150
Stable	3 / 3	3 / 3
Max Stable Difference	0.00 dB	0.06 dB

RSS-247 5.5 / FCC 15.247 (d) Emissions compliance (Transmitter) - Conducted

Limits

In any 100 kHz bandwidth outside the frequency band in which the digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.

Modulation: BTLE 5.1 (GFSK 2 Mbit/s)

Conducted spurious signals detected were minimum 20 dB respect to the limit for the lowest, middle and highest operating channels.

The following tables and plots show the results for the worst case

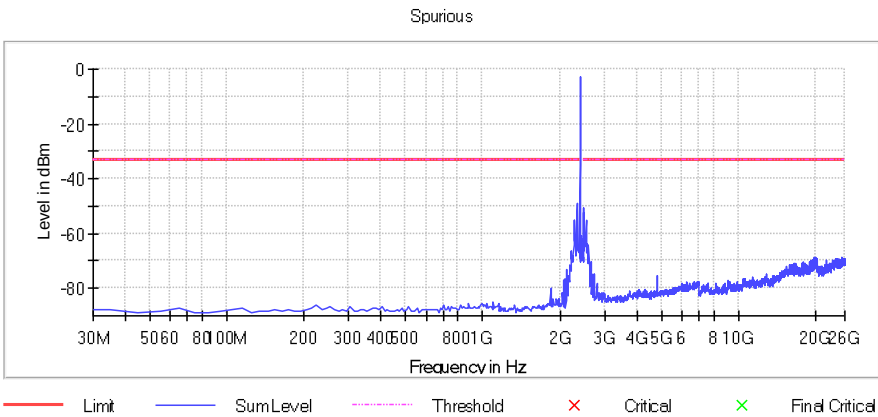
Verdict

Pass

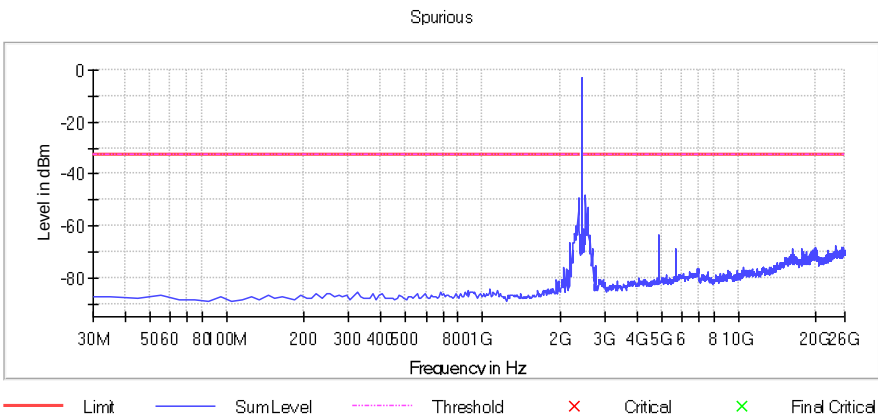
Results

Note: Fundamental signals are above the limit and shown in the frequency range of 2402 - 2480 MHz in the plots

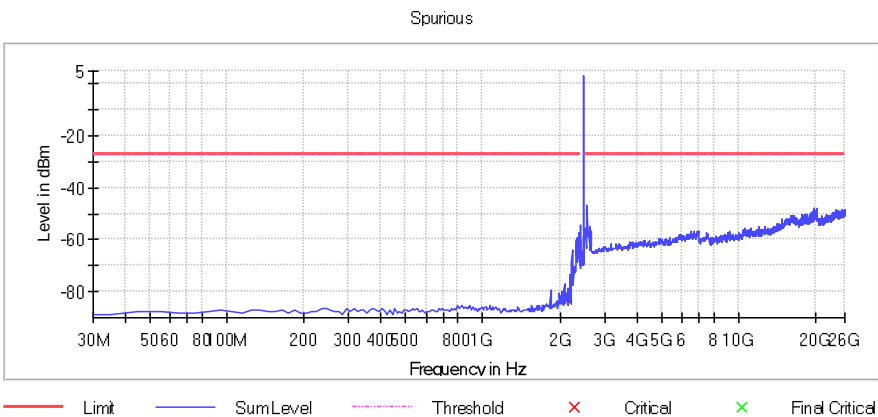
Lowest Channel (2402 MHz)



Middle Channel (2440 MHz)



Highest Channel (2480 MHz)



Spectrum Analyzer Parameters

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	401	~ 401
Sweeptime	37.907 μ s	AUTO
Reference Level	-30.000 dBm	-30.000 dBm
Attenuation	0.000 dB	AUTO
Detector	Sample	Sample
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Average Linear	Average Linear
Sweeptype	FFT	AUTO
Preamplifier	off	off

RSS-247 5.5 / FCC 15.247 (d) Emissions compliance (Transmitter) - Radiated

Limits

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c) / RSS-Gen):

Frequency Range (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RSS-247. Attenuation below the general field strength limits specified in RSS-Gen is not required

The following tables and plots show the results for the worst case

Verdict

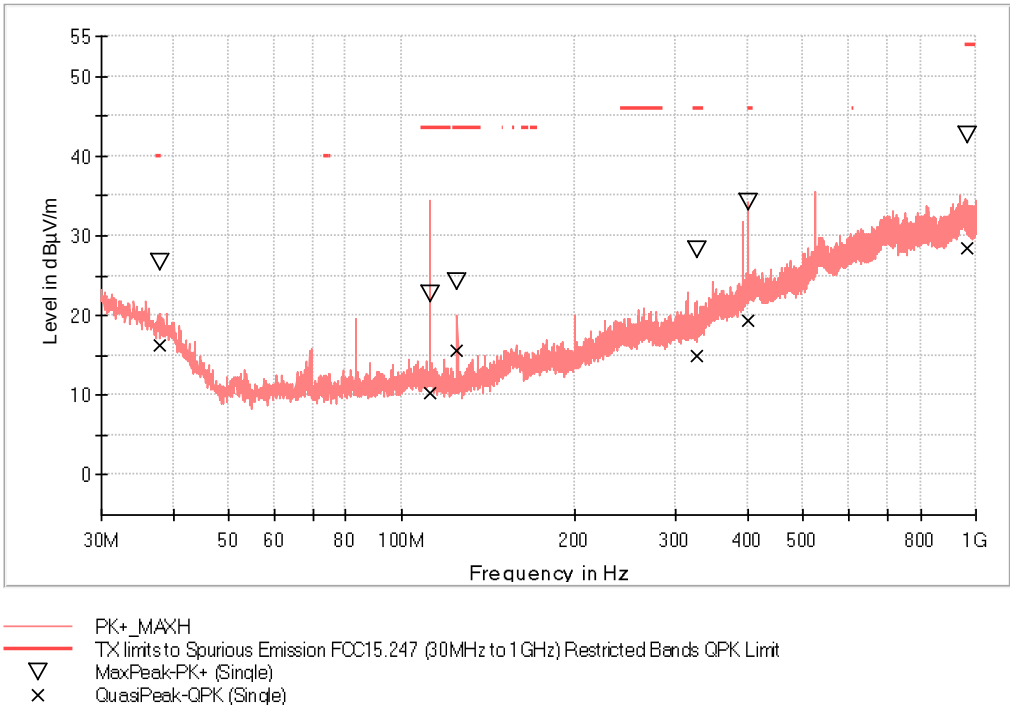
Pass

Modulation: BTLE 5.1 (GFSK 2 Mbit/s)
Results

Frequency range 0.03 - 1 GHz
The spurious emissions below 1 GHz do not depend on the operating channel selected in the EUT.

Lowest Channel

Frequency MHz = 2402.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Modulation = BTLE 5.1 (GFSK 2 Mbit/s), Frequency Range GHz = [0.03, 1]

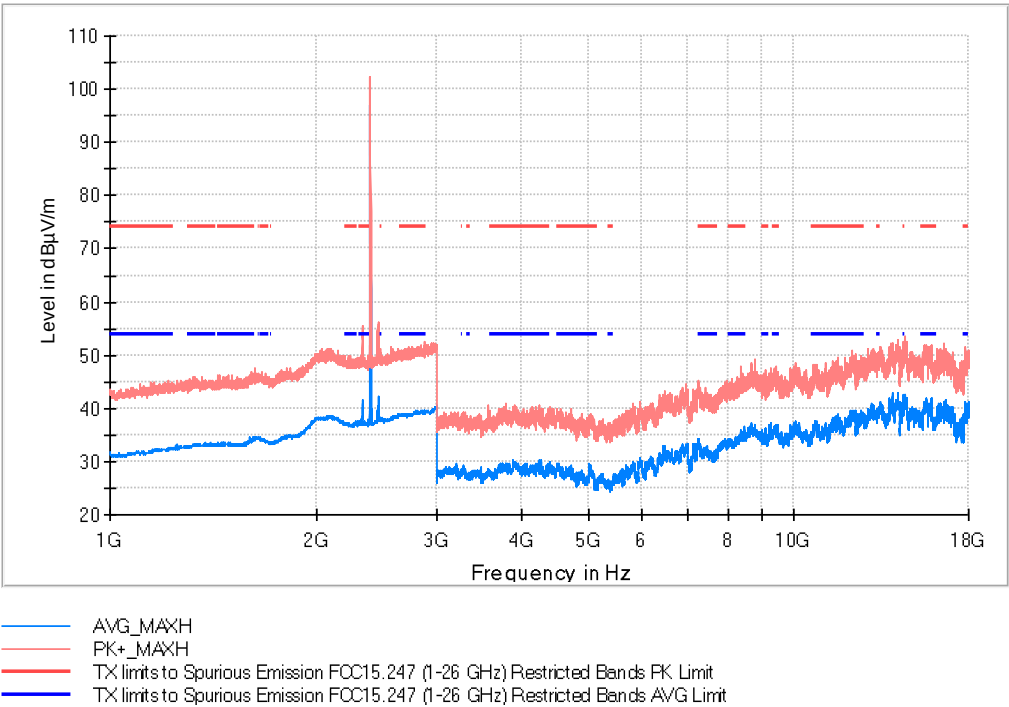


Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Pol	Margin - QPK (dB)	Limit - QPK (dBµV/m)
37.954000	26.8	16.3	V	23.7	40.0
111.819500	22.8	10.2	V	33.3	43.5
125.011500	24.3	15.6	V	27.9	43.5
326.917000	28.3	15.0	H	31.0	46.0
400.928000	34.2	19.4	V	26.6	46.0

Frequency range 1 - 18 GHz

Lowest Channel

Frequency MHz = 2402.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Modulation = BTLE 5.1 (GFSK 2 Mbit/s), Frequency Range GHz = [1, 18]

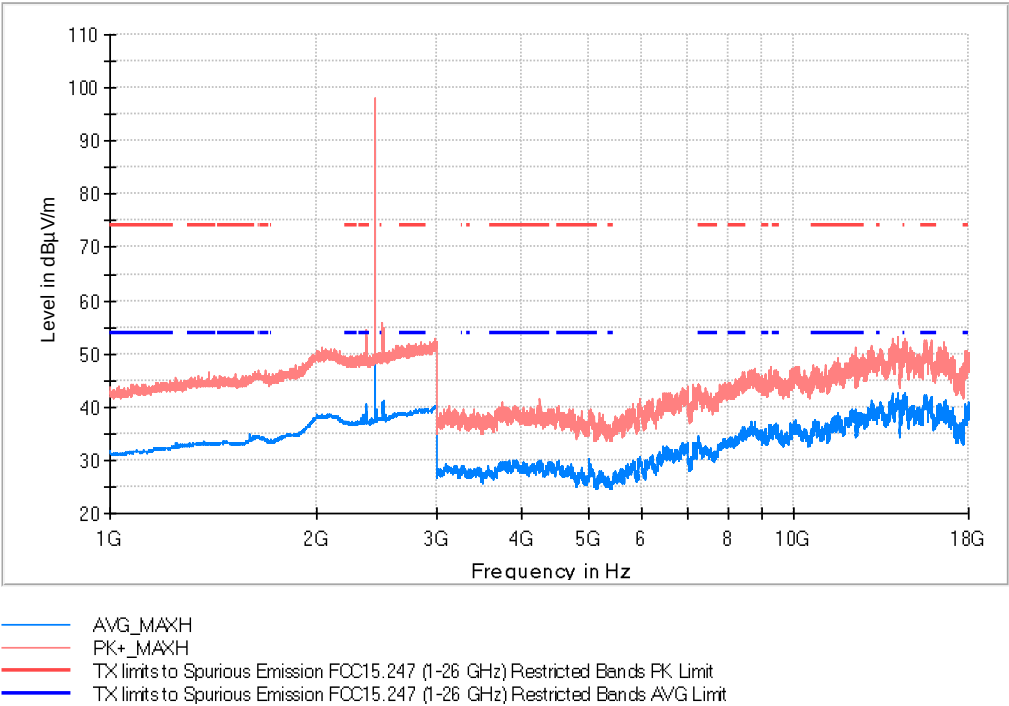


Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
2339.000000	54.9	41.1	H	12.9	54.0	
2402.000000	101.9	97.2	H	---	---	Fundamental
15874.000000	50.5	42.0	H	12.0	54.0	

Frequency range 1 - 18 GHz

Middle Channel

Frequency MHz = 2440.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Modulation = BTLE 5.1 (GFSK 2 Mbit/s), Frequency Range GHz = [1, 18]

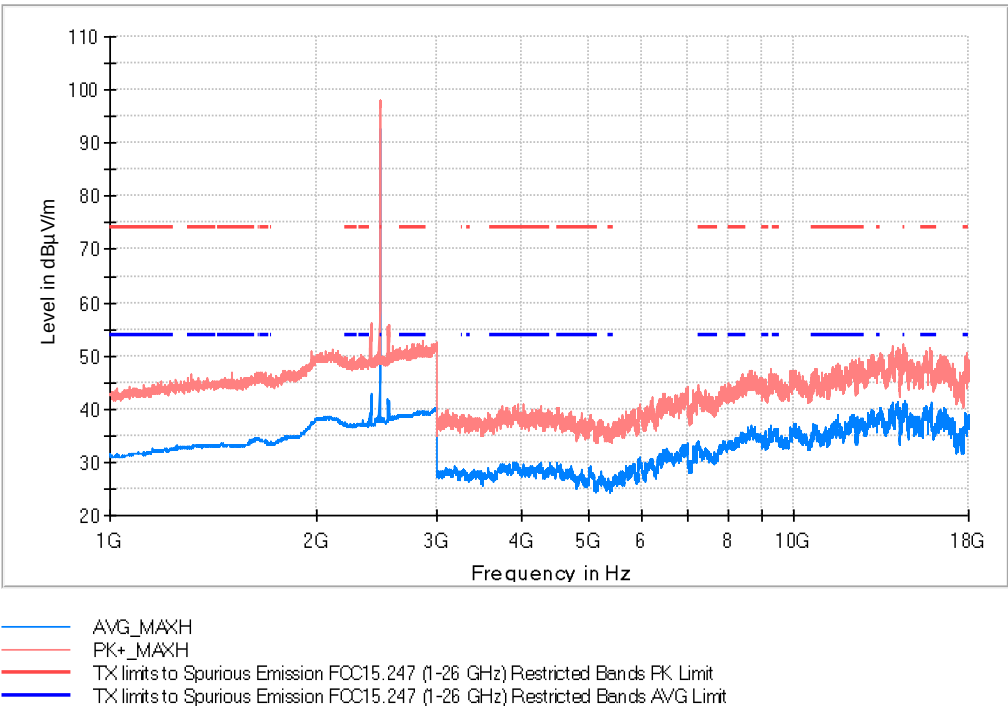


Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
2339.000000	54.9	41.1	H	12.9	54.0	Fundamental
2402.000000	101.9	97.2	H	---	---	
15874.000000	50.5	42.0	H	12.0	54.0	

Frequency range 1 - 18 GHz

Highest Channel

Frequency MHz = 2480.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Modulation = BTLE 5.1 (GFSK 2 Mbit/s), Frequency Range GHz = [1, 18]

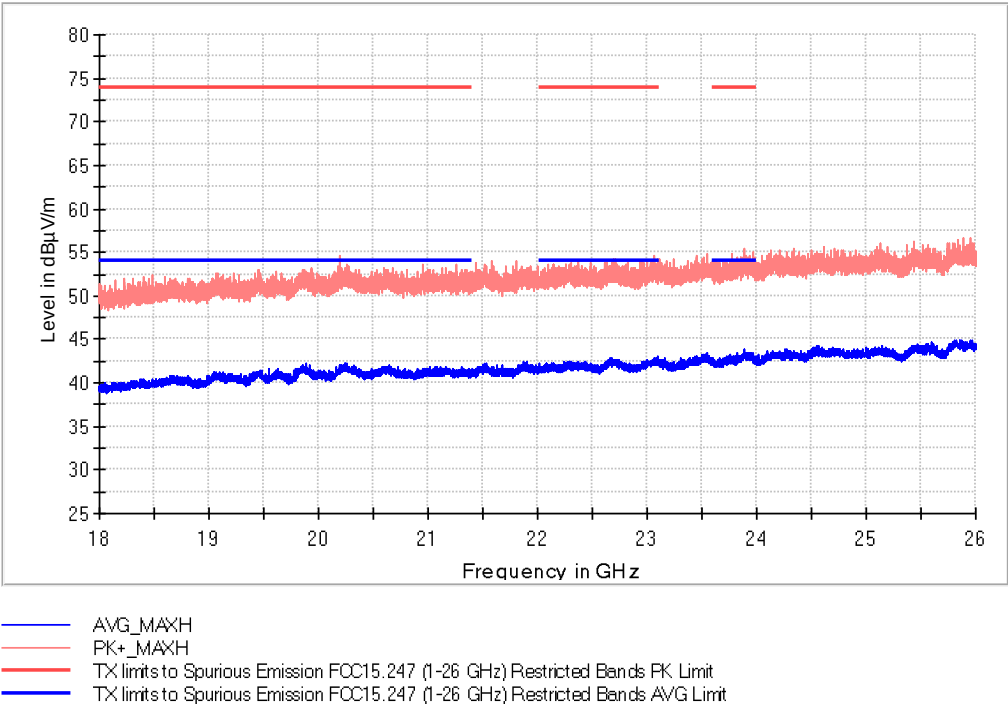


Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
2480.000000	96.6	92.8	H	---	---	Fundamental
2868.000000	52.8	39.2	H	14.8	54.0	
15867.500000	50.0	41.2	H	12.8	54.0	

Frequency range 18 - 26 GHz

Lowest Channel

Frequency MHz = 2402.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Modulation = BTLE 5.1 (GFSK 2 Mbit/s), Frequency Range GHz = [18, 26]

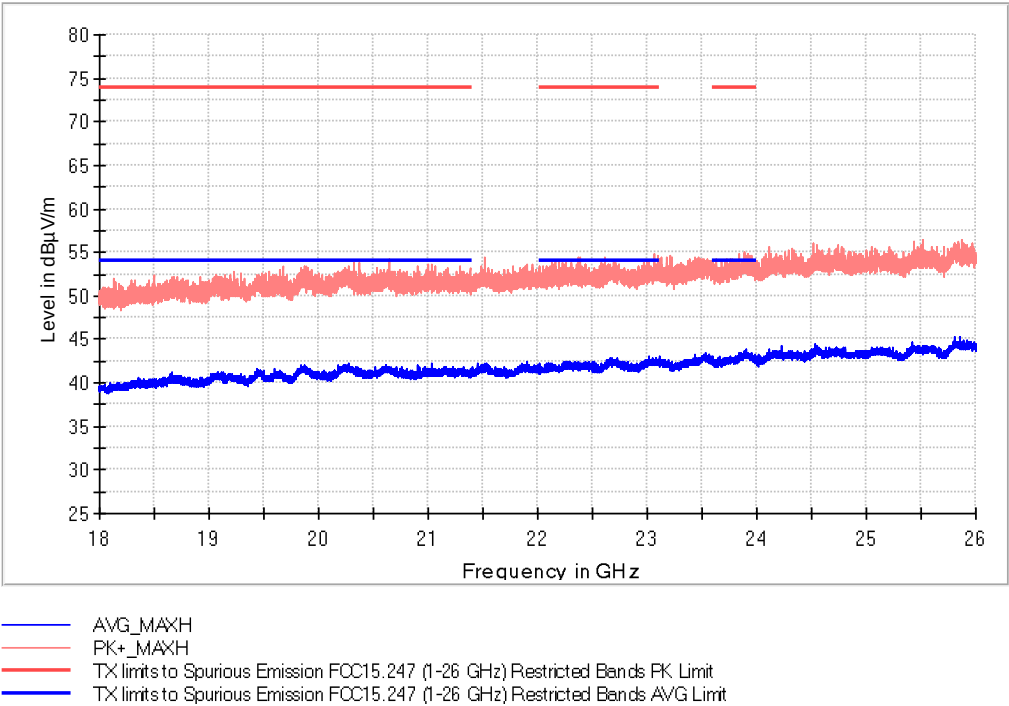


Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
20198.000000	54.6	41.4	V	12.6	54.0
23060.000000	54.6	42.4	V	11.6	54.0
23894.000000	55.4	43.1	V	10.9	54.0

Frequency range 18 - 26 GHz

Middle Channel

Frequency MHz = 2440.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Modulation = BTLE 5.1 (GFSK 2 Mbit/s), Frequency Range GHz = [18, 26]

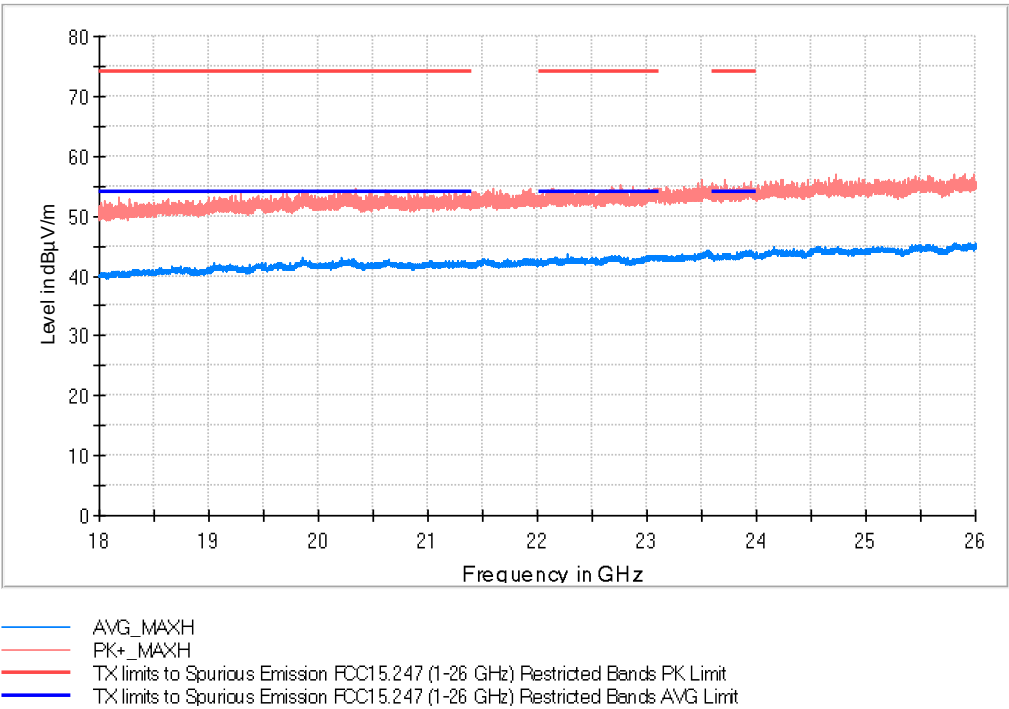


Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
20638.500000	54.3	41.7	H	12.3	54.0
23069.000000	54.8	42.5	H	11.5	54.0
23885.000000	55.1	42.9	H	11.1	54.0

Frequency range 18 - 26 GHz

Highest Channel

Frequency MHz = 2480.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Modulation = BTLE 5.1 (GFSK 2 Mbit/s), Frequency Range GHz = [18, 26]

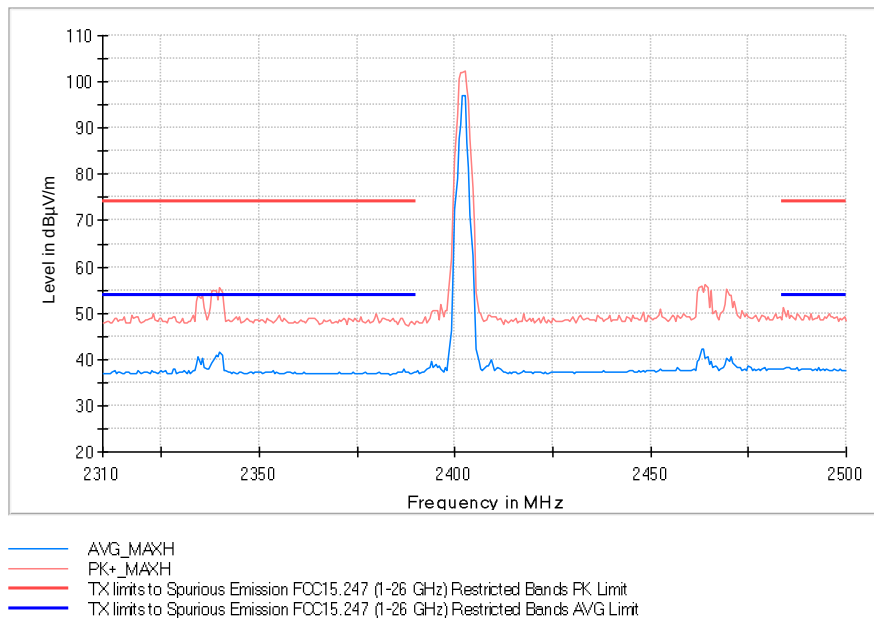


Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
20589.000000	52.2	42.3	H	11.7	54.0
22682.500000	53.7	43.0	H	11.0	54.0
23903.500000	52.9	44.0	H	10.0	54.0

Restricted Bands (2.31 GHz - 2.5 GHz)

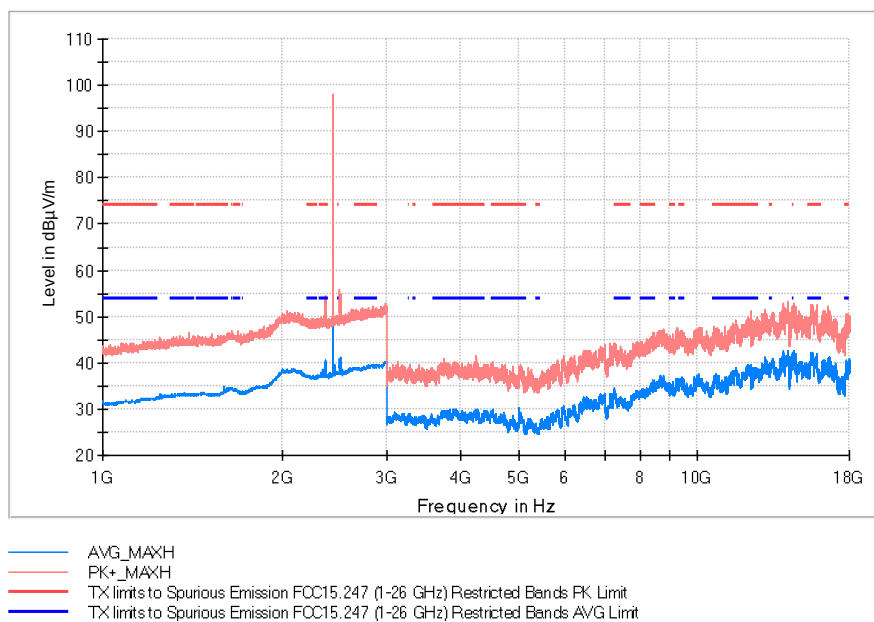
Lowest Channel

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Modulation = BTLE 5.1 (GFSK 2 Mbit/s), Frequency Range GHz = [1, 18]



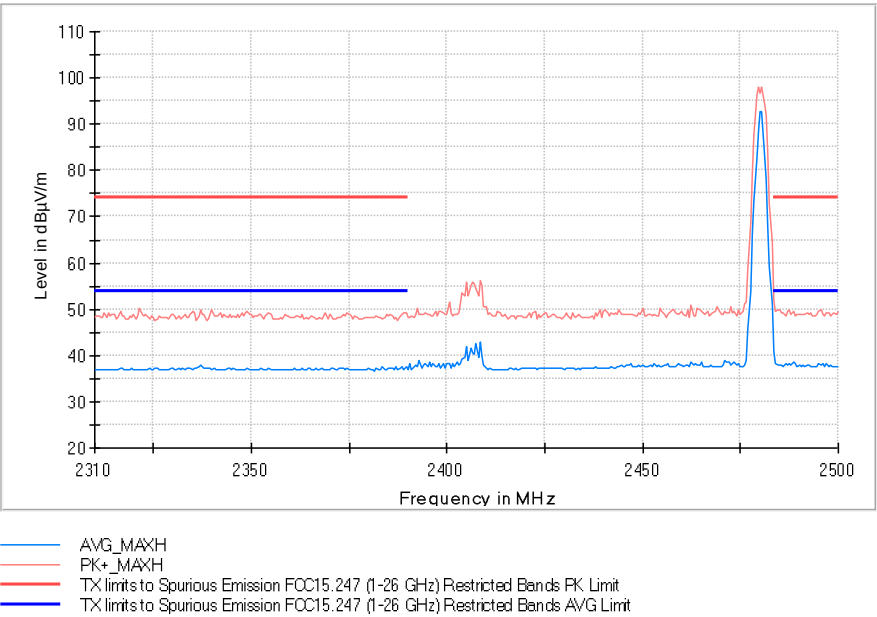
Middle Channel

Frequency MHz = 2440.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Modulation = BTLE 5.1 (GFSK 2 Mbit/s), Frequency Range GHz = [1, 18]



Highest Channel

Frequency MHz = 2480.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Modulation = BTLE 5.1 (GFSK 2 Mbit/s), Frequency Range GHz = [1, 18]



Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	48.5 kHz	RMS ; PK+	100 kHz	1 s	20 dB

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
1 GHz - 3 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s	20 dB
3 GHz - 18 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s	20 dB

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
18 GHz - 26 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s	20 dB

Appendix B: Test results. Bluetooth EDR

Appendix B

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PRODUCT INFORMATION

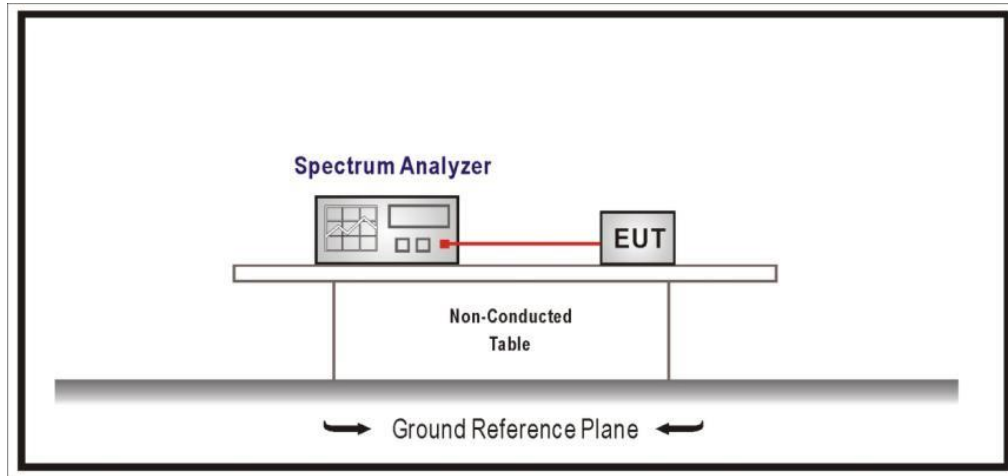
Information	Description
Modulation	GFSK, $\pi/4$ -DQPSK, 8-DPSK
Operation mode 1:	
Operating Frequency Range	2402 – 2480 MHz
Nominal Channel Bandwidth	1 MHz
RF Output Power	10 dBm
Antenna type	External Antenna
Antenna gain	-2.5 dBi
Nominal Voltage	
- Supply Voltage	13.2 Vdc
- Type of power source	DC voltage
Equipment type	Bluetooth Classic

TEST CONDITIONS

(*): Data provided by the client.

TEST CONDITIONS	DESCRIPTION
TC/01	<u>Power supply (V):</u> V_{nominal}: 13.2 Vdc <u>Temperature:</u> T_{nominal}: +15 to +35 °C <u>Modulation:</u> GFSK <u>Test Frequencies for conducted/Radiated tests:</u> Lowest range: 2402 MHz Middle channel: 2441 MHz Highest range: 2480 MHz
TC/02	<u>Power supply (V):</u> V_{nominal}: 13.2 Vdc <u>Temperature:</u> T_{nominal}: +15 to +35 °C <u>Modulation:</u> π/4-DQPSK <u>Test Frequencies for Conducted/Radiated tests:</u> Lowest range: 2402 MHz Middle channel: 2441 MHz Highest range: 2480 MHz
TC/03	<u>Power supply (V):</u> V_{nominal}: 13.2 Vdc <u>Temperature:</u> T_{nominal}: +15 to +35 °C <u>Modulation:</u> 8-DPSK <u>Test Frequencies for Conducted/Radiated tests:</u> Lowest range: 2402 MHz Middle channel: 2441 MHz Highest range: 2480 MHz

CONDUCTED MEASUREMENTS:



RADIATED MEASUREMENTS:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at 3 m for the frequency range 30-1000 MHz (Bilog antenna) and 1-18 GHz Double ridge horn antennas, and 1m for the frequency range 18 GHz- 26 GHz Double ridge horn antenna.

For radiated emissions in the range 18 - 26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

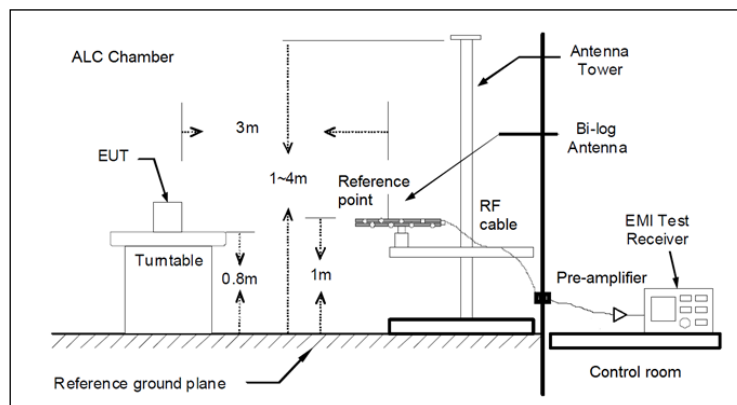


Fig A1: Radiated measurements Setup $f < 1$ GHz

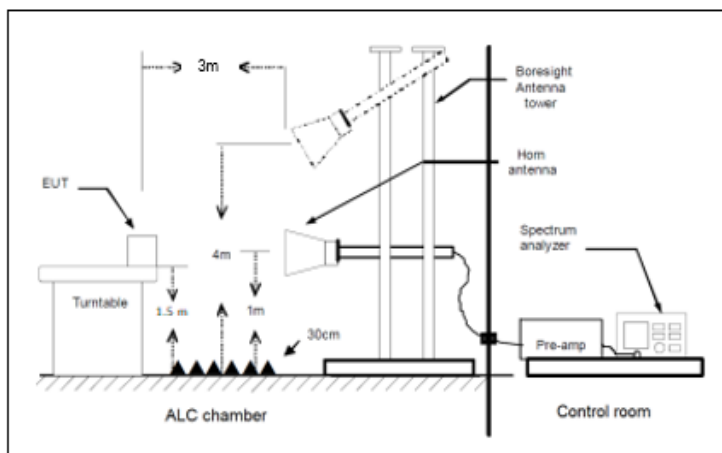


Fig A2: Radiated measurements setup $f > 1-18$ GHz

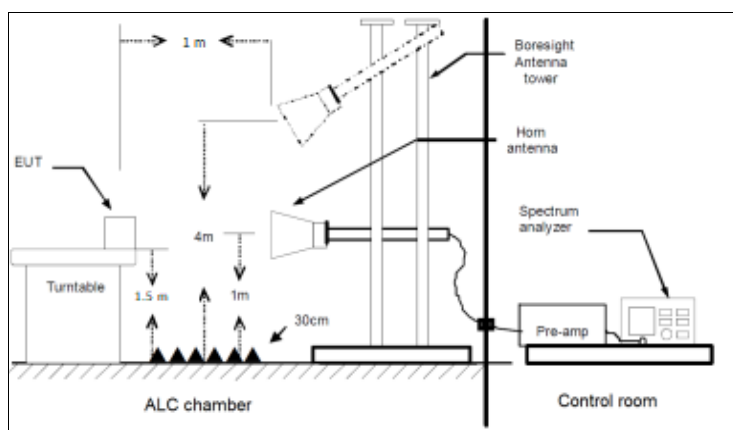


Fig A3: Radiated measurements setup $f > 18$ GHz

TEST CASES DETAILS

RSS-247 5.1 (b) / FCC 15.247 (a) (1) [20dBW] 20 dB Bandwidth

Limits

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Modulation: BT (GFSK 1-DH5)

Results

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Port	20Ebw (MHz)
2402.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	0.895
2441.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	0.895
2480.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	0.895

Modulation: BT (Π/4 DQPSK 2-DH5)

Results

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Port	26Ebw (MHz)
2402.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	1.290
2441.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	1.295
2480.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	1.295

Modulation: BT (8DPSK 3-DH5)

Results

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Port	26Ebw (MHz)
2402.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	1.305
2441.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	1.280
2480.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	1.280

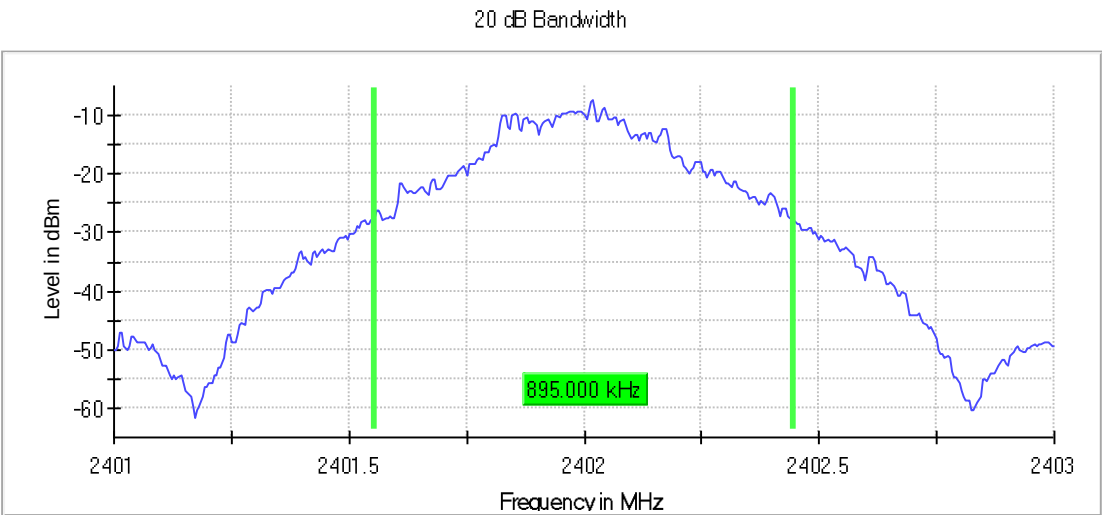
Verdict

Pass

Attachments

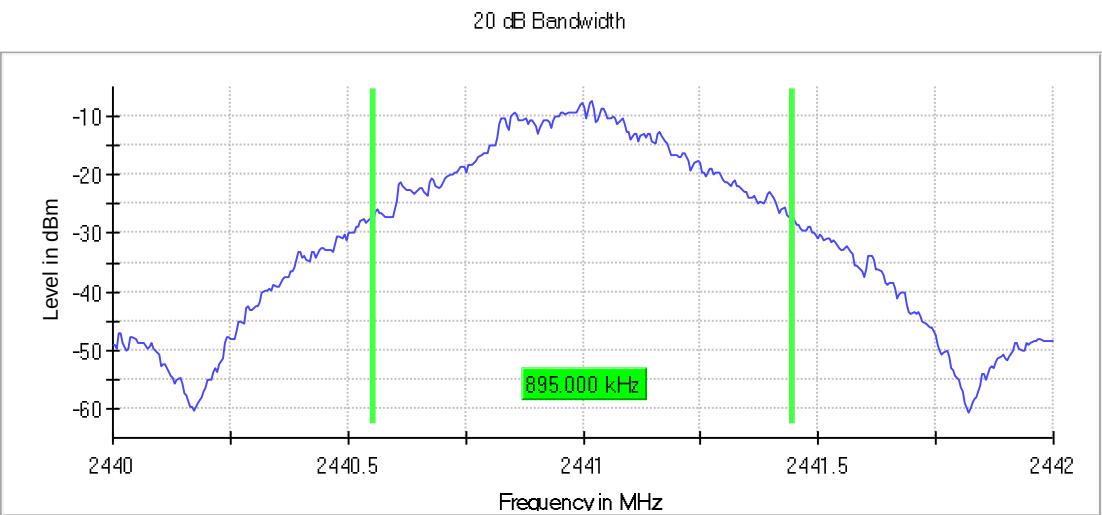
Frequency MHz = 2402.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Bandwidth MHz = 1, Modulation = BT (GFSK 1-DH5), Number of Transmission Chains = 1, Active Port = 1

Images:



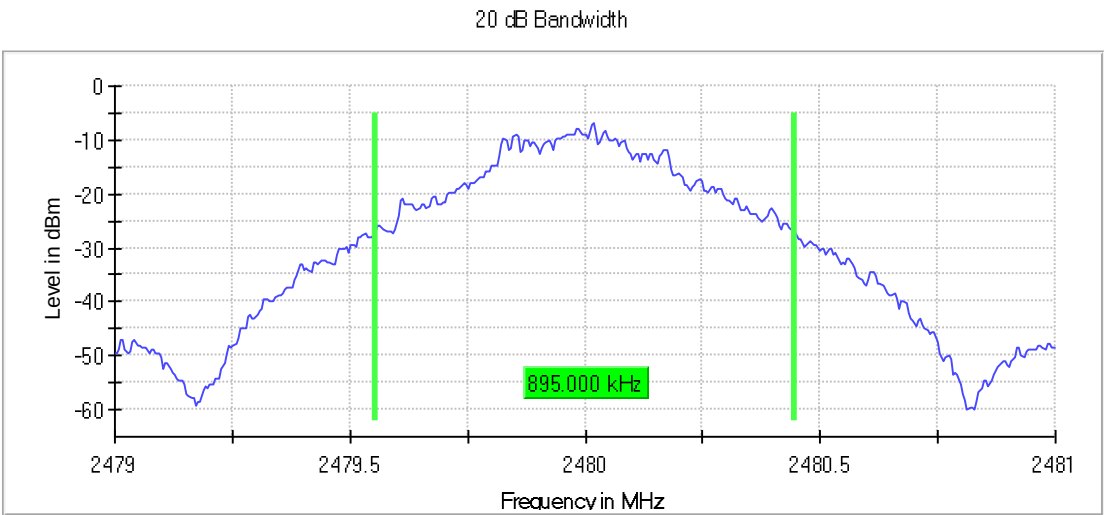
Frequency MHz = 2441.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
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Images:



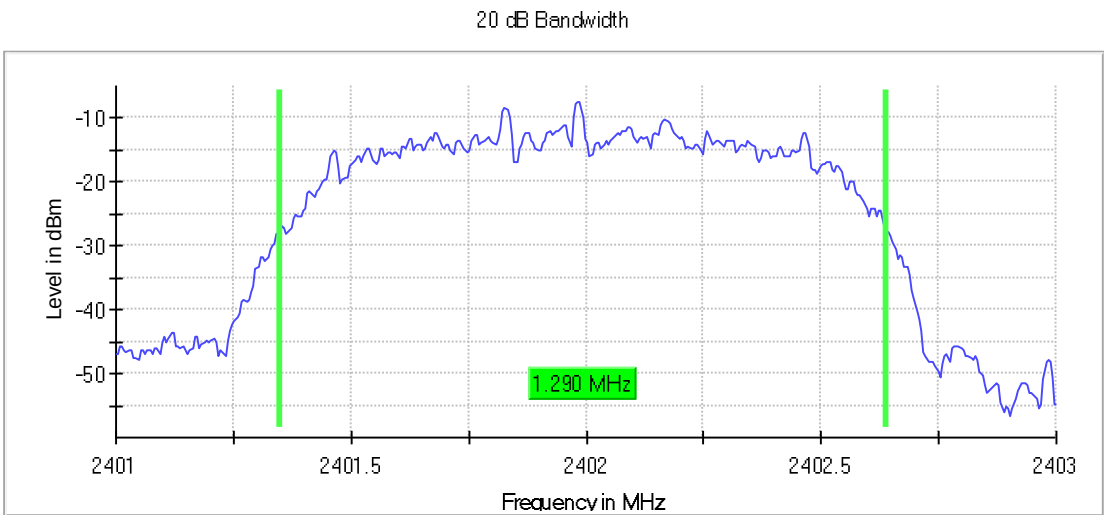
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Bandwidth MHz = 1, Modulation = BT (GFSK 1-DH5), Number of Transmission Chains = 1, Active Port = 1

Images:



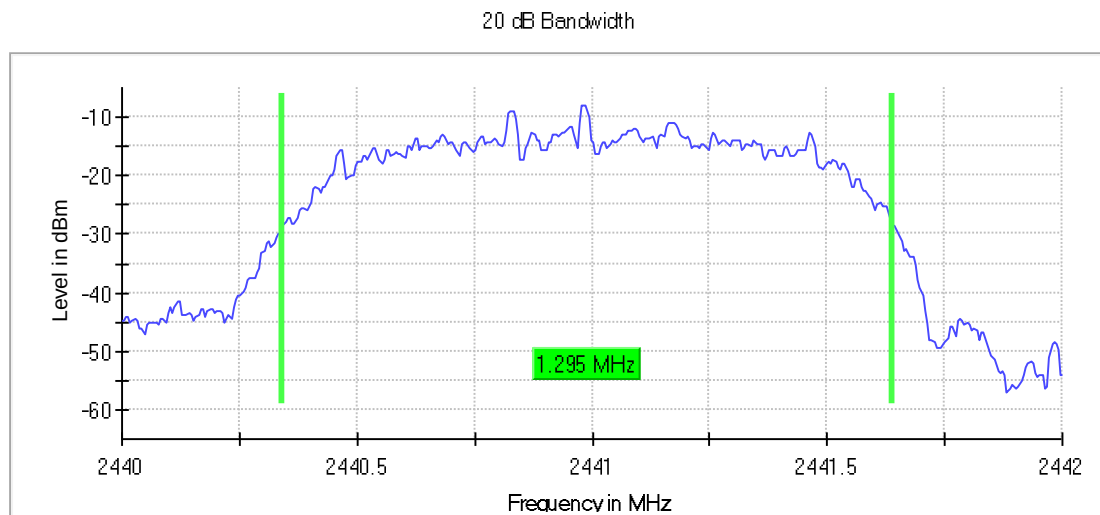
Frequency MHz = 2402.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Bandwidth MHz = 1, Modulation = BT (Π/4 DQPSK 2-DH5), Number of Transmission Chains = 1, Active Port = 1

Images:



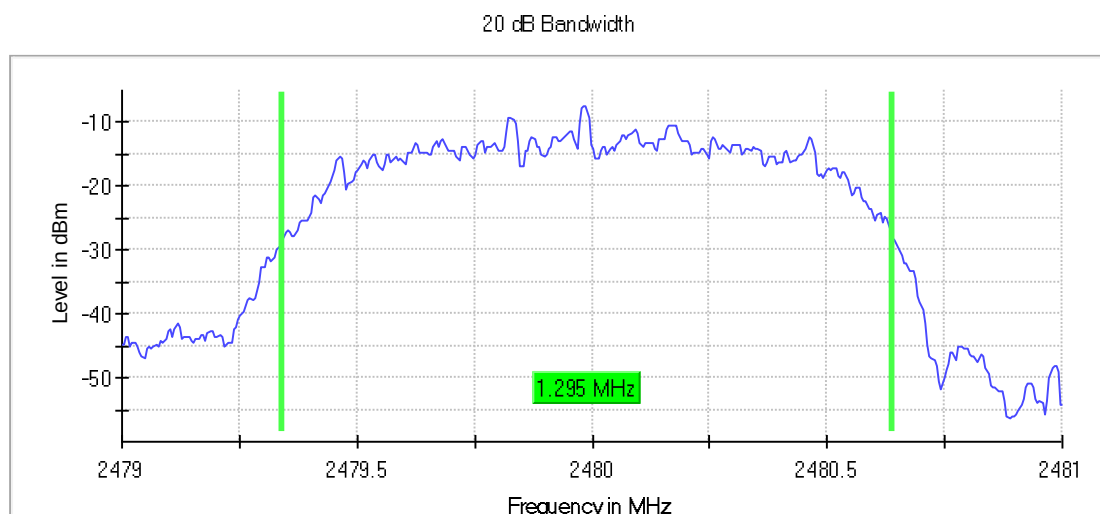
Frequency MHz = 2441.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Bandwidth MHz = 1, Modulation = BT ($\pi/4$ DQPSK 2-DH5), Number of Transmission Chains = 1, Active
Port = 1

Images:



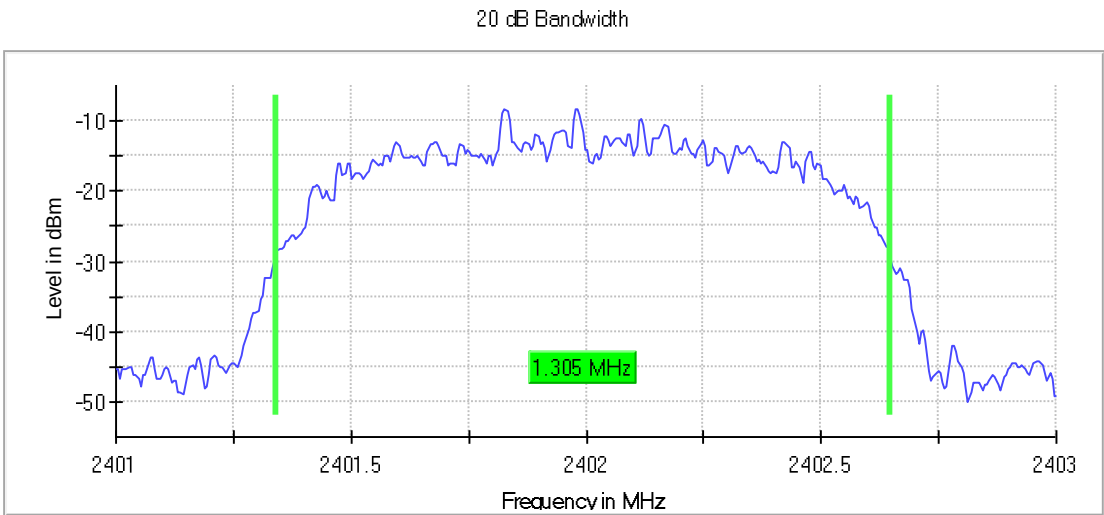
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Port = 1

Images:



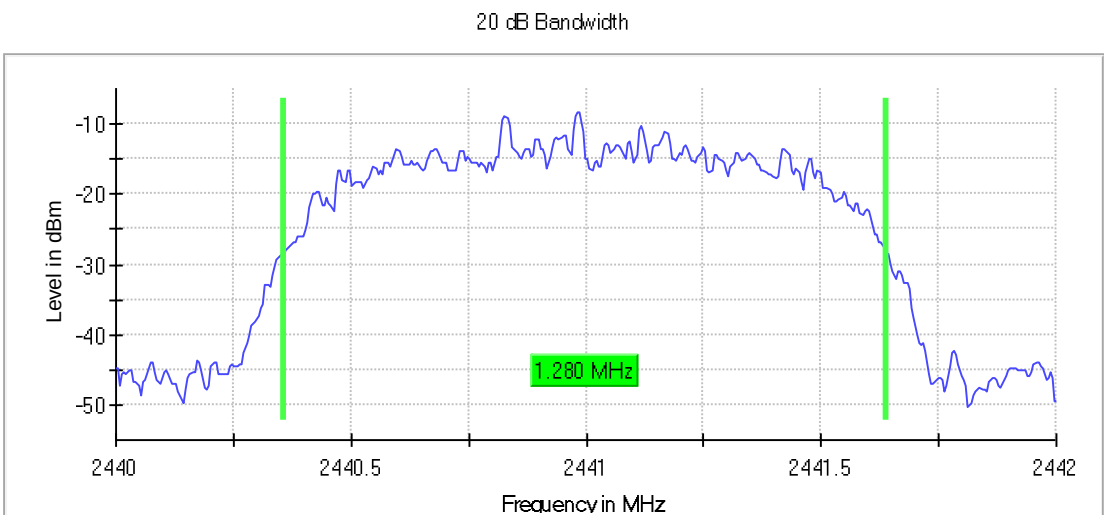
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Images:



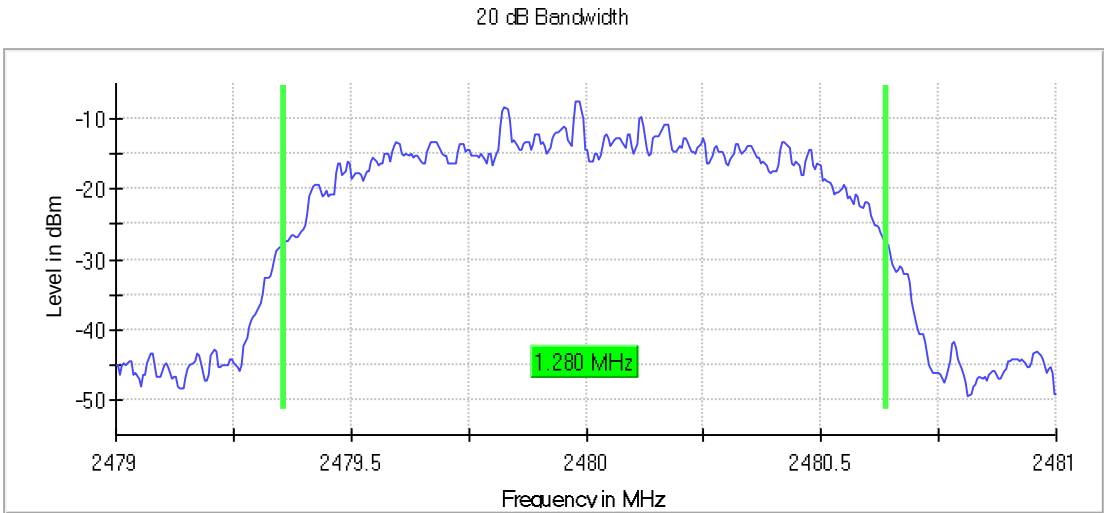
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Bandwidth MHz = 1, Modulation = BT (8DPSK 3-DH5), Number of Transmission Chains = 1, Active Port = 1

Images:



Frequency MHz = 2480.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Bandwidth MHz = 1, Modulation = BT (8DPSK 3-DH5), Number of Transmission Chains = 1, Active Port = 1

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value	Instrument Value	Instrument Value
Start Frequency	2.40100 GHz	2.43900 GHz	2.47900 GHz
Stop Frequency	2.40300 GHz	2.44100 GHz	2.48100 GHz
Span	2.000 MHz	2.000 MHz	2.000 MHz
RBW	10.000 kHz	10.000 kHz	10.000 kHz
VBW	30.000 kHz	30.000 kHz	30.000 kHz
Sweep Points	400	400	400
Sweep time	189.648 μs	189.648 μs	189.648 μs
Reference Level	10.000 dBm	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	30.000 dB	30.000 dB
Detector	MaxPeak	MaxPeak	MaxPeak
Sweep Count	200	200	200
Filter	3 dB	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Max Hold
Sweep type	FFT	FFT	FFT
Preamp	off	off	off
Stable mode	Trace	Trace	Trace
Stable value	0.50 dB	0.50 dB	0.50 dB
Run	12 / max. 150	8 / max. 1150150	9 / max. 150
Stable	5 / 5	5 / 5	5 / 5
Max Stable Difference	0.09 dB	0.10 dB	0.04 dB

FCC 2.1049 / 99dBw Occupied Channel Bandwidth 99%

Limits

No Limit has been set to this test case

Modulation: BT (GFSK 1-DH5)

Results

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Port	Occ Ch BW (MHz)
2402.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	0.860
2441.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	0.860
2480.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	0.860

Modulation: BT (Π/4 DQPSK 2-DH5)

Results

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Port	Occ Ch BW (MHz)
2402.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	1.170
2441.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	1.175
2480.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	1.175

Modulation: BT (8DPSK 3-DH5)

Results

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Port	Occ Ch BW (MHz)
2402.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	1.180
2441.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	1.180
2480.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	1.180

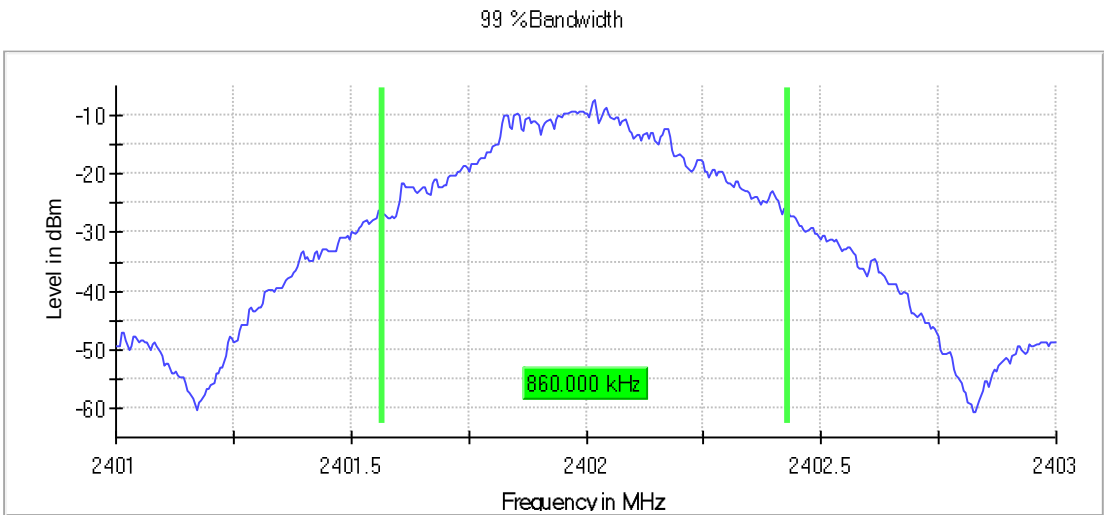
Verdict

Pass

Attachments

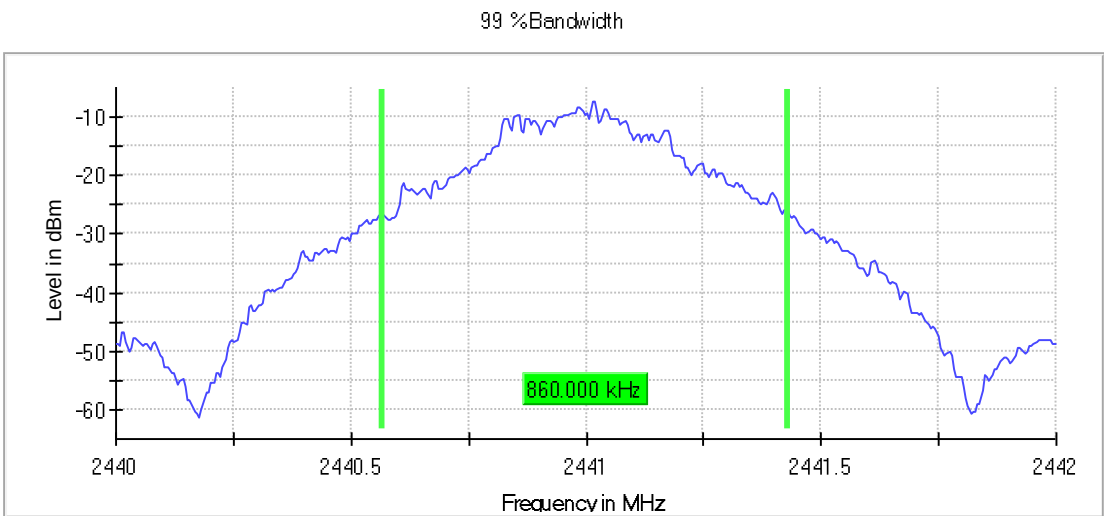
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Images:



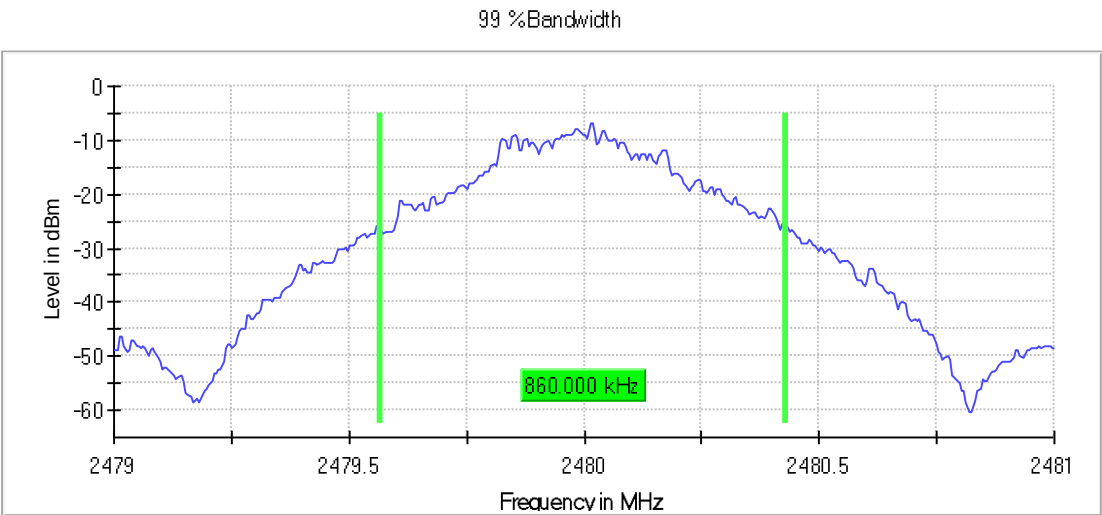
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Images:



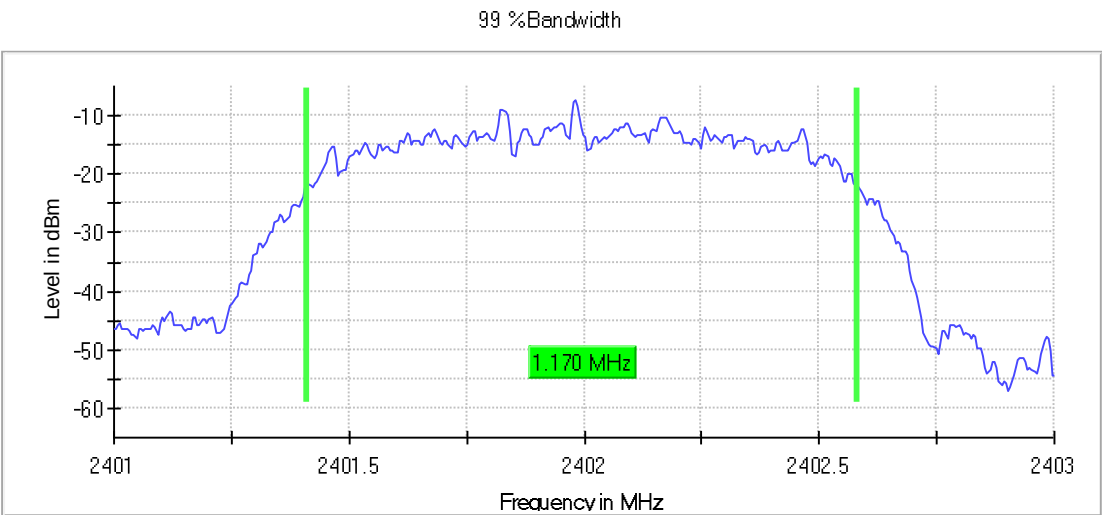
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Images:



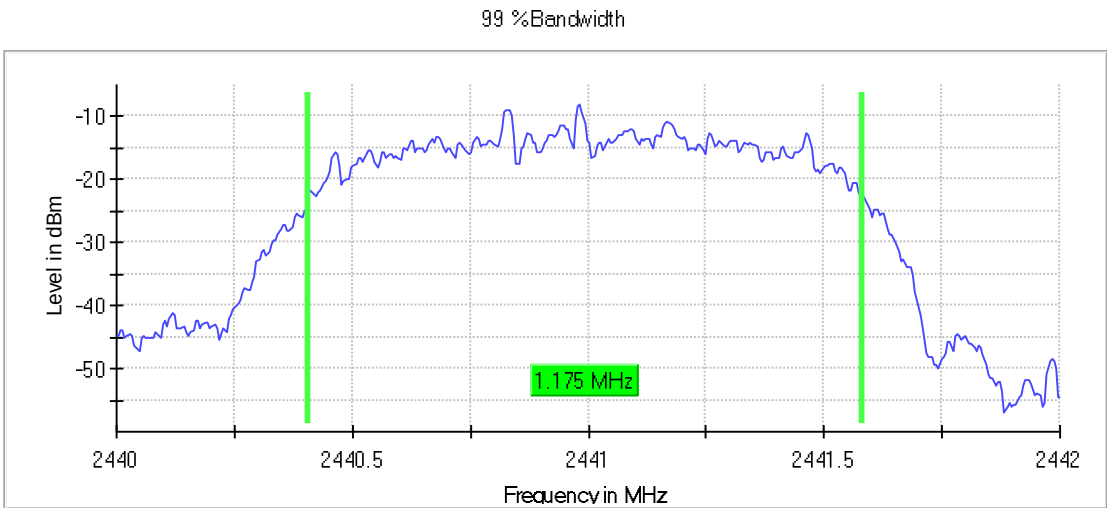
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Bandwidth MHz = 1, Modulation = BT ($\pi/4$ DQPSK 2-DH5), Number of Transmission Chains = 1, Active Port = 1

Images:



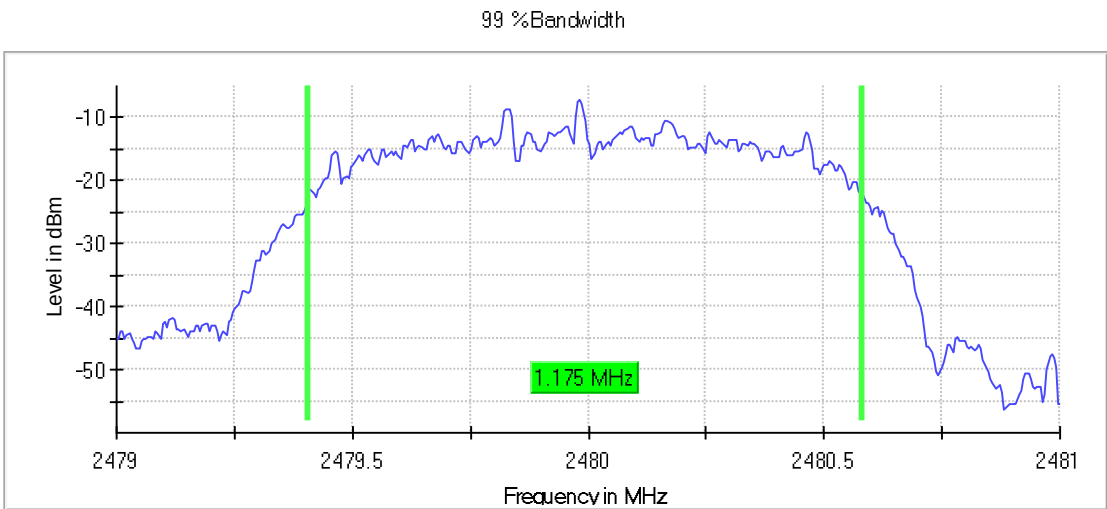
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Port = 1

Images:



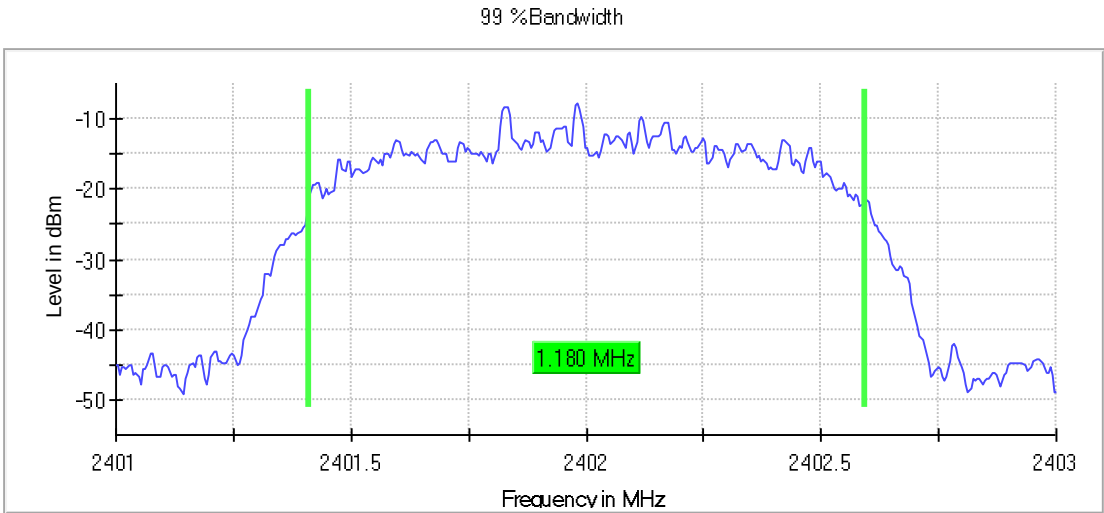
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Port = 1

Images:



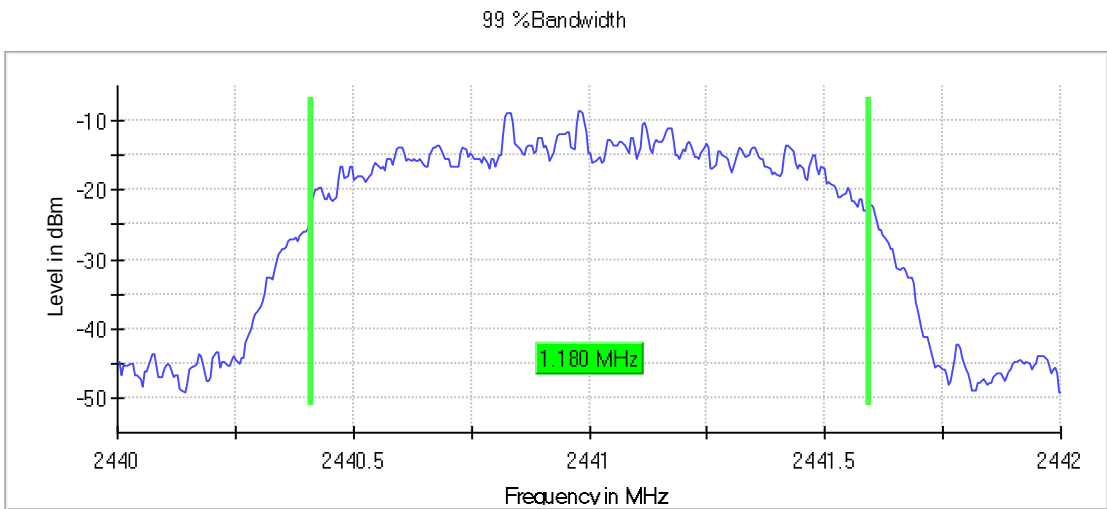
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Images:



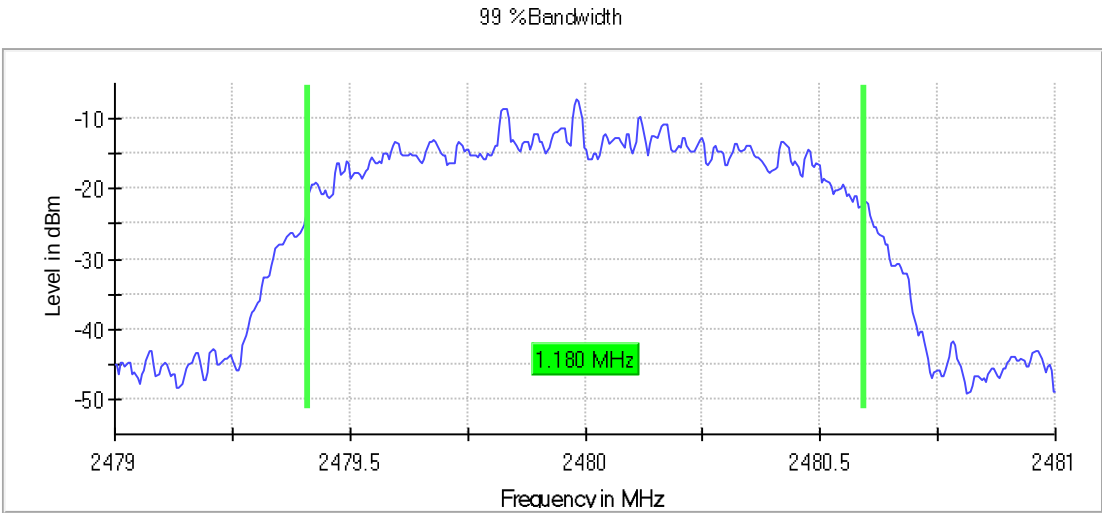
Frequency MHz = 2441.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Bandwidth MHz = 1, Modulation = BT (8DPSK 3-DH5), Number of Transmission Chains = 1, Active Port = 1

Images:



Frequency MHz = 2480.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Bandwidth MHz = 1, Modulation = BT (8DPSK 3-DH5), Number of Transmission Chains = 1, Active Port = 1

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value	Instrument Value	Instrument Value
Start Frequency	2.40100 GHz	2.43900 GHz	2.47900 GHz
Stop Frequency	2.40300 GHz	2.44100 GHz	2.48100 GHz
Span	2.000 MHz	2.000 MHz	2.000 MHz
RBW	10.000 kHz	10.000 kHz	10.000 kHz
VBW	30.000 kHz	30.000 kHz	30.000 kHz
Sweep Points	400	400	400
Sweep time	189.648 μs	189.648 μs	189.648 μs
Reference Level	10.000 dBm	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	30.000 dB	30.000 dB
Detector	MaxPeak	MaxPeak	MaxPeak
Sweep Count	500	500	500
Filter	3 dB	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Max Hold
Sweep type	FFT	FFT	FFT
Preamp	off	off	off
Stable mode	Trace	Trace	Trace
Stable value	0.30 dB	0.30 dB	0.30 dB
Run	5 / max.150	5 / max.150	6 / max.150
Stable	3 / 3	3 / 3	3 / 3
Max Stable Difference	0.17 dB	0.08 dB	0.12 dB

RSS-247 5.1 (b) / FCC 15.247 (a) (1) [CFS] Carrier Frequency Separation

Limits

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW

Modulation: BT (GFSK 1-DH5)

Results

Equipment	BW (MHz)	# of Tx Chains	Port	Freq Sep (MHz)
Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	0.98

Modulation: BT ($\pi/4$ DQPSK 2-DH5)

Results

Equipment	BW (MHz)	# of Tx Chains	Port	Freq Sep (MHz)
Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	1.04

Modulation: BT (8DPSK 3-DH5)

Results

Equipment	BW (MHz)	# of Tx Chains	Port	Freq Sep (MHz)
Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	1.04

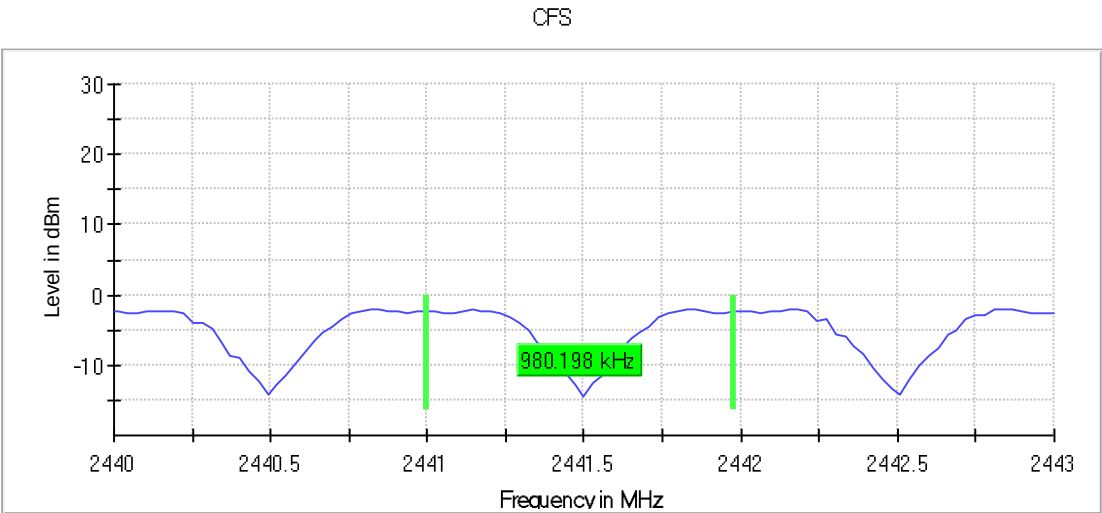
Verdict

Pass

Attachments

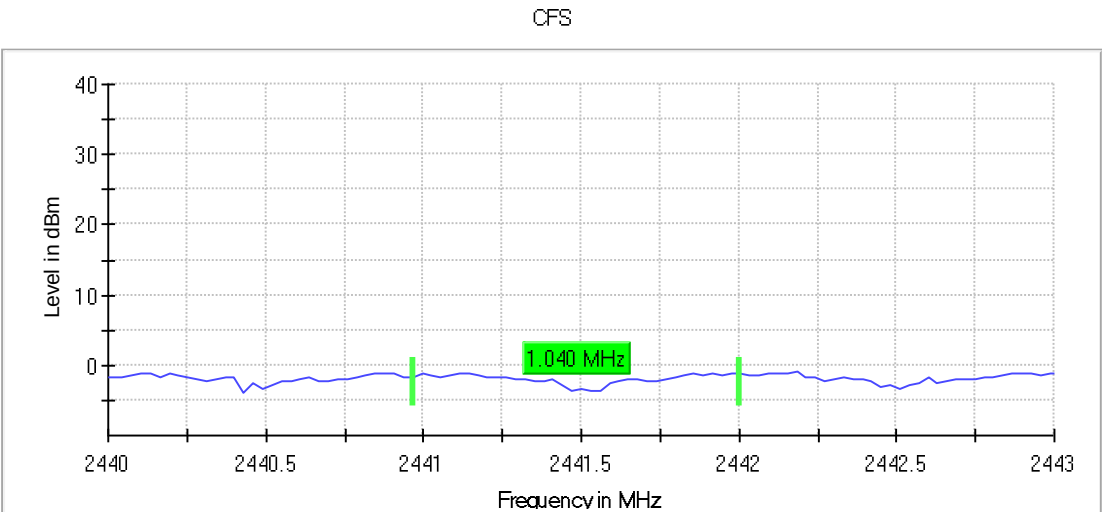
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Images:



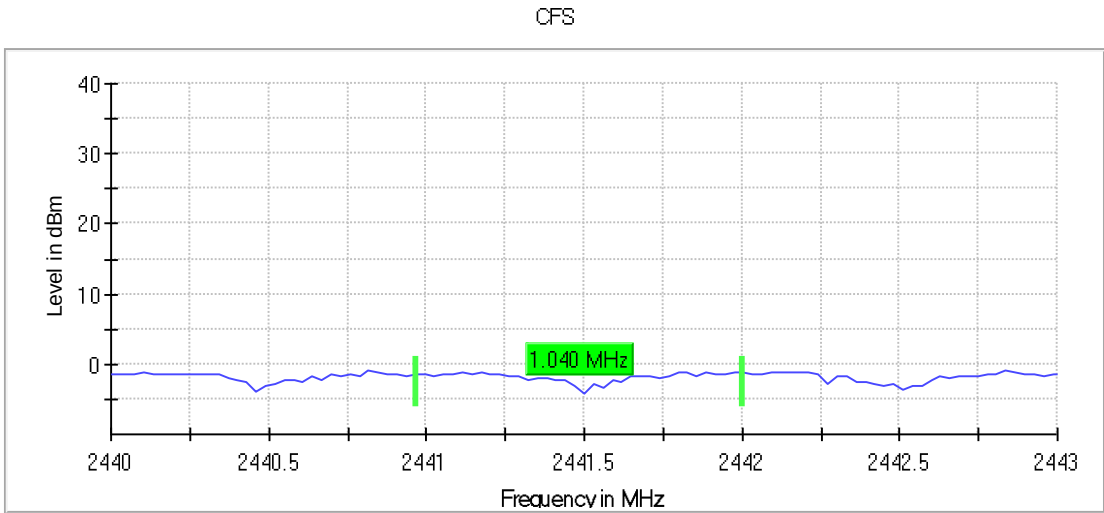
Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Bandwidth MHz = 1, Modulation = BT ($\pi/4$ DQPSK 2-DH5), Number of Transmission Chains = 1, Active Port = 1

Images:



Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Bandwidth MHz = 1, Modulation = BT (8DPSK 3-DH5), Number of Transmission Chains = 1, Active Port = 1

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value	Instrument Value	Instrument Value
Start Frequency	2.40100 GHz	2.43900 GHz	2.47900 GHz
Stop Frequency	2.40300 GHz	2.44100 GHz	2.48100 GHz
Span	2.00 MHz	2.00 MHz	2.00 MHz
RBW	10.000 KHz	10.000 KHz	10.000 KHz
VBW	30.000 kHz	30.000 kHz	30.000 kHz
Sweep Points	400	400	400
Sweep time	189.648 μs	189.648 μs	189.648 μs
Reference Level	10.000 dBm	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	30.000 dB	30.000 dB
Detector	MaxPeak	MaxPeak	MaxPeak
Sweep Count	200	200	200
Filter	3 dB	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Max Hold
Sweep type	FFT	FFT	FFT
Preamp	off	off	off
Stable mode	Trace	Trace	Trace
Stable value	0.50 dB	0.50 dB	0.50 dB
Run	10 / max. 150	7 / max. 150	8 / max. 150
Stable	5 / 5	5 / 5	5 / 5
Max Stable Difference	0.10 dB	0.10 dB	0.07 dB

RSS-247 5.1 (d) / FCC 15.247 (a) (1) (iii) Time of Occupancy (Dwell Time)

Limits

The average time of occupancy on any channel shall not be greater than 0.4 seconds (400 ms) within a period of 0.4 seconds multiplied by the number of hopping channels employed = $0.4 \times 79 = 31.6$ seconds.

Modulation: BT (GFSK 1-DH5)

Results

Equipment	BW (MHz)	# of Tx Chains	Port	NHp	Avg COT (ms)
Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	2	2.39

Modulation: BT (π/4 DQPSK 2-DH5)

Results

Equipment	BW (MHz)	# of Tx Chains	Port	NHp	Avg COT (ms)
Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	1	3.60

Modulation: BT (8DPSK 3-DH5)

Results

Equipment	BW (MHz)	# of Tx Chains	Port	NHp	Avg COT (ms)
Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	5	13.82

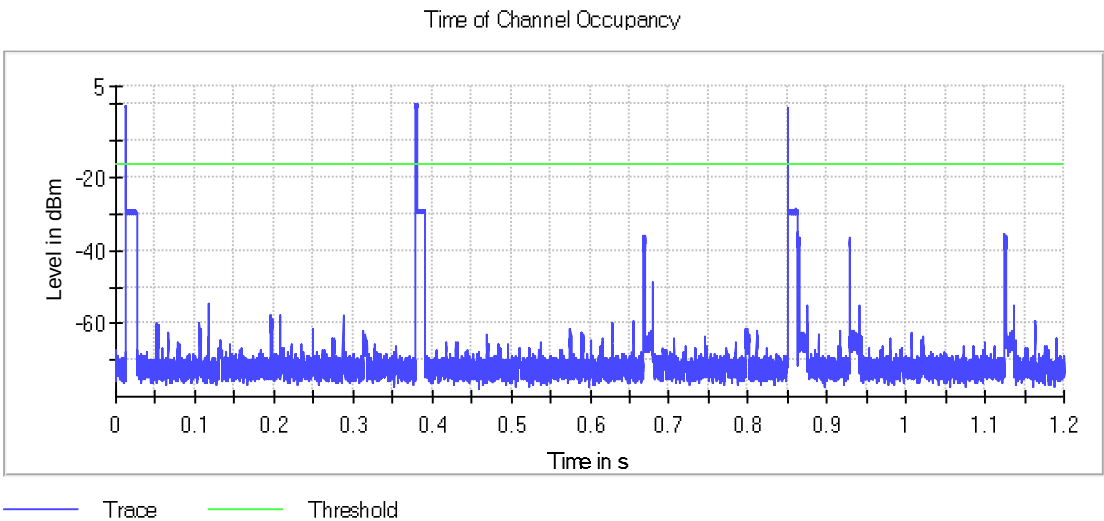
Verdict

Pass

Attachments

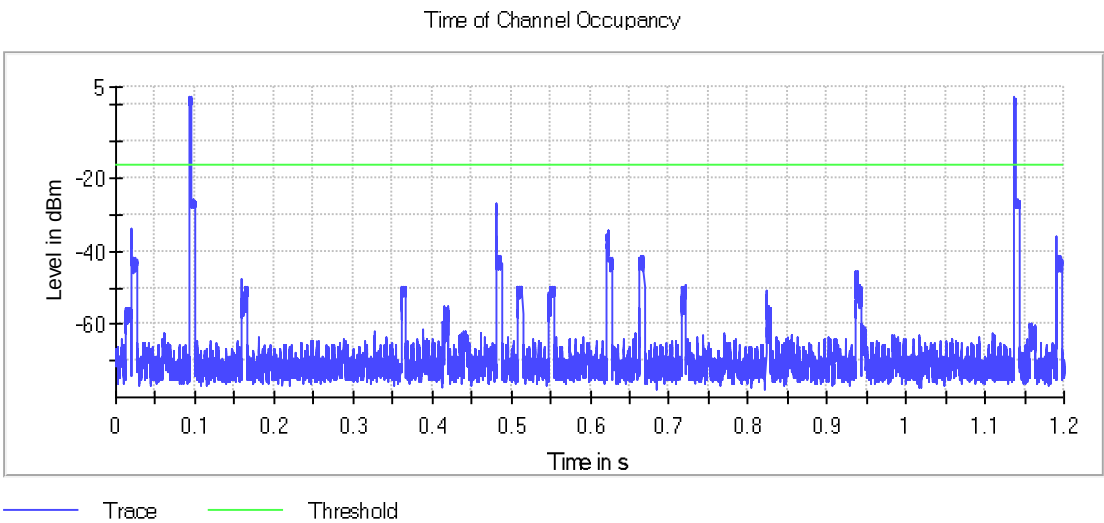
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Images:



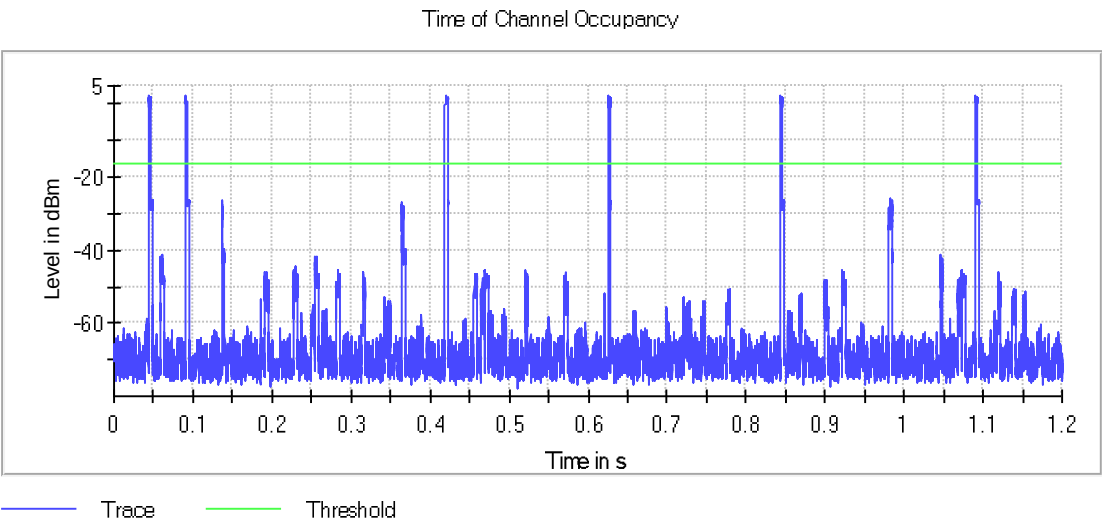
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Images:



Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Bandwidth MHz = 1, Modulation = BT (8DPSK 3-DH5), Number of Transmission Chains = 1, Active Port = 1

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value
Center Frequency	2.44100 GHz
Span	ZeroSpan
RBW	500.000 kHz
VBW	1.000 MHz
SweepPoints	30001
Sweeptime	1.200 s
Reference Level	-10.000 dBm
Attenuation	0.000 dB
Detector	MaxPeak
SweepCount	1
Filter	Channel
Trace Mode	Clear Write
Sweeptype	Sweep
Preamp	off
Trigger	External
Trigger Offset	0.000 s

OSP

Setting	Instrument Value
Measurement Time	1.200 s
Tracepoints	1199999
Time resolution	1.000 μs
Detector	RMS

RSS-247 5.1 (d) / FCC 15.247 (a) (1) (iii) [NHC] Number of hopping channels

Limits

Frequency hopping system in the 2400-2483.5 MHz band shall use at least 15 channels

Modulation: BT (GFSK 1-DH5)

Results

Equipment	BW (MHz)	# of Tx Chains	Port	NHC
Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	79

Modulation: BT (Π/4 DQPSK 2-DH5)

Results

Equipment	BW (MHz)	# of Tx Chains	Port	NHC
Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	81

Modulation: BT (8DPSK 3-DH5)

Results

Equipment	BW (MHz)	# of Tx Chains	Port	NHC
Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	81

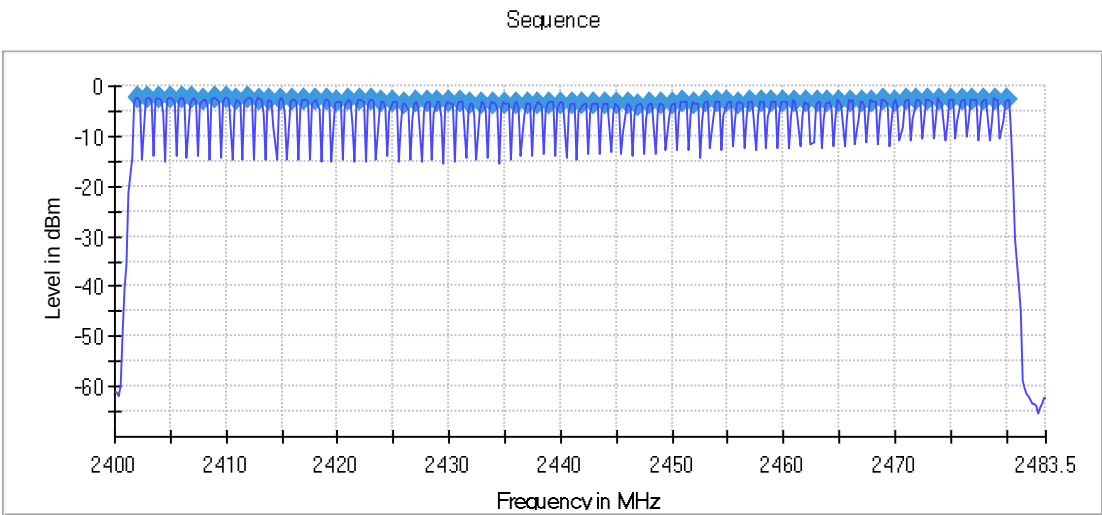
Verdict

Pass

Attachments

Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Bandwidth MHz = 1, Modulation = BT (GFSK 1-DH5), Number of Transmission Chains = 1, Active Port = 1

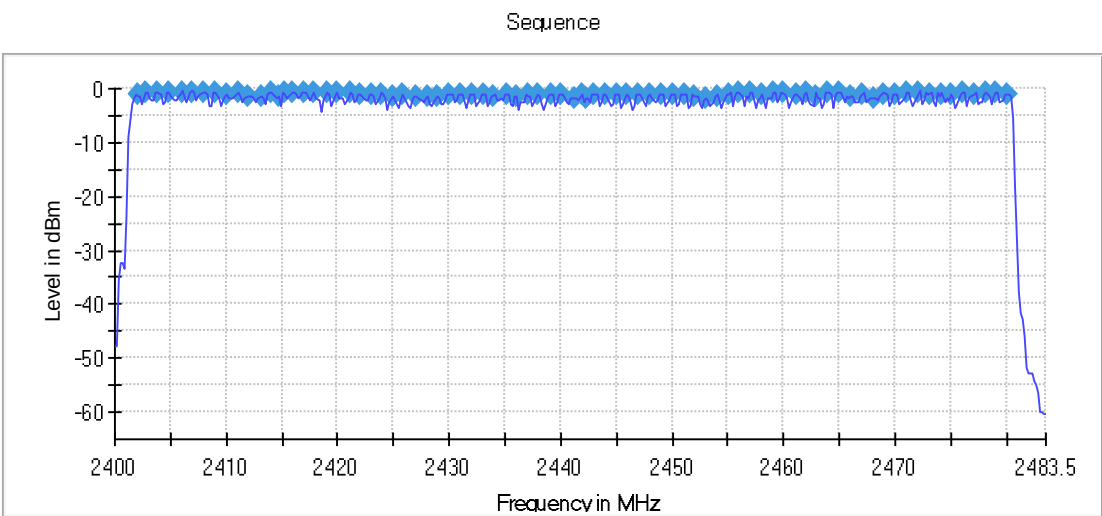
Images:



Attachments

Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Bandwidth MHz = 1, Modulation = BT ($\pi/4$ DQPSK 2-DH5), Number of Transmission Chains = 1, Active Port = 1

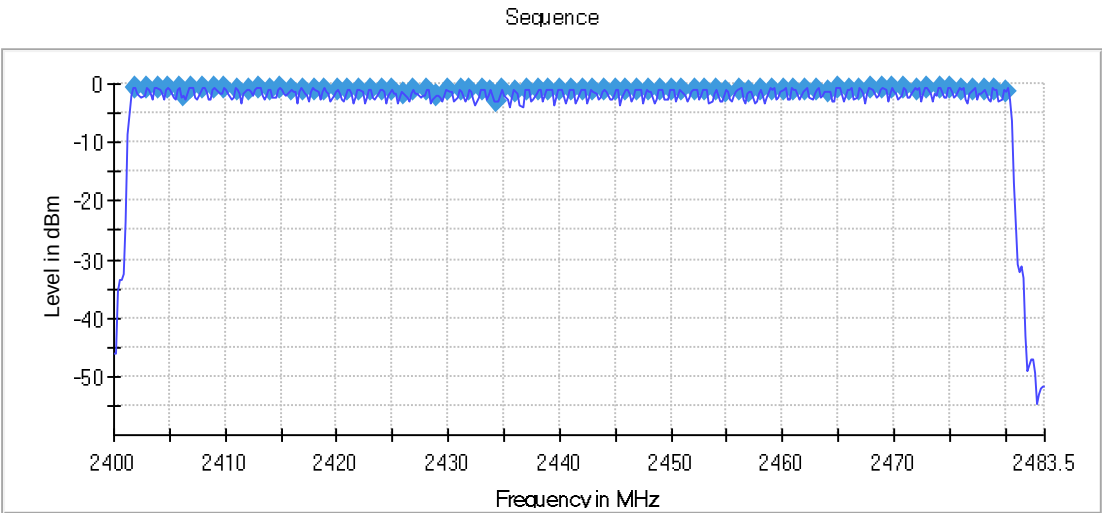
Images:



Attachments

Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Bandwidth MHz = 1, Modulation = BT (8DPSK 3-DH5), Number of Transmission Chains = 1, Active Port = 1

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value
Start Frequency	2.40000 GHz
Stop Frequency	2.48350 GHz
Span	83.500 MHz
RBW	200.000 kHz
VBW	200.000 kHz
SweepPoints	418
Sweeptime	47.405 μ s
Reference Level	0.000 dBm
Attenuation	20.000 dB
Detector	MaxPeak
SweepCount	100
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	FFT
Preamp	off
Stablemode	Trace
Stablevalue	0.50 dB
Run	52 / max. 150
Stable	3 / 3
Max Stable Difference	0.28 dB

RSS-247 5.4 (b) / FCC 15.247 (b) (1) [Pkc] Maximum Peak Conducted output power

Limits

For Frequency Hopping systems operating in the 2400 – 2483.5 MHz band employing at least 75 hopping channels: 1 watt (30 dBm). (Part 15 Subpart C §15.247). The e.i.r.p. shall not exceed 4 W (RSS-247).

Maximum declared antenna gain: -2.5 dBi

Modulation: BT (GFSK 1-DH5)

Results

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Peak Power (dBm)	Maximum EIRP power (dBm)
2402.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	-2.2	-4.7
2441.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	-2.2	-4.7
2480.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	-1.7	-4.2

Modulation: BT (Π/4 DQPSK 2-DH5)

Results

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Peak Power (dBm)	Maximum EIRP power (dBm)
2402.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1.6	-0.9
2441.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1.0	-1.5
2480.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1.4	-1.1

Modulation: BT (8DPSK 3-DH5)

Results

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Peak Power (dBm)	Maximum EIRP power (dBm)
2402.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1.7	-0.8
2441.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1.2	-1.3
2480.00000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1.6	-0.9

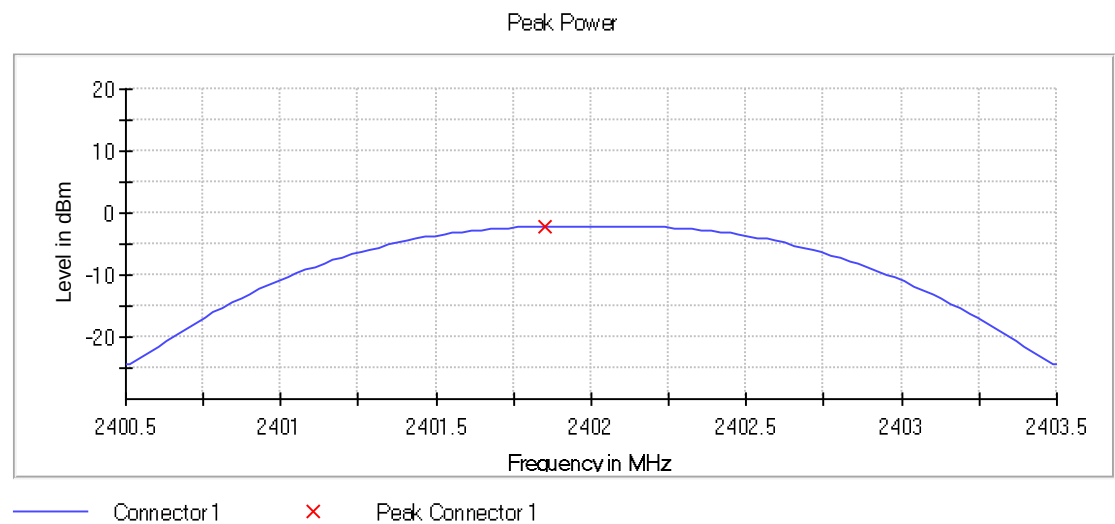
Verdict

Pass

Attachments

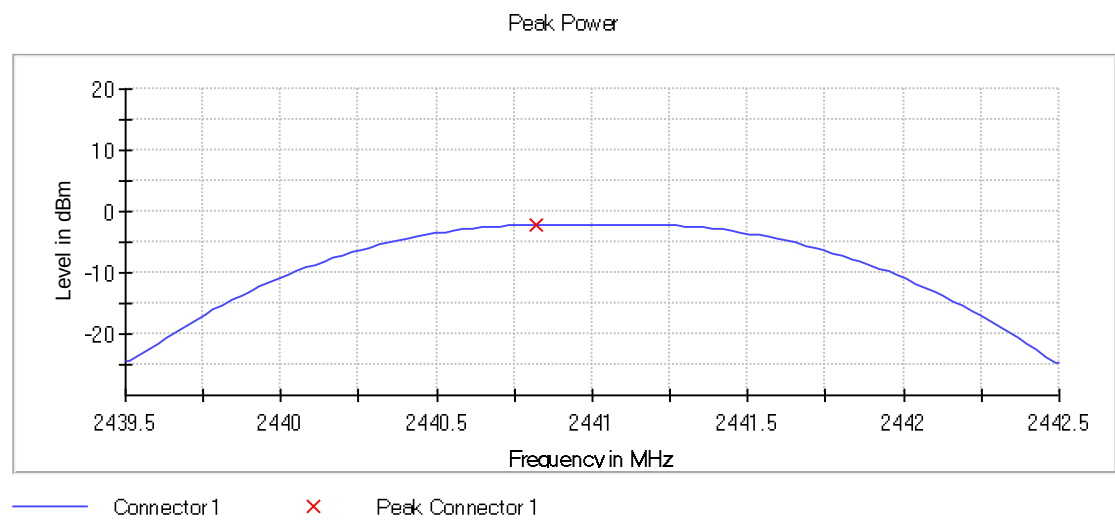
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Bandwidth MHz = 1, Modulation = BT (GFSK 1-DH5), Number of Transmission Chains = 1, Active Port = 1

Images:



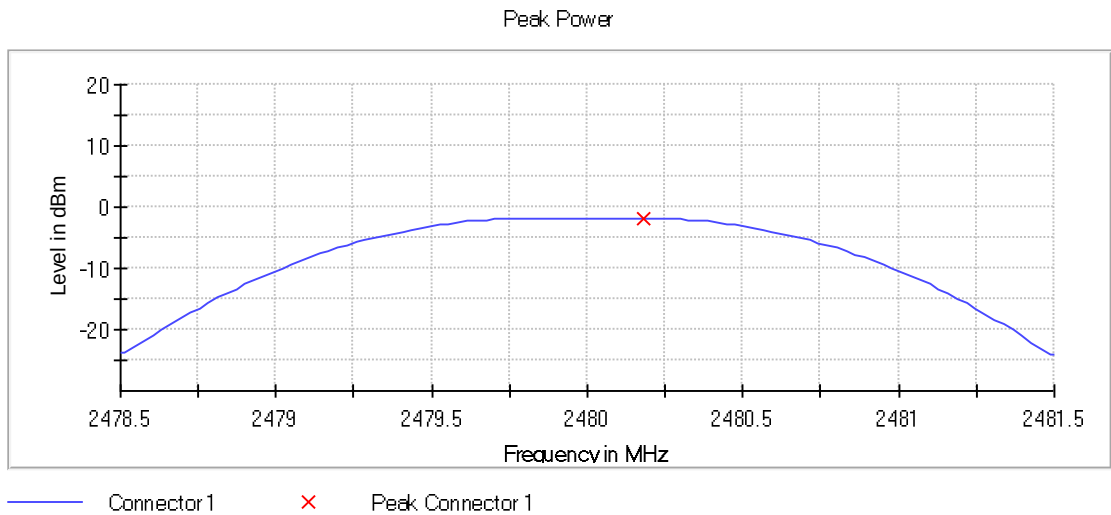
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Bandwidth MHz = 1, Modulation = BT (GFSK 1-DH5), Number of Transmission Chains = 1, Active Port = 1

Images:



Frequency MHz = 2480.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Bandwidth MHz = 1, Modulation = BT (GFSK 1-DH5), Number of Transmission Chains = 1, Active Port = 1

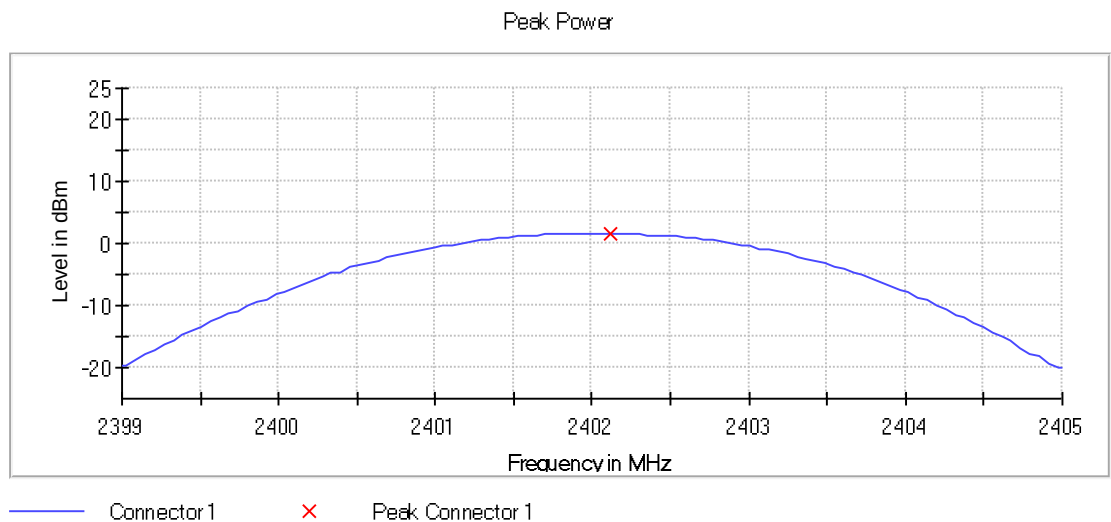
Images:



Attachments

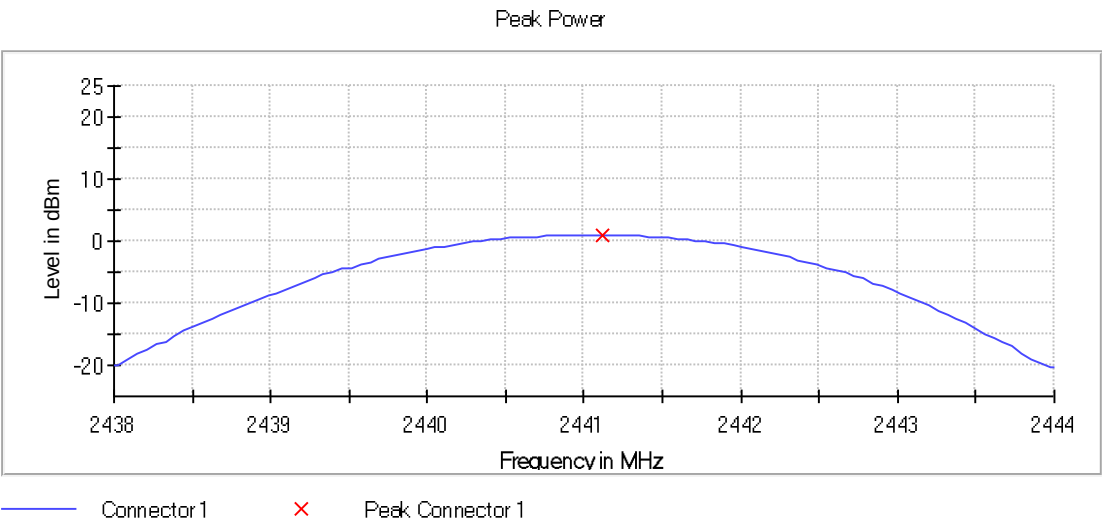
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Bandwidth MHz = 1, Modulation = BT ($\pi/4$ DQPSK 2-DH5), Number of Transmission Chains = 1, Active Port = 1

Images:



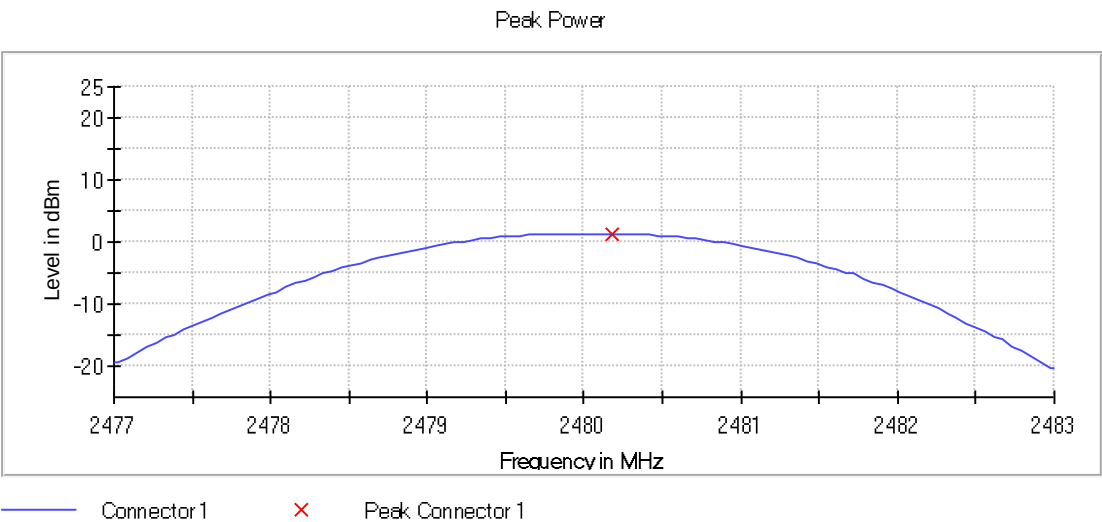
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Bandwidth MHz = 1, Modulation = BT ($\pi/4$ DQPSK 2-DH5), Number of Transmission Chains = 1, Active
Port = 1

Images:



Frequency MHz = 2480.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Bandwidth MHz = 1, Modulation = BT ($\pi/4$ DQPSK 2-DH5), Number of Transmission Chains = 1, Active
Port = 1

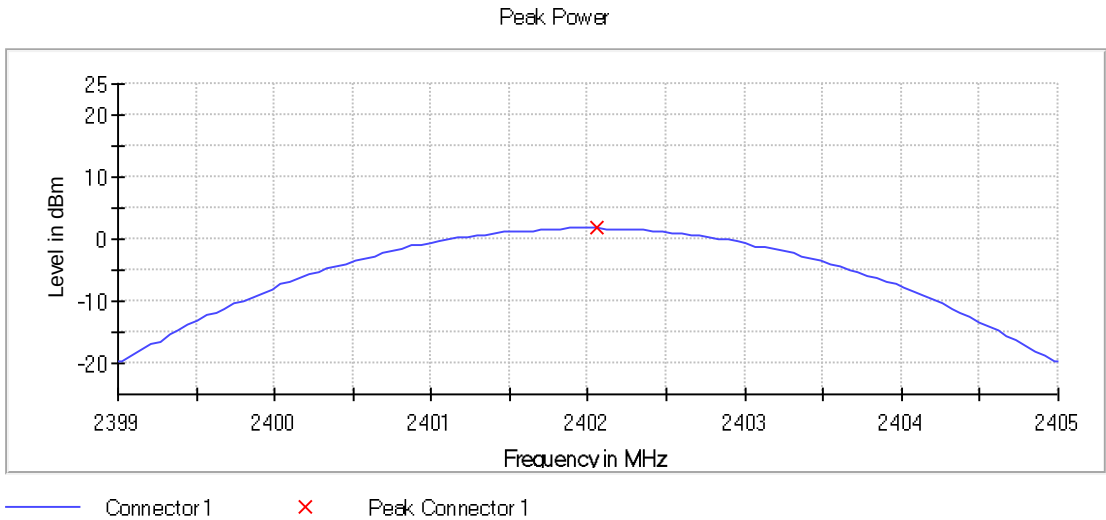
Images:



Attachments

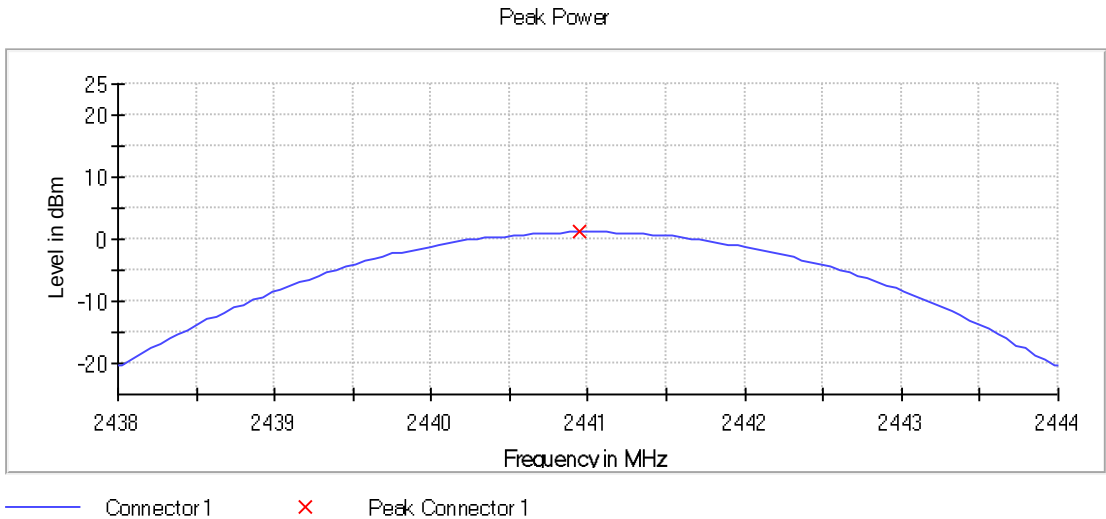
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Bandwidth MHz = 1, Modulation = BT (8DPSK 3-DH5), Number of Transmission Chains = 1, Active Port = 1

Images:



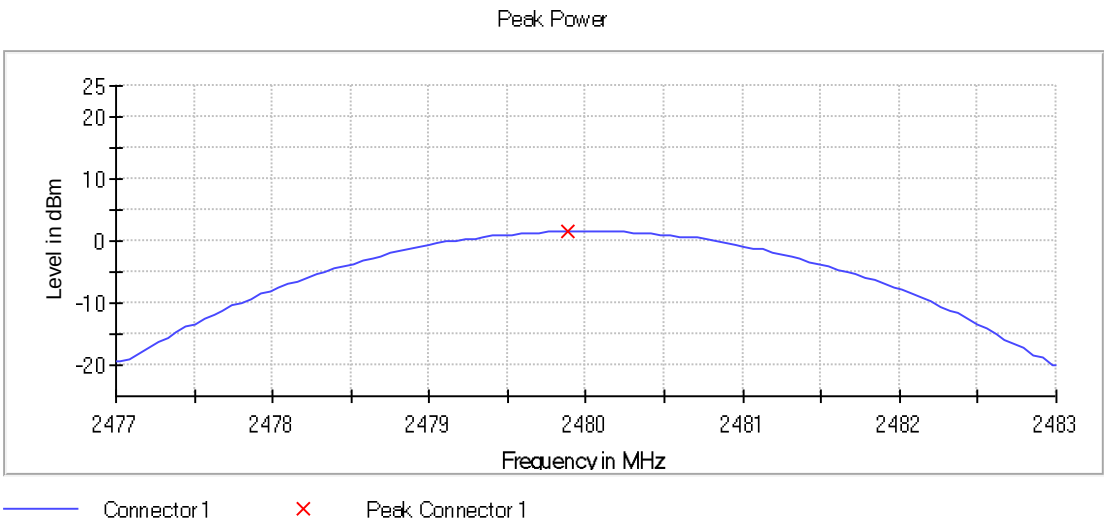
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Bandwidth MHz = 1, Modulation = BT (8DPSK 3-DH5), Number of Transmission Chains = 1, Active Port = 1

Images:



Frequency MHz = 2480.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Bandwidth MHz = 1, Modulation = BT (8DPSK 3-DH5), Number of Transmission Chains = 1, Active Port = 1

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value
Start Frequency	2.40050 GHz
Stop Frequency	2.40350 GHz
Span	3.000 MHz
RBW	1.000 MHz
VBW	3.000 MHz
SweepPoints	101
Sweeptime	1.907 μ s
Reference Level	10.000 dBm
Attenuation	30.000 dB
Detector	MaxPeak
SweepCount	100
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	FFT
Preamp	off
Stablemode	Trace
Stablevalue	0.50 dB
Run	4 / max. 150
Stable	3 / 3
Max Stable Difference	0.01 dB

RSS-247 5.5 / FCC 15.247 (d) Band-edge emissions compliance (Transmitter)

Limits

In any 100 kHz bandwidths outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. 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.

Modulation: BT (GFSK 1-DH5) - HOPPING OFF
Results

DUT Frequency	Result
2402.000000	PASS

DUT Frequency	Result
2480.000000	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.575000	-63.6	40.8	-22.8	PASS
2351.825000	-63.8	41.0	-22.8	PASS
2399.925000	-63.8	41.0	-22.8	PASS
2374.625000	-63.8	41.0	-22.8	PASS
2399.875000	-63.9	41.1	-22.8	PASS
2399.975000	-64.0	41.2	-22.8	PASS
2399.525000	-64.0	41.2	-22.8	PASS
2374.675000	-64.3	41.5	-22.8	PASS
2351.875000	-64.5	41.7	-22.8	PASS
2351.775000	-64.6	41.8	-22.8	PASS
2374.575000	-64.8	42.0	-22.8	PASS
2399.475000	-65.0	42.2	-22.8	PASS
2399.425000	-65.0	42.2	-22.8	PASS
2394.525000	-65.2	42.4	-22.8	PASS
2393.475000	-65.4	42.6	-22.8	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2492.625000	-61.1	39.2	-21.9	PASS
2492.675000	-61.1	39.2	-21.9	PASS
2492.725000	-62.8	40.9	-21.9	PASS
2488.975000	-62.8	40.9	-21.9	PASS
2492.575000	-62.9	41.0	-21.9	PASS
2488.925000	-63.2	41.2	-21.9	PASS
2487.475000	-63.2	41.2	-21.9	PASS
2489.025000	-63.6	41.6	-21.9	PASS
2487.425000	-63.7	41.8	-21.9	PASS
2487.525000	-64.3	42.3	-21.9	PASS
2487.575000	-64.4	42.4	-21.9	PASS
2487.375000	-64.4	42.4	-21.9	PASS
2487.625000	-64.7	42.7	-21.9	PASS
2492.775000	-65.2	43.2	-21.9	PASS
2488.475000	-65.4	43.5	-21.9	PASS

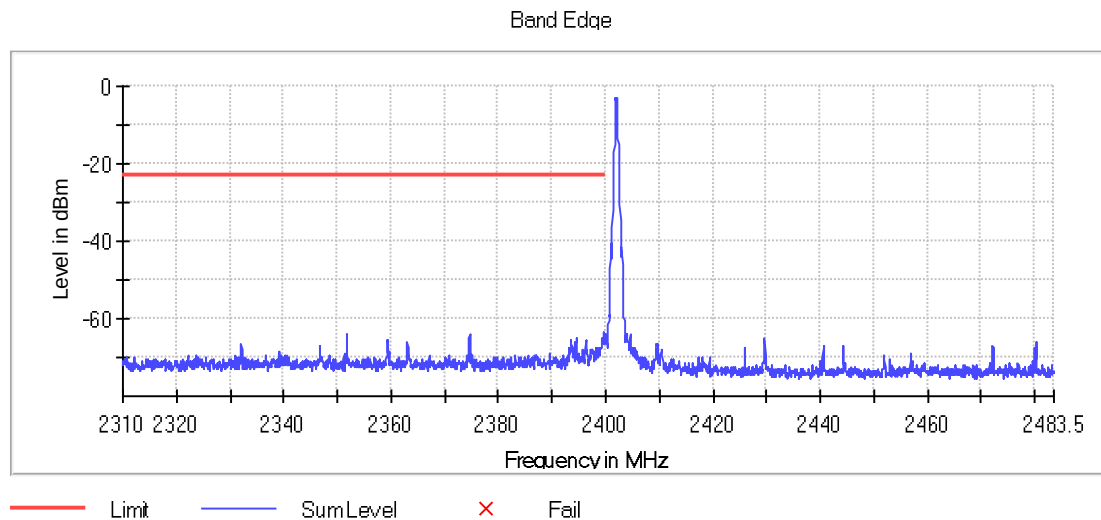
Verdict

Pass

Attachments

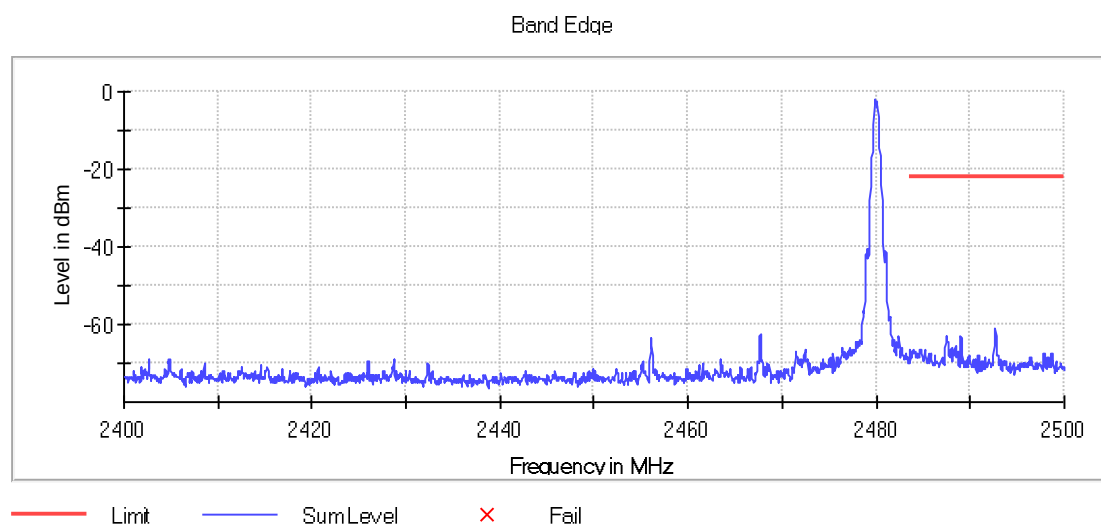
Frequency MHz = 2402.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Bandwidth MHz = 1, Modulation = BT (GFSK 1-DH5), Number of Transmission Chains = 1, Measurement
Point = 1, Active Port = 1

Images:



Frequency MHz = 2480.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Bandwidth MHz = 1, Modulation = BT (GFSK 1-DH5), Number of Transmission Chains = 1, Measurement
Point = 1, Active Port = 1

Images:



Modulation: BT (GFSK 1-DH5) - HOPPING ON
Results

DUT Frequency	Result
2402.000000	PASS

DUT Frequency	Result
2480.000000	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2339.875000	-54.4	31.7	-22.7	PASS
2348.875000	-54.4	31.8	-22.7	PASS
2339.925000	-54.6	31.9	-22.7	PASS
2311.075000	-54.6	31.9	-22.7	PASS
2348.925000	-54.6	31.9	-22.7	PASS
2322.375000	-54.6	31.9	-22.7	PASS
2340.575000	-54.6	31.9	-22.7	PASS
2338.575000	-54.8	32.1	-22.7	PASS
2322.425000	-54.8	32.1	-22.7	PASS
2330.825000	-54.8	32.2	-22.7	PASS
2316.075000	-54.9	32.2	-22.7	PASS
2340.525000	-54.9	32.2	-22.7	PASS
2329.825000	-55.0	32.3	-22.7	PASS
2332.825000	-55.1	32.4	-22.7	PASS
2338.525000	-55.2	32.5	-22.7	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2498.575000	-58.6	36.2	-22.4	PASS
2494.375000	-59.7	37.2	-22.4	PASS
2498.625000	-59.8	37.4	-22.4	PASS
2494.325000	-60.0	37.5	-22.4	PASS
2498.525000	-60.4	37.9	-22.4	PASS
2497.625000	-60.7	38.2	-22.4	PASS
2497.575000	-61.0	38.6	-22.4	PASS
2494.225000	-61.5	39.0	-22.4	PASS
2486.675000	-62.0	39.5	-22.4	PASS
2496.575000	-62.0	39.6	-22.4	PASS
2494.275000	-62.3	39.9	-22.4	PASS
2497.525000	-62.4	39.9	-22.4	PASS
2497.475000	-62.7	40.3	-22.4	PASS
2486.625000	-62.8	40.4	-22.4	PASS
2497.675000	-62.8	40.4	-22.4	PASS

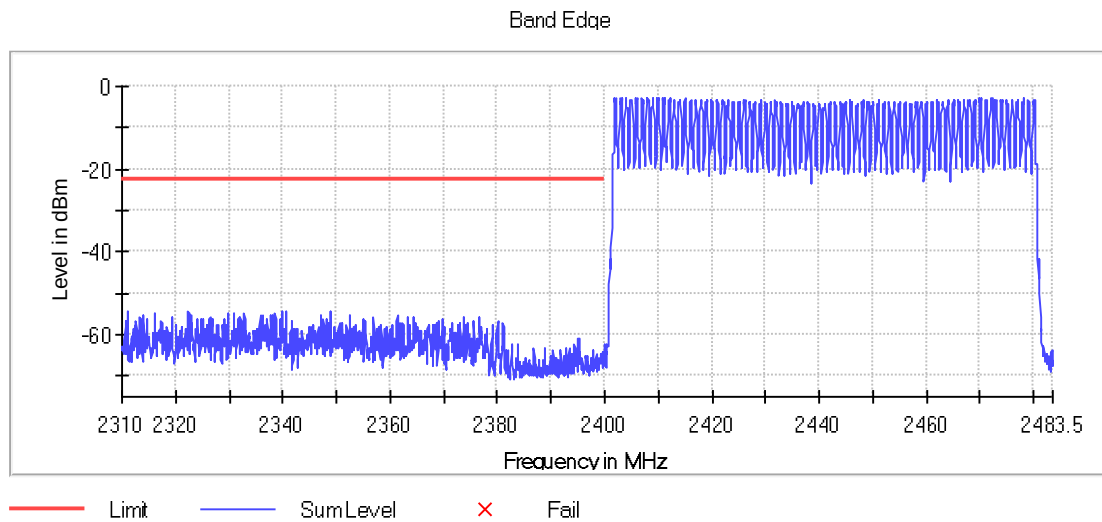
Verdict

Pass

Attachments

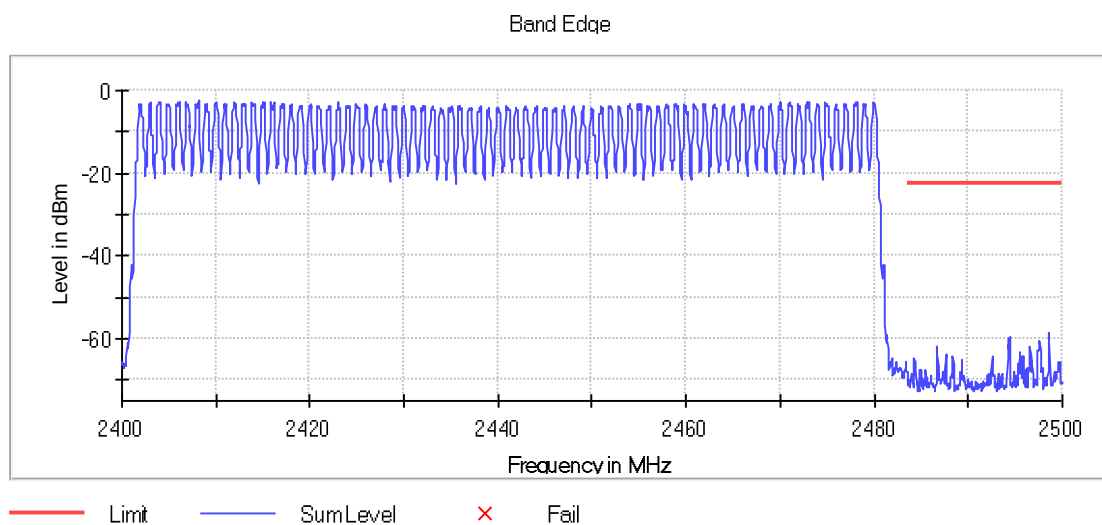
Frequency MHz = 2402.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Bandwidth MHz = 1, Modulation = BT (GFSK 1-DH5), Number of Transmission Chains = 1, Measurement
Point = 1, Active Port = 1

Images:



Frequency MHz = 2480.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Bandwidth MHz = 1, Modulation = BT (GFSK 1-DH5), Number of Transmission Chains = 1, Measurement
Point = 1, Active Port = 1

Images:



Modulation: BT (Π/4 DQPSK 2-DH5) - HOPPING OFF
Results

DUT Frequency	Result
2402.000000	PASS

DUT Frequency	Result
2480.000000	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.975000	-48.8	28.2	-20.6	PASS
2399.925000	-49.2	28.5	-20.6	PASS
2399.875000	-49.5	28.9	-20.6	PASS
2399.825000	-49.7	29.0	-20.6	PASS
2399.775000	-52.4	31.8	-20.6	PASS
2399.725000	-52.8	32.2	-20.6	PASS
2399.525000	-53.6	32.9	-20.6	PASS
2399.475000	-53.6	33.0	-20.6	PASS
2399.675000	-53.7	33.0	-20.6	PASS
2399.625000	-53.9	33.3	-20.6	PASS
2399.225000	-54.2	33.6	-20.6	PASS
2399.175000	-54.3	33.6	-20.6	PASS
2399.275000	-54.4	33.7	-20.6	PASS
2399.575000	-54.4	33.8	-20.6	PASS
2342.925000	-54.8	34.2	-20.6	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2483.525000	-61.6	40.7	-20.9	PASS
2483.625000	-62.6	41.7	-20.9	PASS
2483.575000	-62.7	41.8	-20.9	PASS
2483.725000	-62.9	42.0	-20.9	PASS
2483.775000	-63.2	42.3	-20.9	PASS
2483.675000	-63.6	42.7	-20.9	PASS
2483.925000	-64.0	43.1	-20.9	PASS
2483.825000	-64.1	43.3	-20.9	PASS
2484.075000	-64.5	43.6	-20.9	PASS
2483.975000	-64.7	43.8	-20.9	PASS
2483.875000	-64.9	44.0	-20.9	PASS
2486.025000	-65.0	44.1	-20.9	PASS
2484.375000	-65.1	44.2	-20.9	PASS
2484.425000	-65.1	44.2	-20.9	PASS
2485.975000	-65.2	44.3	-20.9	PASS

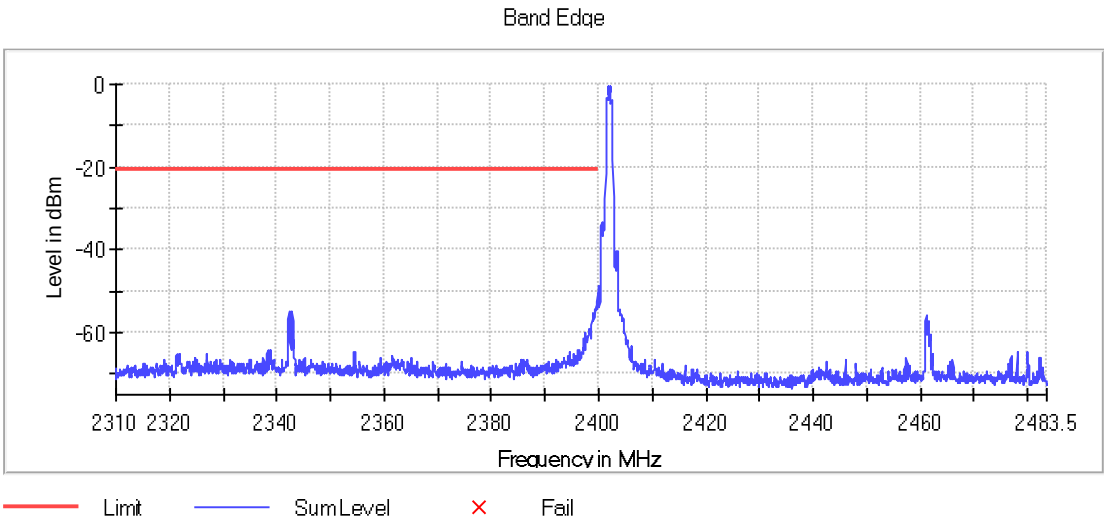
Verdict

Pass

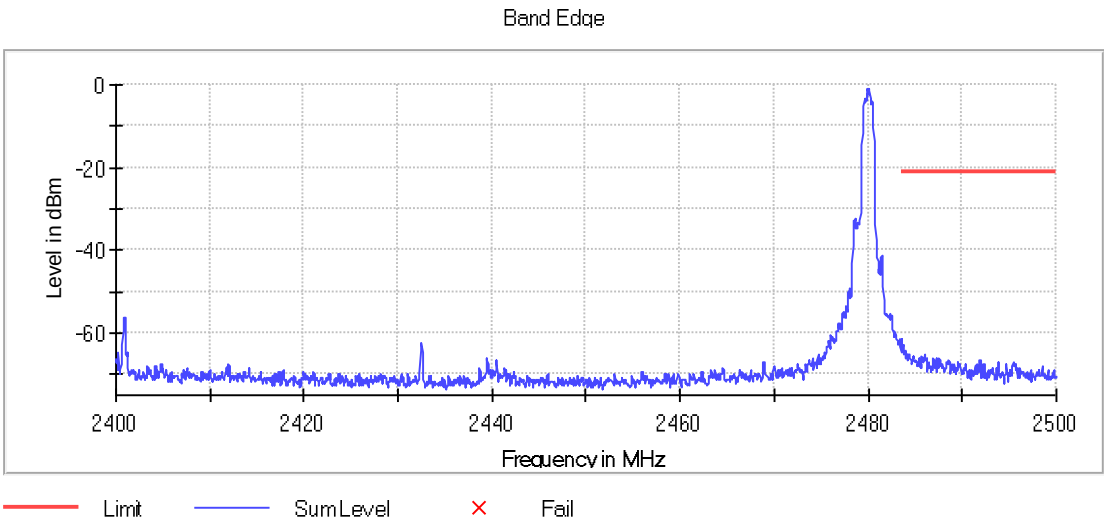
Attachments

Frequency MHz = 2402.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Bandwidth MHz = 1, Modulation = BT (Π/4 DQPSK 2-DH5), Number of Transmission Chains = 1,
Measurement Point = 1, Active Port = 1

Images:



Frequency MHz = 2480.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Bandwidth MHz = 1, Modulation = BT (Π/4 DQPSK 2-DH5), Number of Transmission Chains = 1,
Measurement Point = 1, Active Port = 1



Modulation: BT (Π/4 DQPSK 2-DH5) - HOPPING ON
Results

DUT Frequency	Result
2402.000000	PASS

DUT Frequency	Result
2480.000000	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.925000	-53.4	32.7	-20.7	PASS
2399.975000	-53.4	32.8	-20.7	PASS
2396.425000	-54.1	33.4	-20.7	PASS
2399.575000	-54.8	34.1	-20.7	PASS
2371.325000	-54.8	34.2	-20.7	PASS
2396.475000	-54.9	34.2	-20.7	PASS
2399.625000	-54.9	34.2	-20.7	PASS
2399.725000	-55.2	34.5	-20.7	PASS
2395.425000	-55.2	34.6	-20.7	PASS
2371.375000	-55.4	34.7	-20.7	PASS
2359.875000	-55.4	34.7	-20.7	PASS
2395.475000	-55.4	34.7	-20.7	PASS
2396.375000	-55.4	34.8	-20.7	PASS
2399.675000	-55.6	34.9	-20.7	PASS
2359.925000	-55.8	35.1	-20.7	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2499.425000	-60.7	40.1	-20.7	PASS
2499.475000	-60.9	40.3	-20.7	PASS
2496.975000	-61.8	41.1	-20.7	PASS
2496.925000	-62.1	41.4	-20.7	PASS
2499.375000	-64.5	43.8	-20.7	PASS
2497.025000	-64.6	44.0	-20.7	PASS
2483.925000	-65.0	44.4	-20.7	PASS
2492.475000	-65.2	44.5	-20.7	PASS
2483.975000	-65.3	44.7	-20.7	PASS
2486.525000	-65.3	44.7	-20.7	PASS
2486.475000	-65.5	44.8	-20.7	PASS
2491.475000	-66.4	45.8	-20.7	PASS
2483.875000	-66.5	45.8	-20.7	PASS
2491.425000	-66.6	46.0	-20.7	PASS
2492.425000	-66.7	46.0	-20.7	PASS

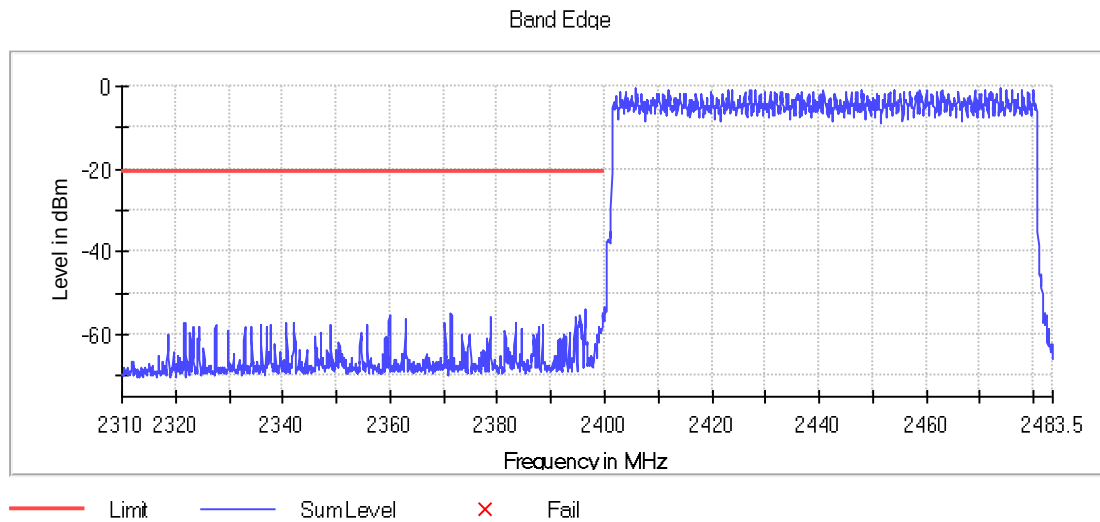
Verdict

Pass

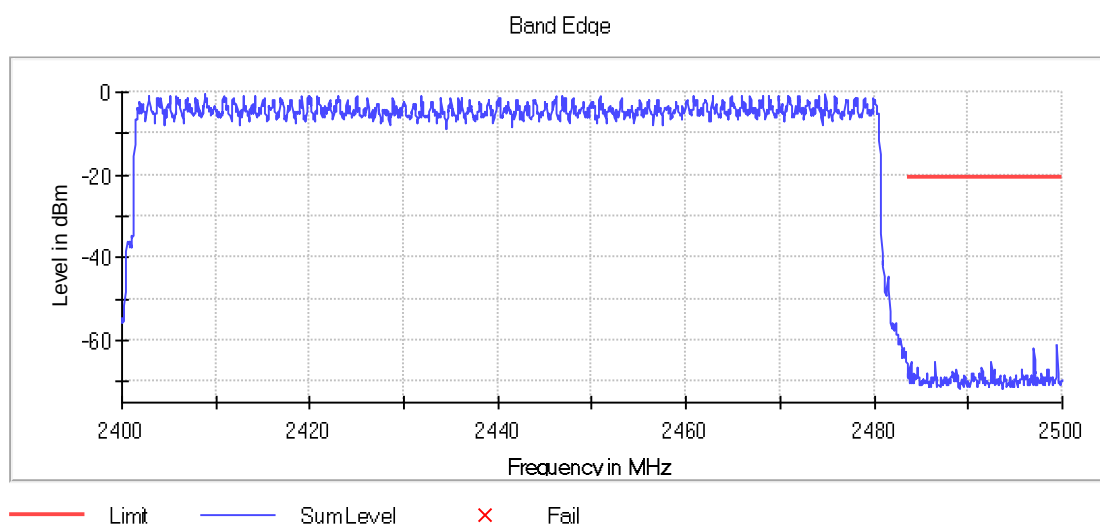
Attachments

Frequency MHz = 2402.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Bandwidth MHz = 1, Modulation = BT ($\pi/4$ DQPSK 2-DH5), Number of Transmission Chains = 1,
Measurement Point = 1, Active Port = 1

Images:



Frequency MHz = 2480.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Bandwidth MHz = 1, Modulation = BT ($\pi/4$ DQPSK 2-DH5), Number of Transmission Chains = 1,
Measurement Point = 1, Active Port = 1



Modulation: BT (8DPSK 3-DH5) - HOPPING OFF

Results

DUT Frequency	Result
2402.000000	PASS

DUT Frequency	Result
2480.000000	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.625000	-48.7	27.9	-20.8	PASS
2399.975000	-49.0	28.2	-20.8	PASS
2399.675000	-49.1	28.3	-20.8	PASS
2399.925000	-49.2	28.4	-20.8	PASS
2399.775000	-49.3	28.5	-20.8	PASS
2399.725000	-49.4	28.6	-20.8	PASS
2399.575000	-49.8	29.0	-20.8	PASS
2399.875000	-49.8	29.1	-20.8	PASS
2399.825000	-49.9	29.1	-20.8	PASS
2399.525000	-50.3	29.5	-20.8	PASS
2399.475000	-51.7	31.0	-20.8	PASS
2399.225000	-51.9	31.1	-20.8	PASS
2399.275000	-52.0	31.2	-20.8	PASS
2398.975000	-52.1	31.3	-20.8	PASS
2399.025000	-52.2	31.4	-20.8	PASS

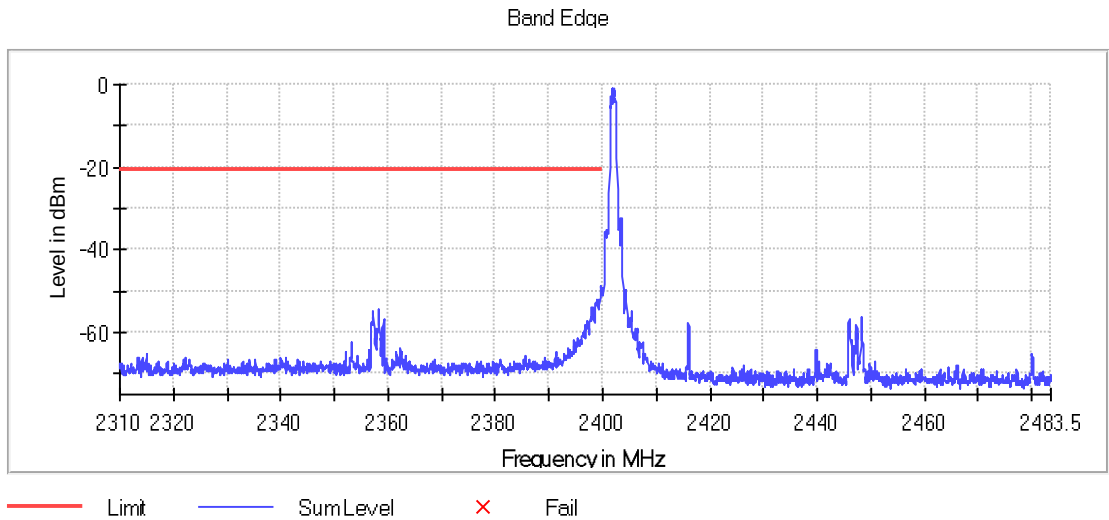
Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2483.525000	-56.7	35.9	-20.8	PASS
2483.825000	-57.4	36.6	-20.8	PASS
2484.225000	-57.5	36.7	-20.8	PASS
2484.275000	-57.5	36.7	-20.8	PASS
2483.775000	-57.7	36.9	-20.8	PASS
2484.425000	-57.9	37.1	-20.8	PASS
2484.075000	-57.9	37.2	-20.8	PASS
2484.475000	-58.0	37.2	-20.8	PASS
2484.125000	-58.1	37.3	-20.8	PASS
2483.875000	-58.3	37.5	-20.8	PASS
2484.025000	-58.7	38.0	-20.8	PASS
2484.325000	-59.1	38.3	-20.8	PASS
2484.375000	-59.1	38.3	-20.8	PASS
2484.175000	-59.3	38.5	-20.8	PASS
2483.575000	-59.4	38.6	-20.8	PASS

Verdict

Pass

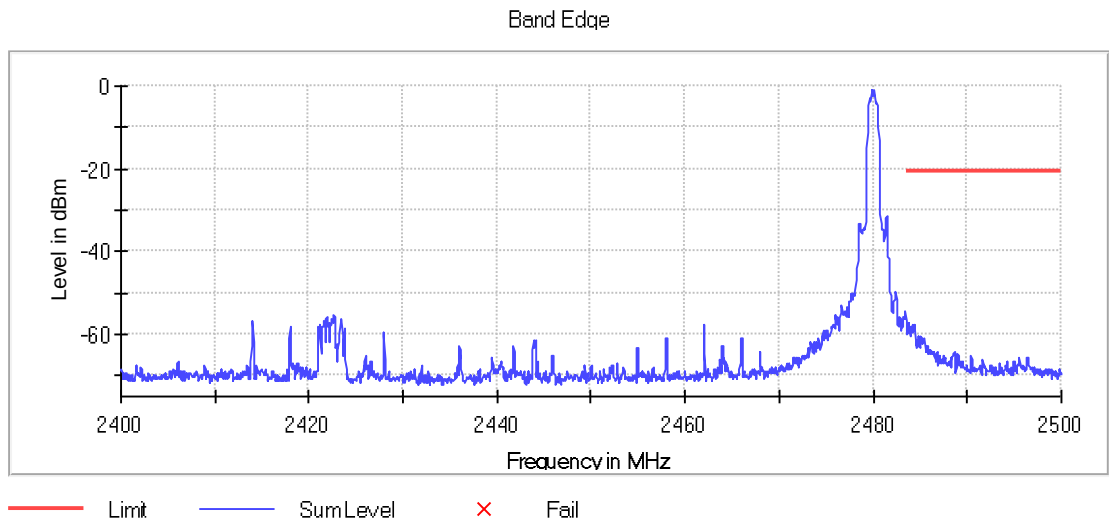
Attachments

Frequency MHz = 0.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Bandwidth MHz = 1, Modulation = BT (8DPSK 3-DH5), Number of Transmission Chains = 1, Measurement
Point = 1, Active Port = 1



Frequency MHz = 2480.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Bandwidth MHz = 1, Modulation = BT (8DPSK 3-DH5), Number of Transmission Chains = 1, Measurement
Point = 1, Active Port = 1

Images:



Modulation: BT (8DPSK 3-DH5) - HOPPING ON
Results

DUT Frequency	Result
2402.000000	PASS

DUT Frequency	Result
2480.000000	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.675000	-51.3	30.6	-20.7	PASS
2399.625000	-52.0	31.3	-20.7	PASS
2399.725000	-52.3	31.6	-20.7	PASS
2399.825000	-52.9	32.2	-20.7	PASS
2399.775000	-53.1	32.4	-20.7	PASS
2399.875000	-53.8	33.1	-20.7	PASS
2399.925000	-54.1	33.4	-20.7	PASS
2399.475000	-55.1	34.4	-20.7	PASS
2399.525000	-55.6	34.9	-20.7	PASS
2399.425000	-55.6	34.9	-20.7	PASS
2383.775000	-55.7	35.0	-20.7	PASS
2394.725000	-55.7	35.0	-20.7	PASS
2385.275000	-55.7	35.0	-20.7	PASS
2394.675000	-55.9	35.2	-20.7	PASS
2383.725000	-56.1	35.4	-20.7	PASS

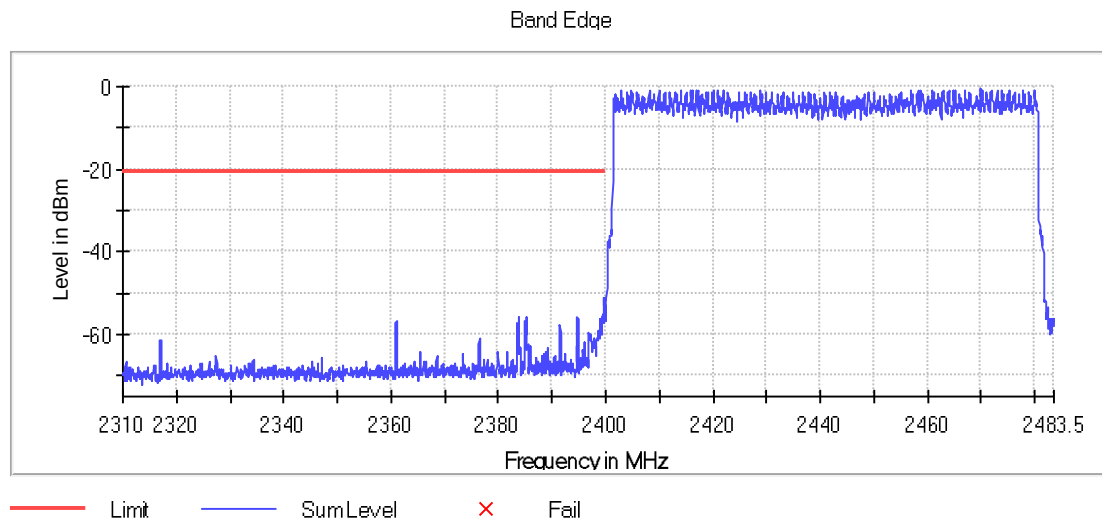
Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2483.975000	-63.5	42.8	-20.7	PASS
2485.025000	-63.5	42.8	-20.7	PASS
2484.975000	-63.6	42.9	-20.7	PASS
2484.025000	-63.7	43.0	-20.7	PASS
2484.725000	-64.6	43.9	-20.7	PASS
2484.775000	-64.6	43.9	-20.7	PASS
2484.175000	-65.2	44.5	-20.7	PASS
2484.125000	-65.2	44.5	-20.7	PASS
2484.075000	-65.6	44.9	-20.7	PASS
2485.375000	-65.7	45.0	-20.7	PASS
2488.175000	-66.2	45.5	-20.7	PASS
2488.125000	-66.4	45.7	-20.7	PASS
2483.525000	-66.5	45.8	-20.7	PASS
2484.225000	-66.6	45.9	-20.7	PASS
2484.375000	-66.7	46.0	-20.7	PASS

Verdict

Pass

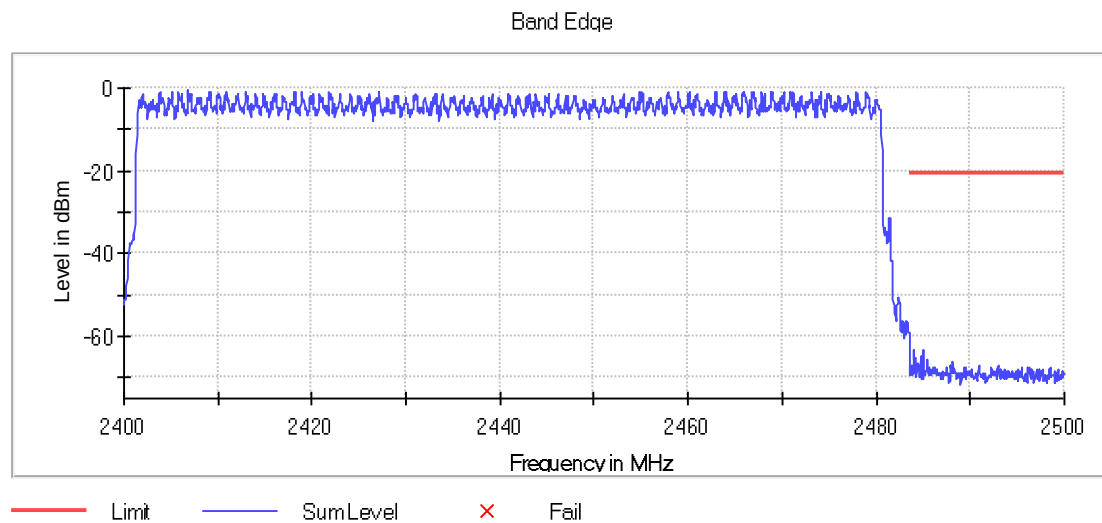
Attachments

Frequency MHz = 0.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Bandwidth MHz = 1, Modulation = BT (8DPSK 3-DH5), Number of Transmission Chains = 1, Measurement
Point = 1, Active Port = 1



Frequency MHz = 2480.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Bandwidth MHz = 1, Modulation = BT (8DPSK 3-DH5), Number of Transmission Chains = 1, Measurement
Point = 1, Active Port = 1

Images:



Spectrum Analyzer Parameters

Setting	HOPPING OFF		HOPPING ON	
	Instrument Value - low	Instrument Value- high	Instrument Value- low	Instrument Value- high
Start Frequency	2.31000 GHz	2.40000 GHz	2.31000 GHz	2.40000 GHz
Stop Frequency	2.40000 GHz	2.48350 GHz	2.40000 GHz	2.48350 GHz
Span	90.000 MHz	83.500 MHz	90.000 MHz	83.500 MHz
RBW	100.000 kHz	100.000 kHz	100.000 kHz	100.000 kHz
VBW	300.000 kHz	300.000 kHz	300.000 kHz	300.000 kHz
SweepPoints	1800	1670	1800	1670
Sweeptime	113.672 μ s	94.727 μ s	113.672 μ s	94.727 μ s
Reference Level	0.000 dBm	0.000 dBm	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	20.000 dB	20.000 dB	20.000 dB
Detector	MaxPeak	MaxPeak	MaxPeak	MaxPeak
SweepCount	100	100	100	100
Filter	3 dB	3 dB	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Max Hold	Max Hold
SweepType	FFT	FFT	FFT	FFT
Preamp	off	off	off	off
Stablemode	Trace	Trace	Trace	Trace
Stablevalue	0.50 dB	0.50 dB	0.50 dB	0.50 dB
Run	4 / max. 150	5 / max. 150	4 / max. 150	139 / max. 150
Stable	3 / 3	3 / 3	3 / 3	3 / 3
Max Stable Difference	0.00 dB	0.12 dB	0.00 dB	0.00 dB

RSS-247 5.5 / FCC 15.247 (d) Emissions compliance (Transmitter) - Conducted

Limits

In any 100 kHz bandwidth outside the frequency band in which the digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.

Conducted spurious signals detected were minimum 20 dB respect to the limit for the lowest, middle and highest operating channels.

The following tables and plots show the results for the worst case

Verdict

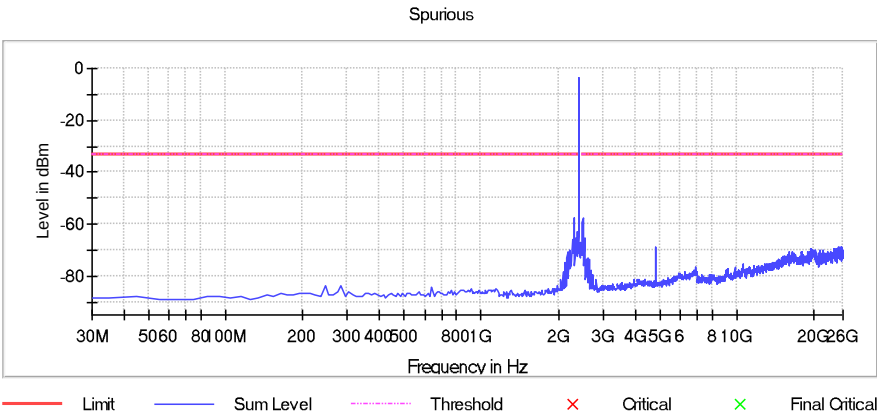
Pass

Results

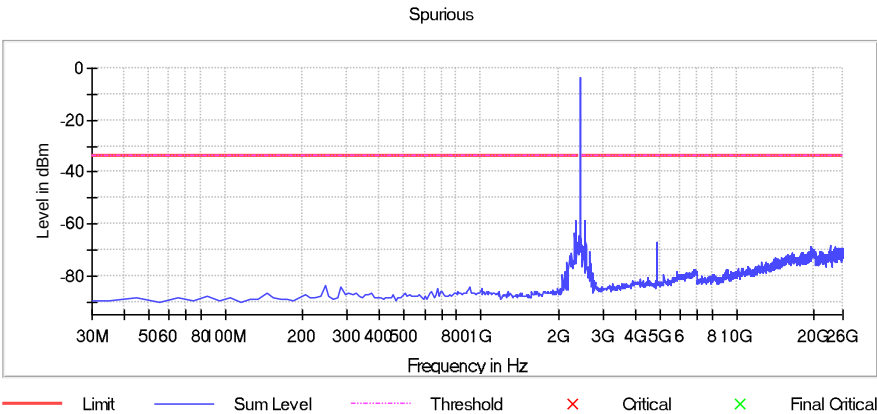
Modulation: BTBR (GFSK 1-DH5)

Note: Fundamental signals are above the limit and shown in the frequency range of 2402 - 2480 MHz in the plots

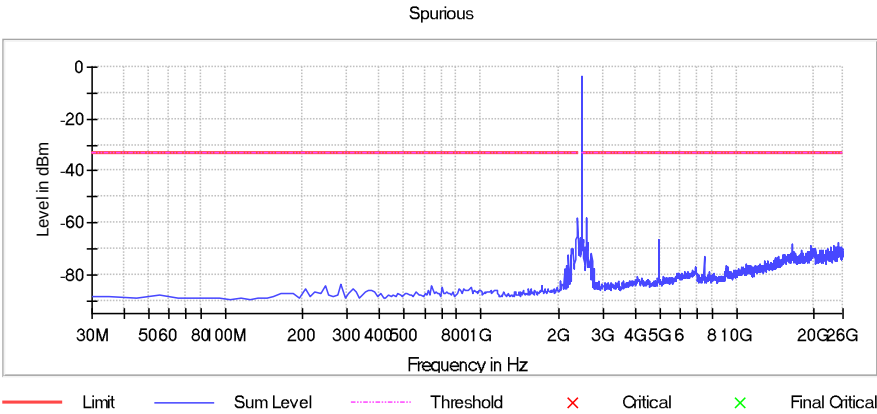
Lowest Channel



Middle Channel



Highest Channel

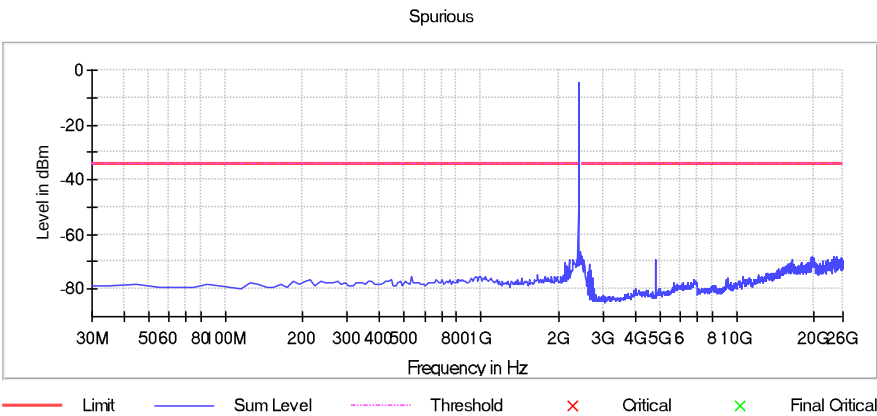


Results

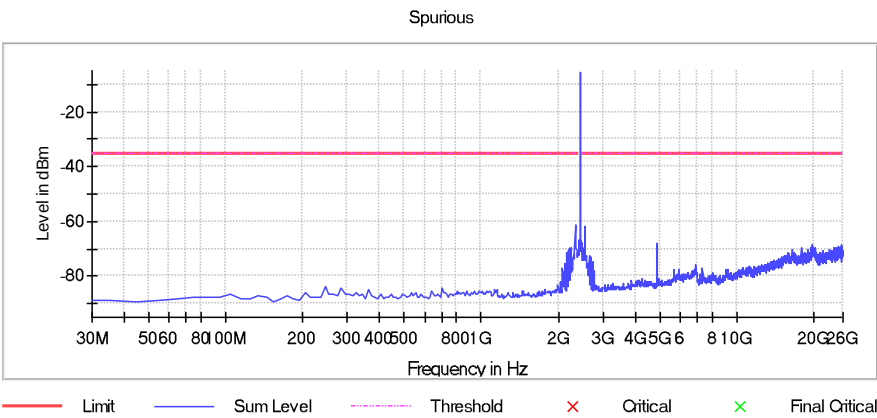
Modulation: BTEDR ($\pi/4$ -DQPSK 2-DH5)

Note: Fundamental signals are above the limit and shown in the frequency range of 2402 - 2480 MHz in the plots

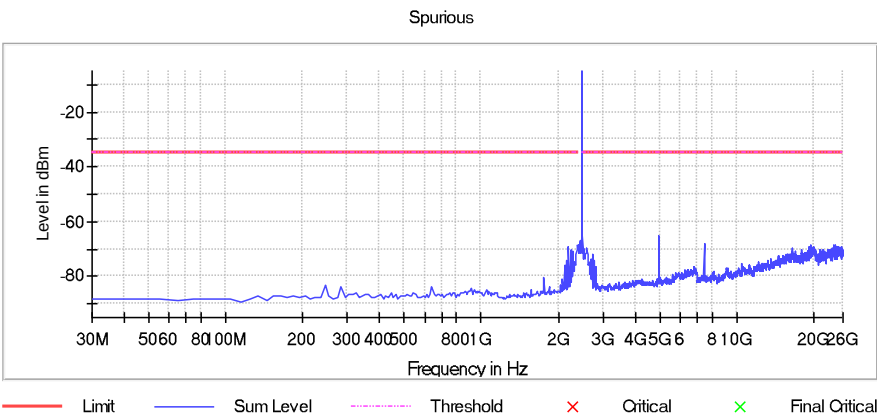
Lowest Channel



Middle Channel



Highest Channel

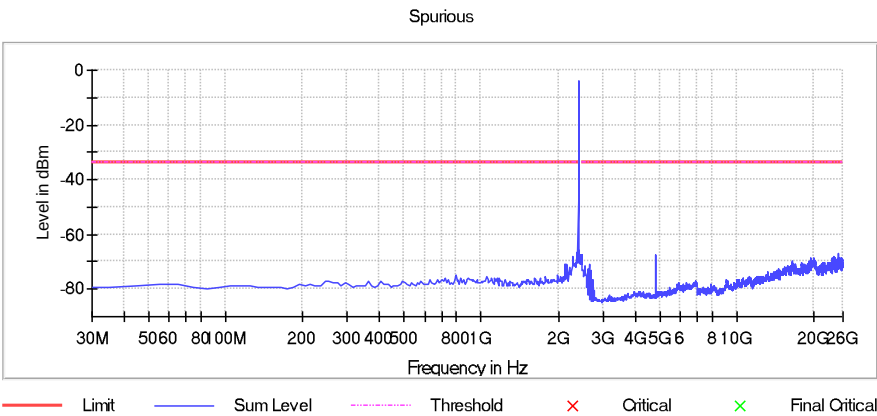


Results

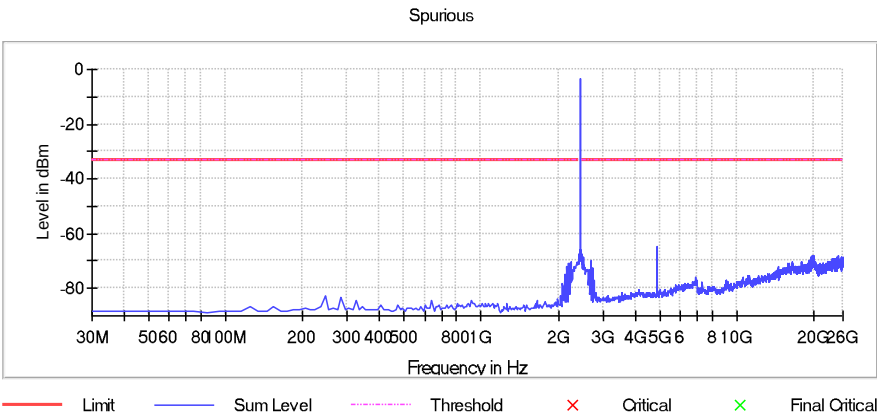
Modulation: BTEDR (8DPSK 3-DH5)

Note: Fundamental signals are above the limit and shown in the frequency range of 2402 - 2480 MHz in the plots

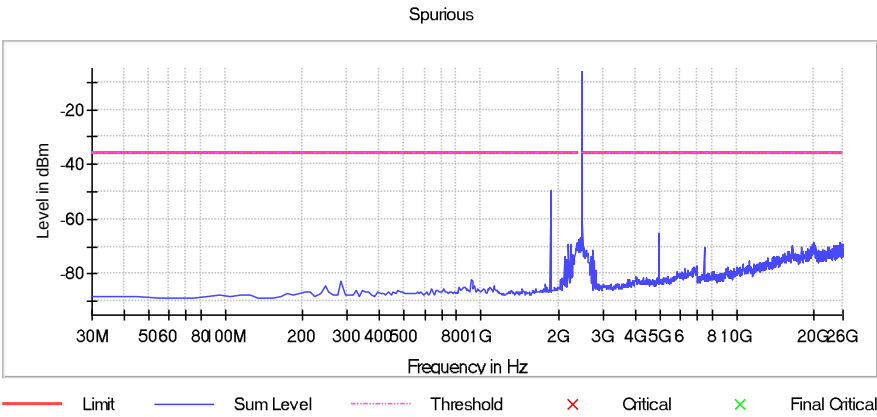
Lowest Channel



Middle Channel



Highest Channel



Spectrum Analyzer Parameters

Setting	Instrument Value
RBW	100.000 kHz
VBW	300.000 kHz
SweepPoints	238
Sweeptime	23.700 ms
Reference Level	-30.000 dBm
Attenuation	0.000 dB
Detector	MaxPeak
SweepCount	3
Filter	3 dB
Trace Mode	Max Hold
SweepType	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.50 dB
Run	4 / max. 40
Stable	3 / 3
Max Stable Difference	0.00 dB

RSS-247 5.5 / FCC 15.247 (d) Emissions compliance (Transmitter) – Radiated

Limits

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c) / RSS-Gen):

Frequency Range (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RSS-247. Attenuation below the general field strength limits specified in RSS-Gen is not required

The following tables and plots show the results for the worst case

Verdict

Pass

Modulation: BT (8DPSK 3-DH5)

Results

Frequency range 0.03 - 1 GHz

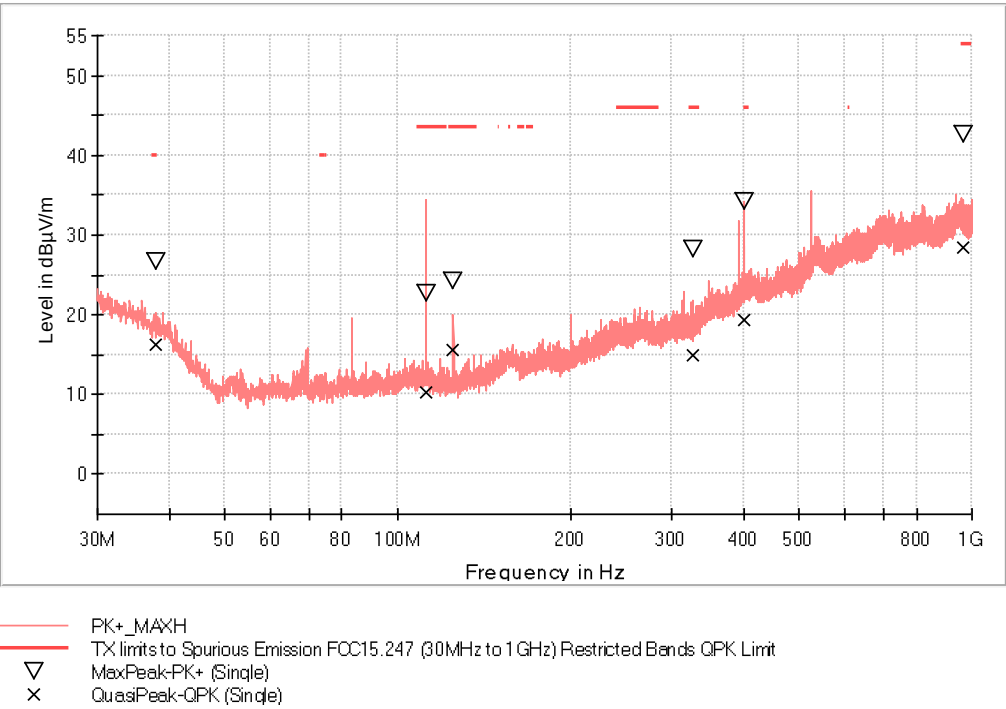
The spurious emissions below 1 GHz do not depend on the operating channel selected in the EUT.

Middle Channel

Frequency MHz = 2441.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),

Modulation = BT (8DPSK 3-DH5), Frequency Range GHz = [0.03, 1]

Images:



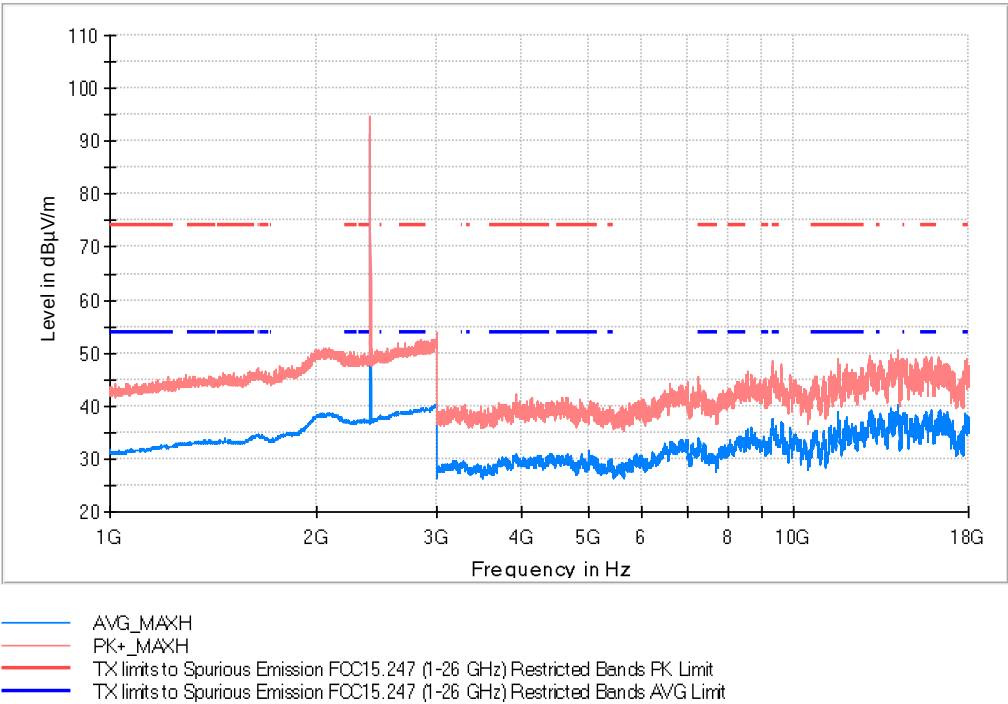
Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Pol	Margin - QPK (dB)	Limit - QPK (dBµV/m)
37.954000	26.8	16.3	V	23.7	40.0
111.819500	22.8	10.2	V	33.3	43.5
125.011500	24.3	15.6	V	27.9	43.5
326.917000	28.3	15.0	H	31.0	46.0
400.928000	34.2	19.4	V	26.6	46.0
963.285500	42.6	28.5	V	25.5	54.0

Frequency range 1 - 18 GHz

Lowest Channel

Frequency MHz = 2402.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Modulation = BT (8DPSK 3-DH5), Frequency Range GHz = [1, 18]

Images:



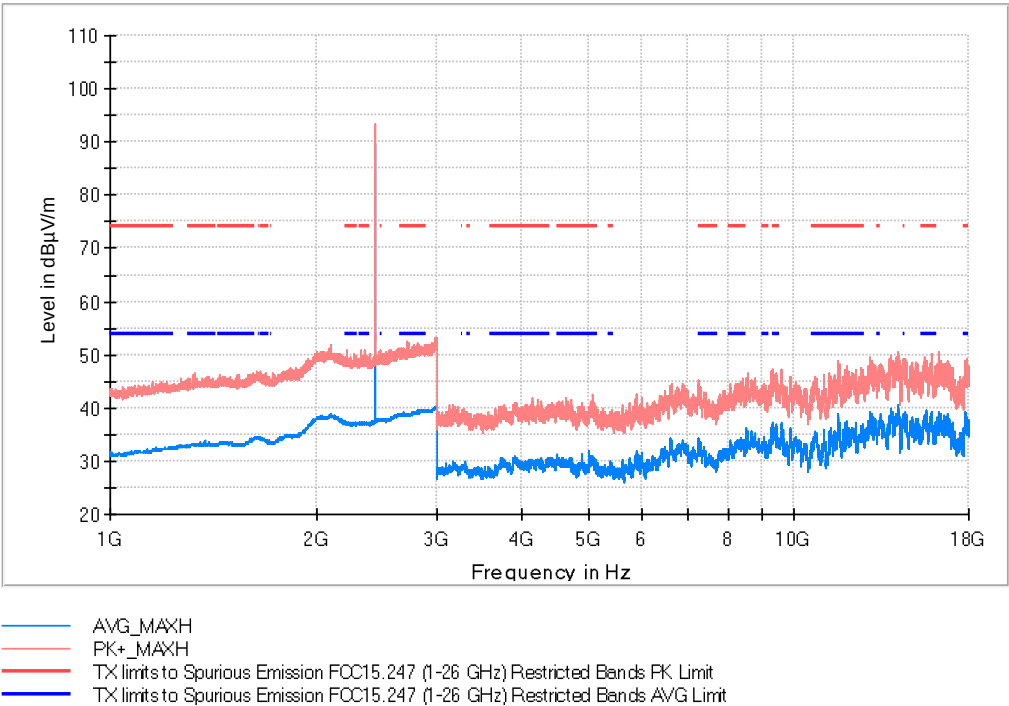
Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
2402.000000	94.7	91.4	H	---	---	Fundamental
2807.500000	52.4	39.2	V	14.8	54.0	
15874.000000	47.1	39.2	V	14.8	54.0	

Frequency range 1 - 18 GHz

Middle Channel

Frequency MHz = 2441.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Modulation = BT (8DPSK 3-DH5), Frequency Range GHz = [1, 18]

Images:



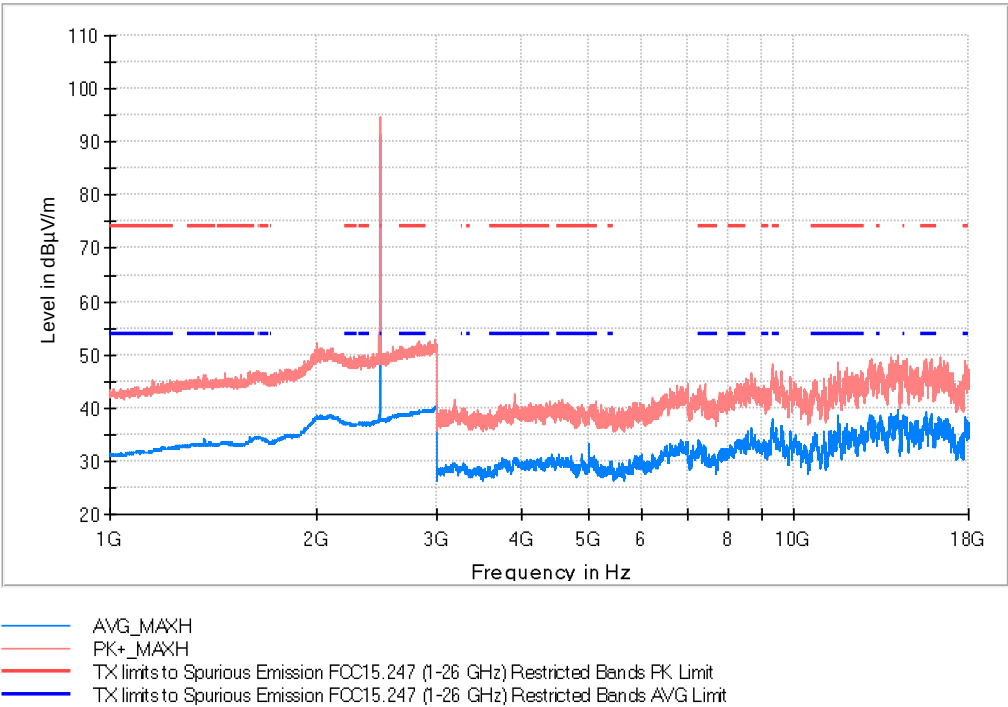
Frequency (MHz)	PK+ _MAXH (dBµV/m)	AVG _MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
2441.000000	93.3	89.8	H	---	---	Fundamental
15873.000000	50.1	39.0	V	15.0	54.0	
17835.000000	48.4	39.3	V	14.7	54.0	

Frequency range 1 - 18 GHz

Highest Channel

Frequency MHz = 2480.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Modulation = BT (8DPSK 3-DH5), Frequency Range GHz = [1, 18]

Images:



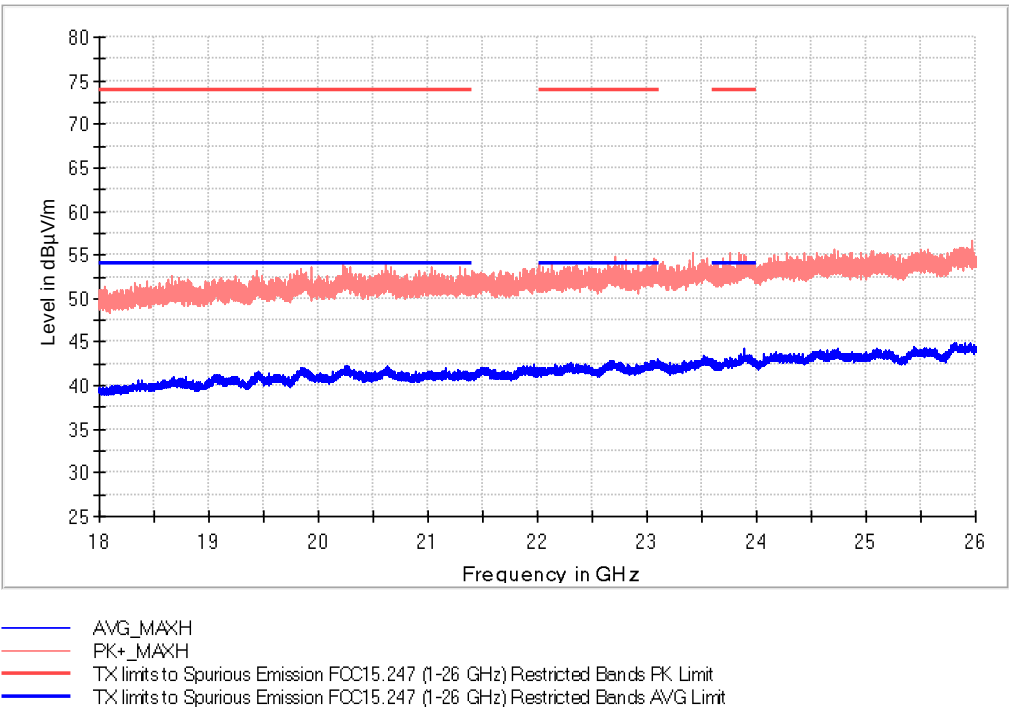
Frequency (MHz)	PK+ _MAXH (dBµV/m)	AVG _MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
2480.000000	94.9	91.5	H	---	---	Fundamental
11601.500000	47.7	38.6	V	15.4	54.0	
17825.000000	46.9	38.4	V	15.6	54.0	

Frequency range 18 - 26 GHz

Lowest Channel

Frequency MHz = 2402.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Modulation = BT (8DPSK 3-DH5), Frequency Range GHz = [18, 26]

Images:



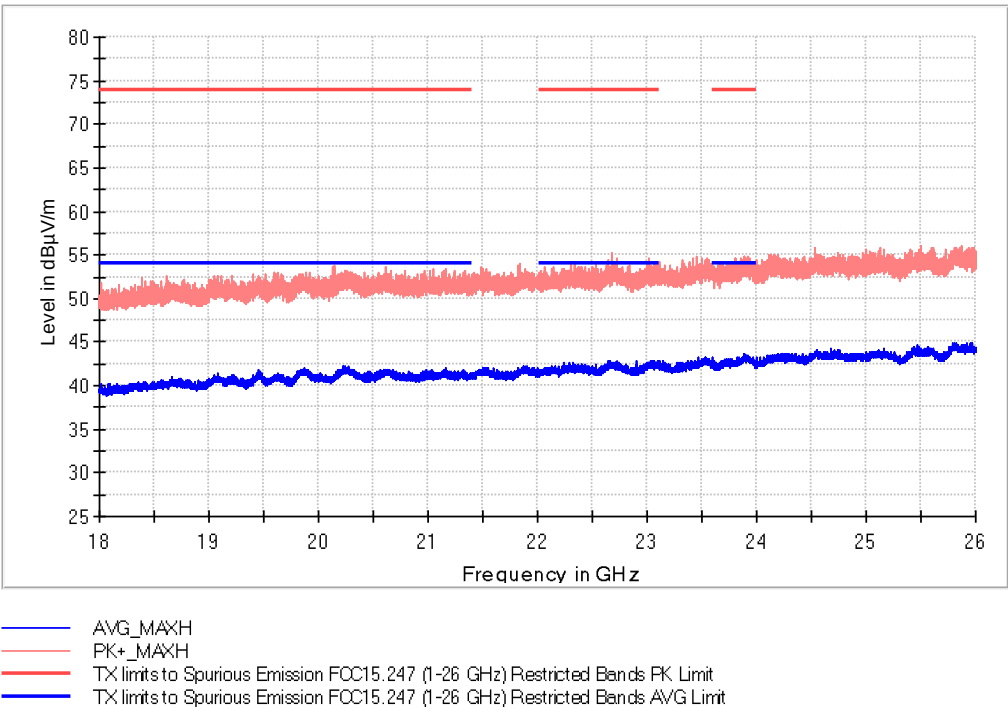
Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
20611.500000	54.2	41.3	V	12.8	54.0
22715.000000	54.9	42.3	V	11.7	54.0
23764.500000	55.1	42.4	H	11.6	54.0

Frequency range 18 - 26 GHz

Middle Channel

Frequency MHz = 2441.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Modulation = BT (8DPSK 3-DH5), Frequency Range GHz = [18, 26]

Images:



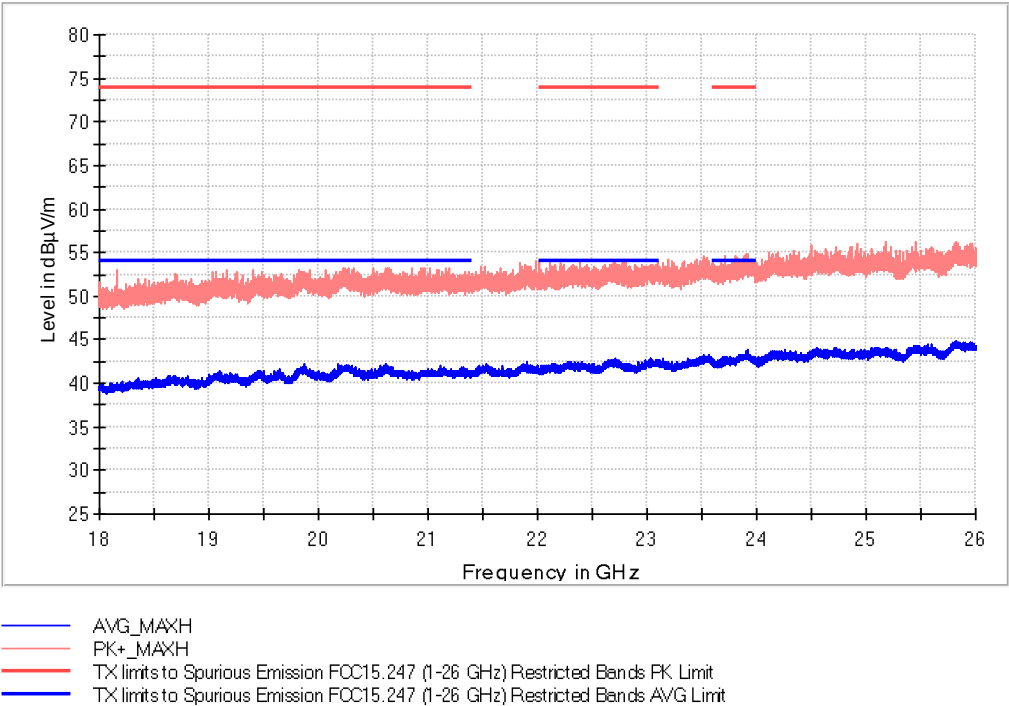
Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
20266.500000	52.9	42.3	H	11.7	54.0
22675.500000	55.2	42.4	V	11.6	54.0
23881.500000	53.2	43.8	H	10.2	54.0

Frequency range 18 - 26 GHz

Highest Channel

Frequency MHz = 2480.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Modulation = BT (8DPSK 3-DH5), Frequency Range GHz = [18, 26]

Images:

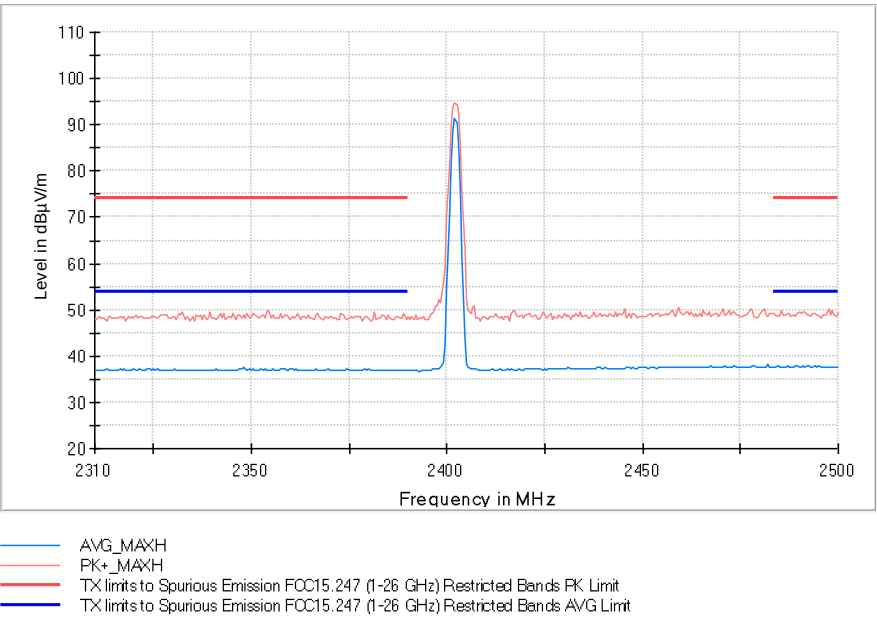


Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
20617.000000	51.6	42.3	V	11.7	54.0
23030.000000	52.4	42.9	V	11.1	54.0
23922.000000	53.1	43.9	V	10.1	54.0

Restricted Bands (2.31 GHz - 2.5 GHz)

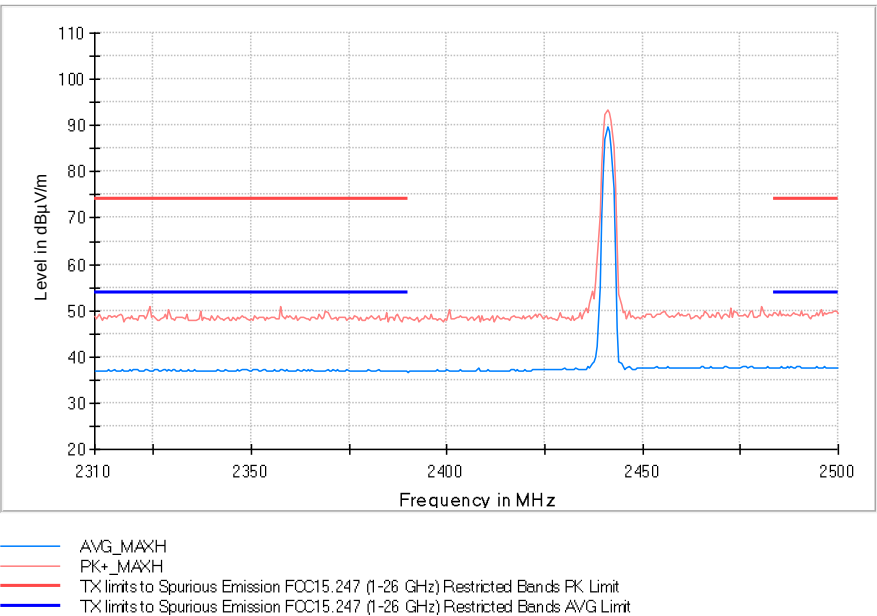
Lowest Channel

**Frequency MHz = 2402.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Modulation = BT (8DPSK 3-DH5), Frequency Range GHz = [1, 18]**



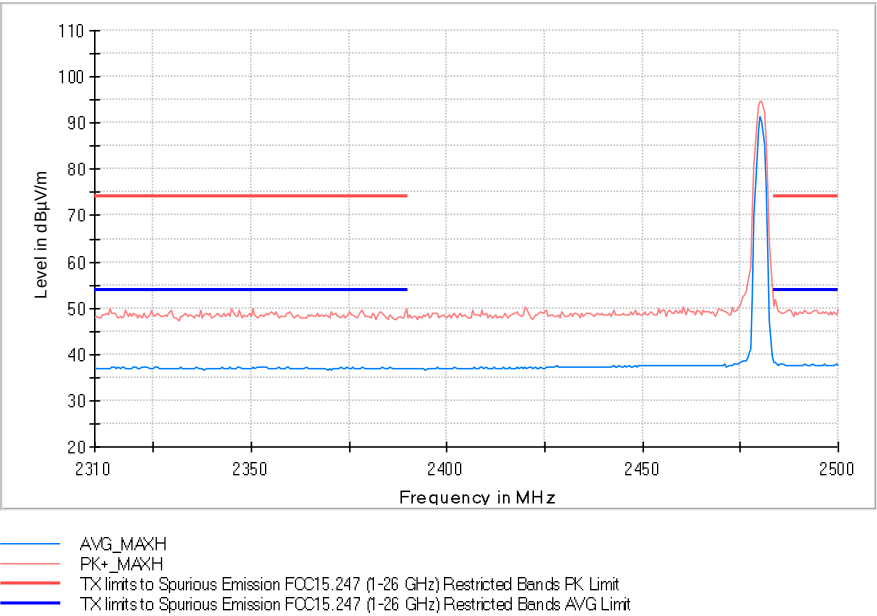
Middle Channel

**Frequency MHz = 2441.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Modulation = BT (8DPSK 3-DH5), Frequency Range GHz = [1, 18]**



Highest Channel

Frequency MHz = 2480.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS),
Modulation = BT (8DPSK 3-DH5), Frequency Range GHz = [1, 18]



Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	48.5 kHz	RMS ; PK+	100 kHz	1 s	20 dB

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
1 GHz - 3 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s	20 dB
3 GHz - 18 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s	20 dB

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
18 GHz - 26 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s	20 dB

Appendix C: Test results. Wi-Fi 2.4GHz

Appendix C

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PRODUCT INFORMATION

Information	Description
Modulation	DSSS/OFDM
Maximum RF Output Power	10 dBm
Operation mode	
- Operating Frequency Range	2400 – 2483.5 MHz
- Nominal Channel Bandwidth	20 MHz
Extreme operating conditions	
- Temperature range	-20 °C to +55 °C
Antenna type	External Antenna
Antenna gain	-2,5 dBi
Nominal Voltage	
- Supply Voltage	13.2 Vdc
- Type of power source	DC voltage
Equipment type	Wi-Fi 2.4 GHz b/g/n20

TEST CONDITIONS

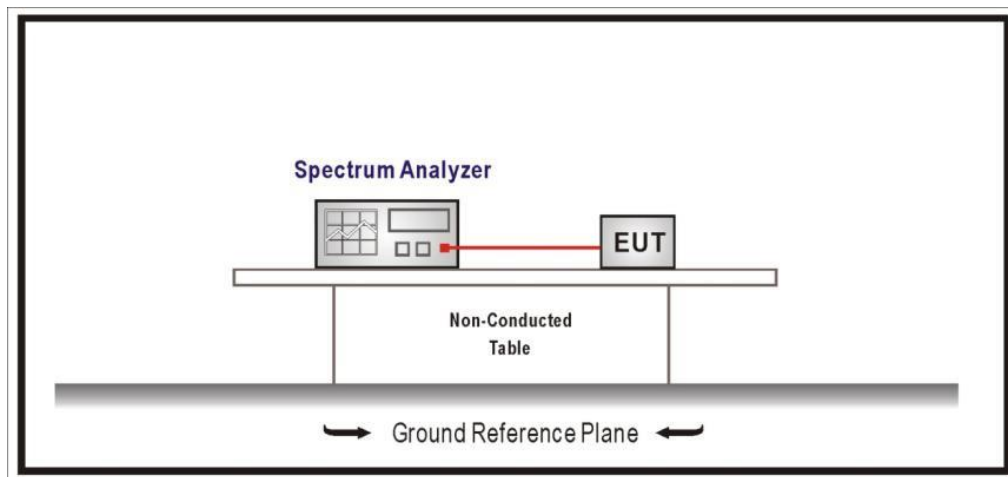
(*): Data provided by the client.

TEST CONDITIONS	DESCRIPTION
TC#01 ⁽¹⁾ (b mode)	<u>Power supply (V):</u> V_{nominal}: 13.2 Vdc <u>Temperature:</u> T_{nominal}: +15 to +35 °C <u>Channel Bandwidth:</u> 20 MHz <u>Test Frequencies for Conducted/Radiated tests:</u> Lowest channel: 2412 MHz Middle channel: 2442 MHz Highest channel: 2462 MHz
TC#02 ⁽¹⁾ (g mode)	<u>Power supply (V):</u> V_{nominal}: 13.2 Vdc <u>Temperature:</u> T_{nominal}: +15 to +35 °C <u>Channel Bandwidth:</u> 20 MHz <u>Test Frequencies for Conducted/Radiated tests:</u> Lowest channel: 2412 MHz Middle channel: 2442 MHz Highest channel: 2462 MHz
TC#03 ⁽¹⁾ (n mode)	<u>Power supply (V):</u> V_{nominal}: 13.2 Vdc <u>Temperature:</u> T_{nominal}: +15 to +35 °C <u>Channel Bandwidth:</u> 20 MHz <u>Test Frequencies for Conducted/Radiated tests:</u> Lowest channel: 2412 MHz Middle channel: 2442 MHz Highest channel: 2462 MHz

Note (1): For spurious emissions for OFDM modes 802.11g and 802.11n20 a preliminary scan was performed to determine the worst case. The following tables and plots show the results for the worst case in DSSS modulation (802.11b) and OFDM modulation (802.11g).

The data rates of 1Mb/s for 802.11b, 6Mb/s for 802.11g, MCS0 for 802.11n20 were selected based on preliminary testing that identified those rates corresponding to the worst cases.

CONDUCTED MEASUREMENTS:



RADIATED MEASUREMENTS:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at 3 m for the frequency range 30-1000 MHz (Bilog antenna) and 1-18 GHz Double ridge horn antennas, and 1m for the frequency range 18 GHz- 26 GHz Double ridge horn antenna.

For radiated emissions in the range 18 - 26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

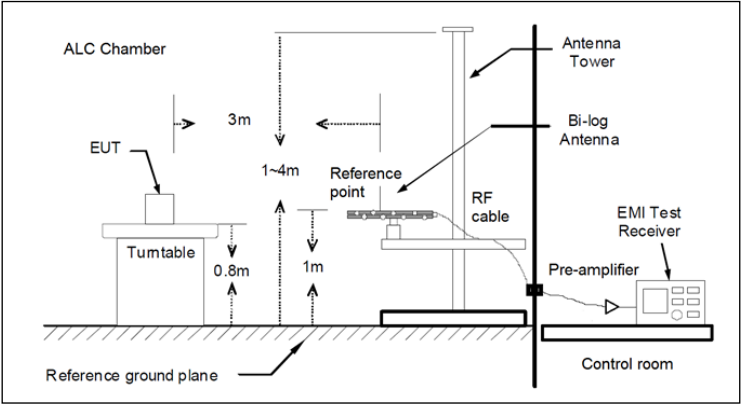


Fig A1: Radiated measurements Setup $f < 1$ GHz

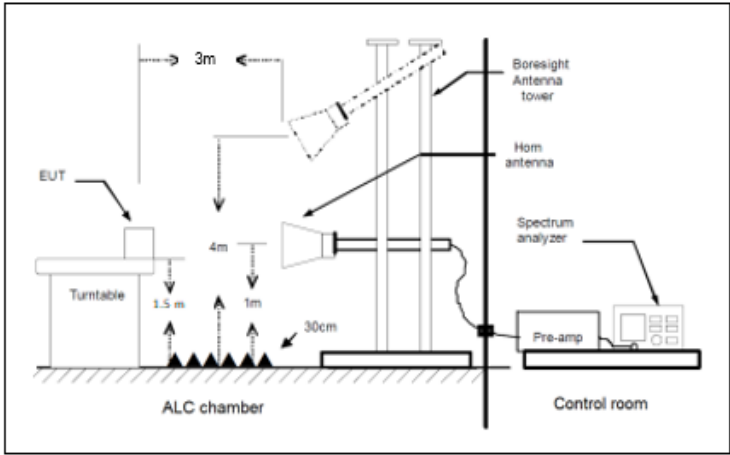


Fig A2: Radiated measurements setup $f > 1-18$ GHz

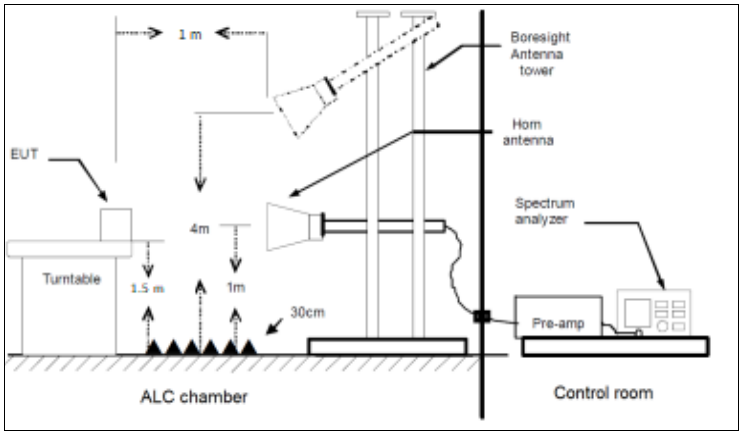


Fig A3: Radiated measurements setup $f > 18$ GHz

TEST CASES DETAILS

RSS-247 5.2 (a) / FCC 15.247 (a) (2) [6dBw] 6 dB Bandwidth

Limits

The minimum 6 dB bandwidth shall be at least 500 kHz

Modulation: 802.11b (DSSS 1 Mbit/s)

Results

Freq (MHz)	BW (MHz)	# of Tx Chains	Port	Emission Bandwidth (MHz)
2412.00000	20	1	1	10.150
2442.00000	20	1	1	10.150
2462.00000	20	1	1	10.150

Modulation: 802.11g (OFDM 6 Mbit/s)

Results

Freq (MHz)	BW (MHz)	# of Tx Chains	Port	Emission Bandwidth (MHz)
2412.00000	20	1	1	16.450
2442.00000	20	1	1	16.400
2462.00000	20	1	1	16.400

Modulation: 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)

Results

Freq (MHz)	BW (MHz)	# of Tx Chains	Port	Emission Bandwidth (MHz)
2412.00000	20	1	1	16.450
2442.00000	20	1	1	16.400
2462.00000	20	1	1	16.400

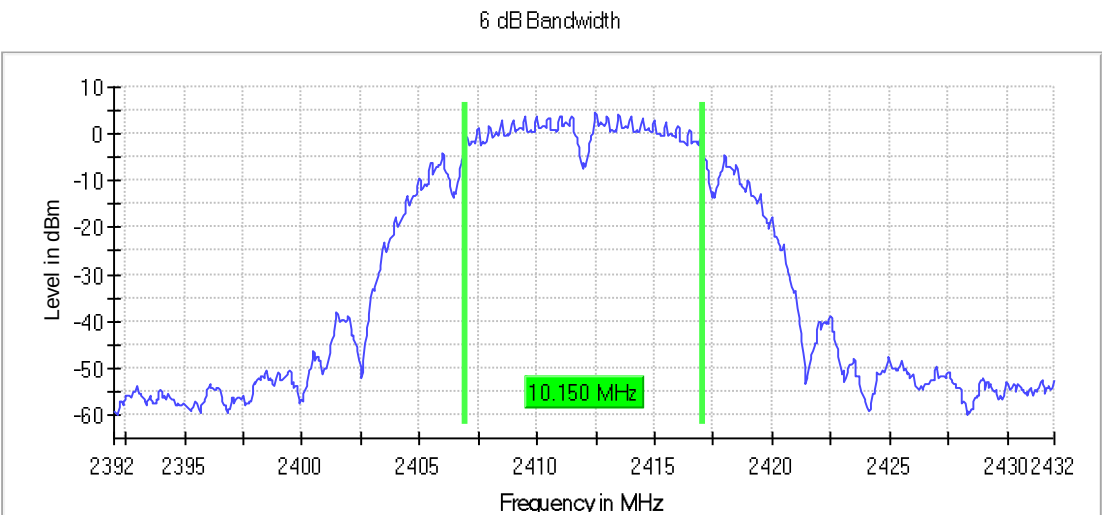
Verdict

Pass

Attachments

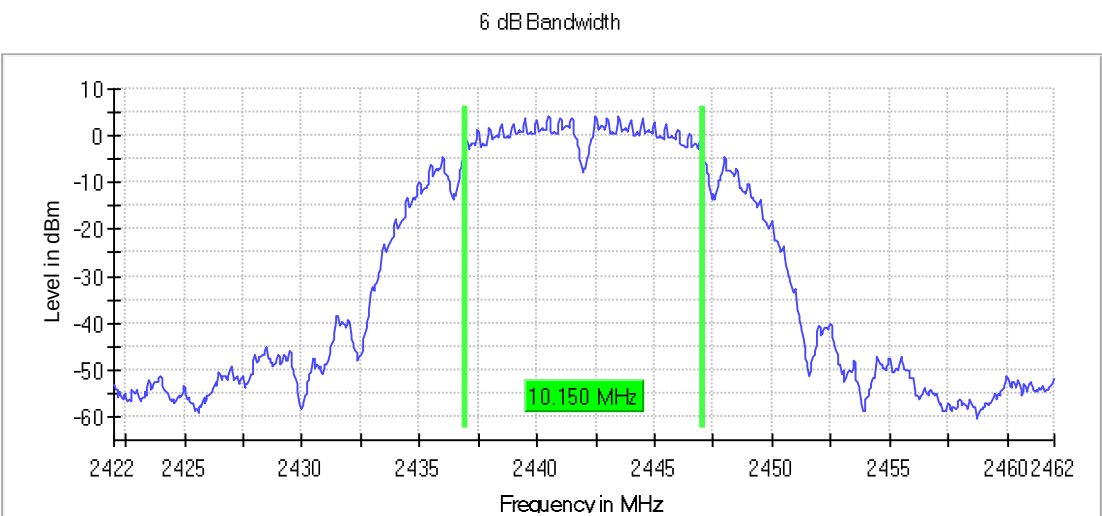
Frequency MHz = 2412.00000, Bandwidth MHz = 20, Modulation = 802.11b (DSSS 1 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



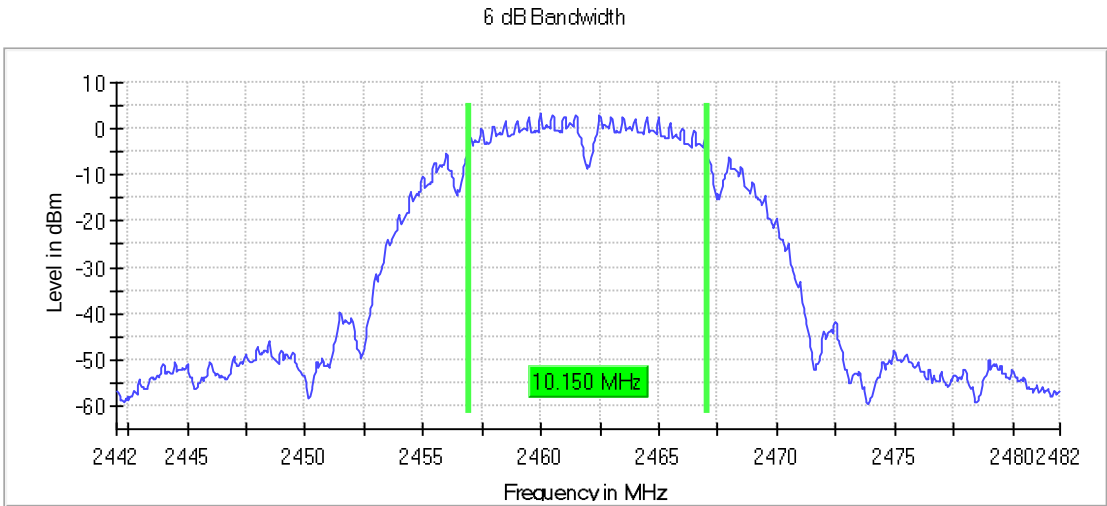
Frequency MHz = 2442.00000, Bandwidth MHz = 20, Modulation = 802.11b (DSSS 1 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



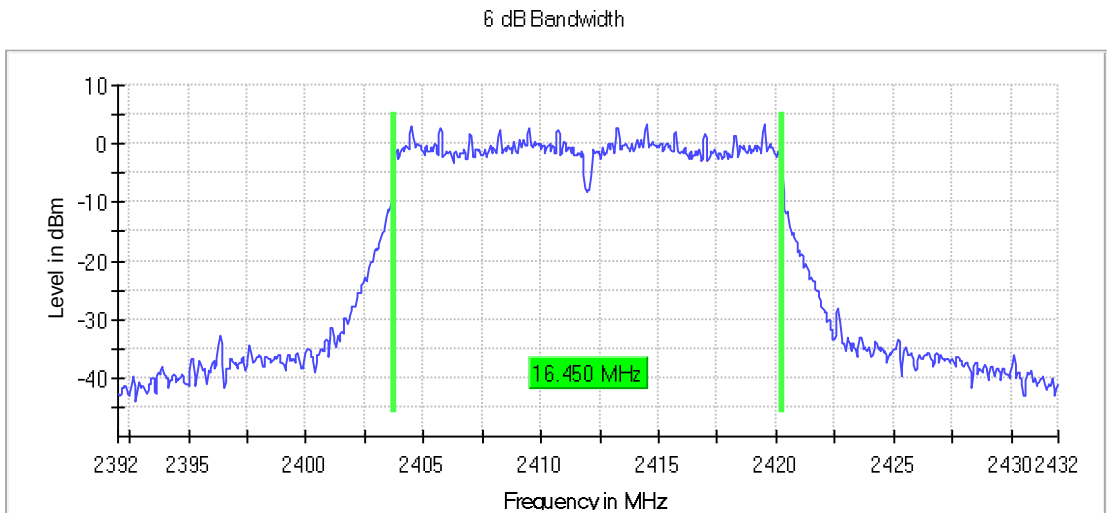
Frequency MHz = 2462.00000, Bandwidth MHz = 20, Modulation = 802.11b (DSSS 1 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



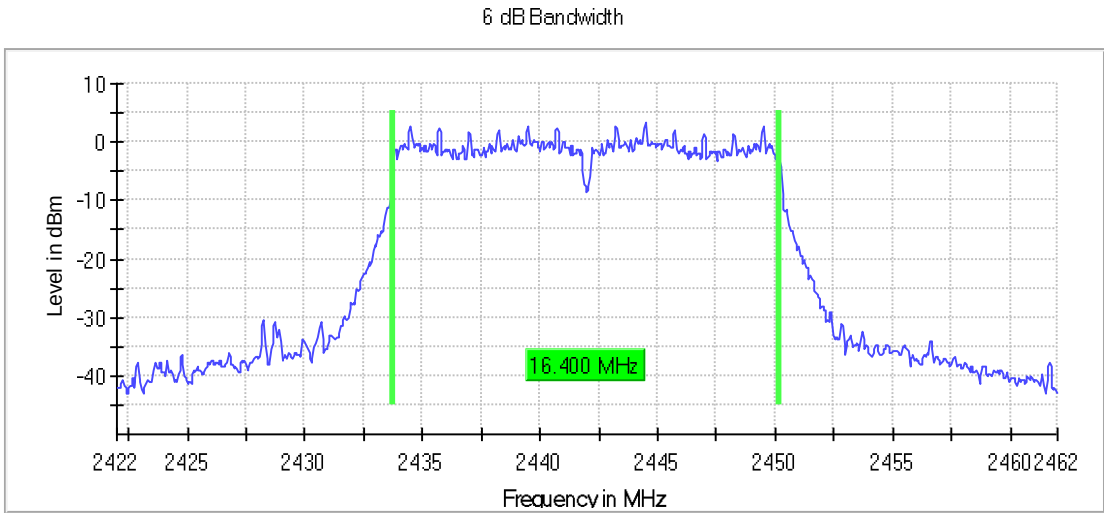
Frequency MHz = 2412.00000, Bandwidth MHz = 20, Modulation = 802.11g (OFDM 6 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



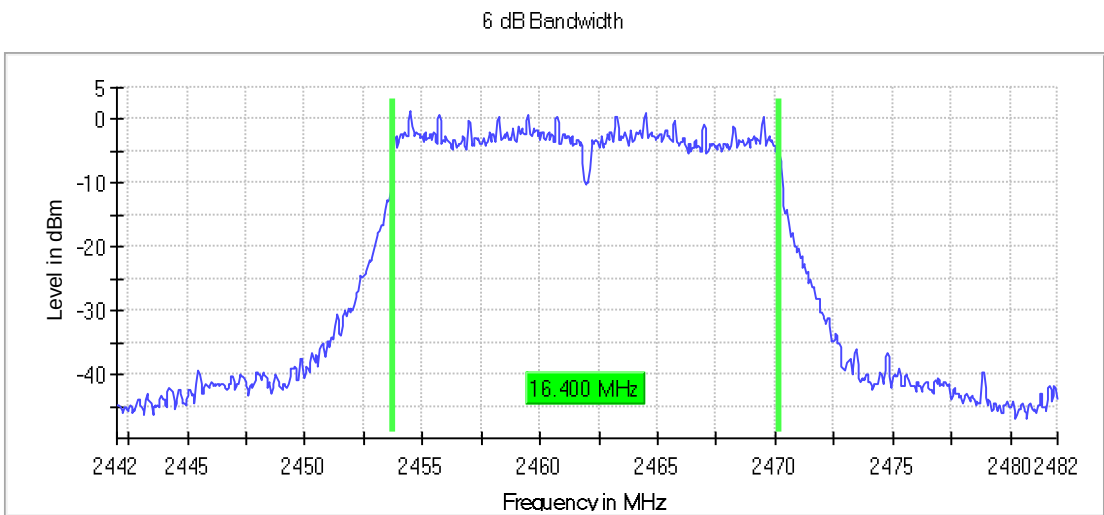
Frequency MHz = 2442.00000, Bandwidth MHz = 20, Modulation = 802.11g (OFDM 6 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



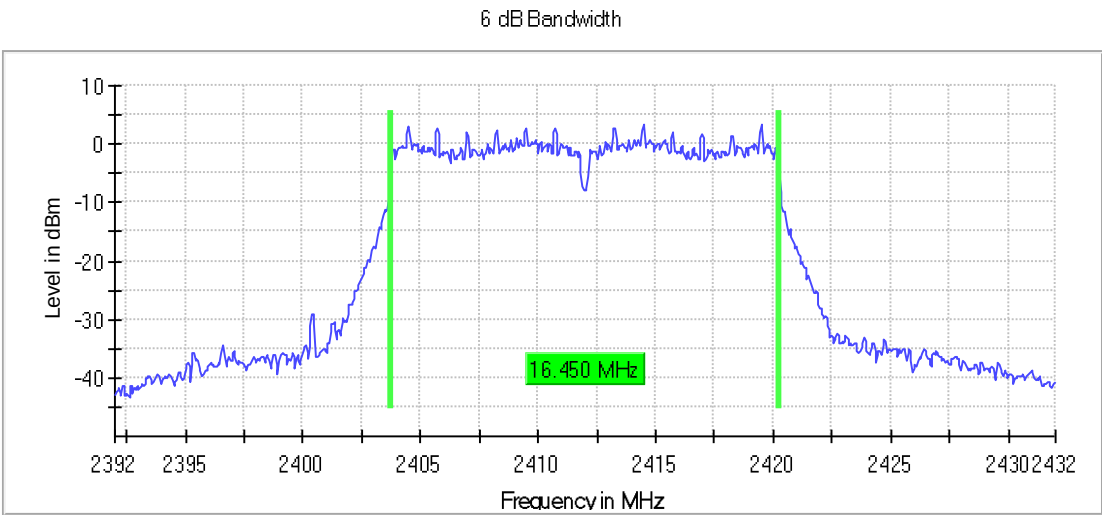
Frequency MHz = 2462.00000, Bandwidth MHz = 20, Modulation = 802.11g (OFDM 6 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



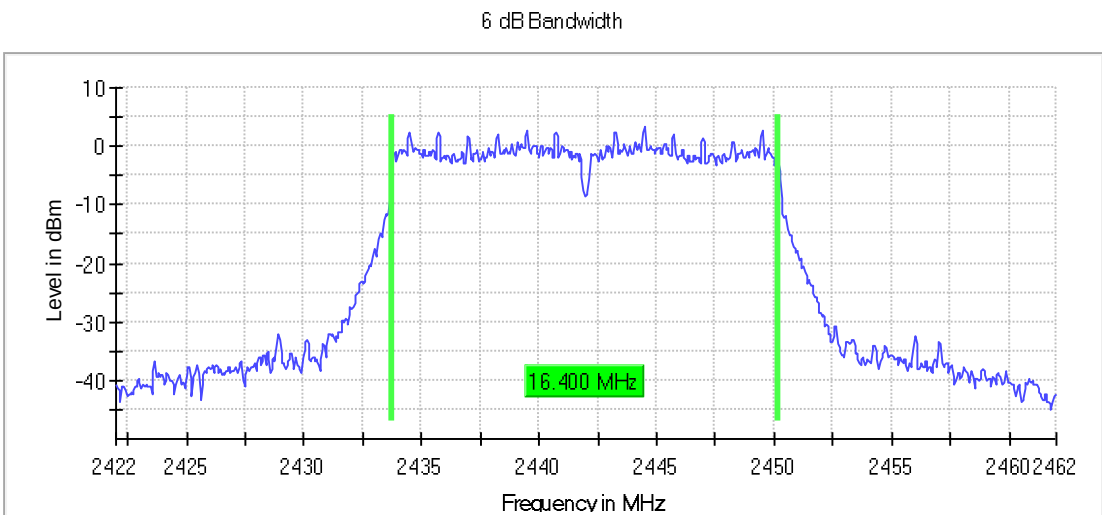
Frequency MHz = 2412.00000, Bandwidth MHz = 20, Modulation = 802.11n HT20 (OFDM MCS1), Number of Transmission Chains = 1, Active Port = 1

Images:



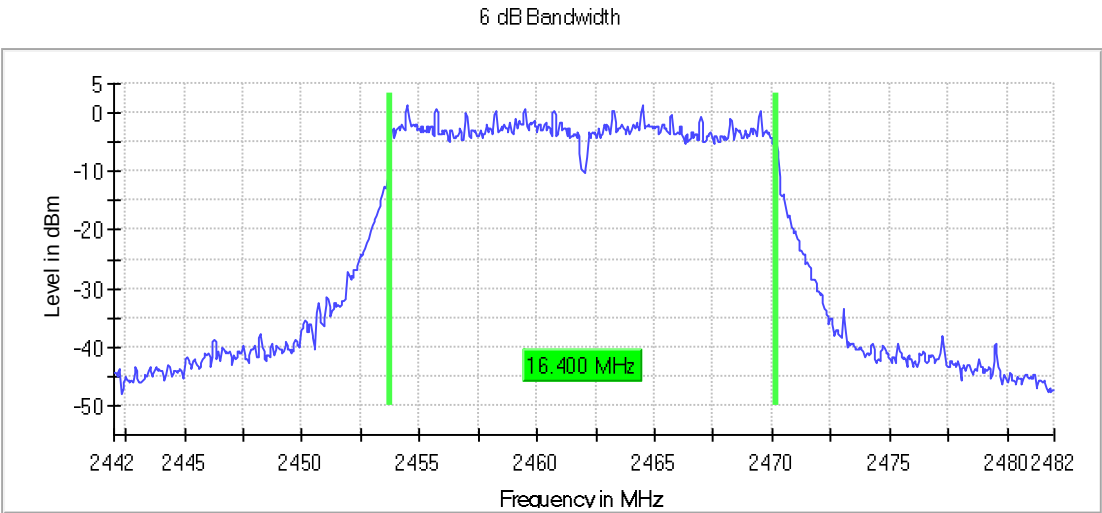
Frequency MHz = 2442.00000, Bandwidth MHz = 20, Modulation = 802.11n HT20 (OFDM MCS1), Number of Transmission Chains = 1, Active Port = 1

Images:



Frequency MHz = 2462.00000, Bandwidth MHz = 20, Modulation = 802.11n HT20 (OFDM MCS1), Number of Transmission Chains = 1, Active Port = 1

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value	Instrument Value	Instrument Value
Start Frequency	2.39200 GHz	2.41700 GHz	2.44200 GHz
Stop Frequency	2.43200 GHz	2.45700 GHz	2.48200 GHz
Span	40.00 MHz	40.000 MHz	40.000 MHz
RBW	100.000 kHz	100.000 kHz	100.000 kHz
VBW	300.000 kHz	300.000 kHz	300.000 kHz
Sweep Points	800	800	800
Sweep time	56.836 μs	56.836 μs	56.836 μs
Reference Level	10.000 dBm	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	30.000 dB	30.000 dB
Detector	MaxPeak	MaxPeak	MaxPeak
Sweep Count	100	100	100
Filter	3 dB	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Max Hold
Sweep type	FFT	FFT	FFT
Preamp	off	off	off
Stable mode	Trace	Trace	Trace
Stable value	0.50 dB	0.50 dB	0.50 dB
Run	15 / max. 150	20 / max. 150	29 / max. 150
Stable	5 / 5	5 / 5	5 / 5
Max Stable Difference	0.33 dB	0.27 dB	0.04 dB

FCC 2.1049 / 99dBw Occupied Channel Bandwidth 99%

Modulation: 802.11b (DSSS 1 Mbit/s)

Results

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Port	Occ Ch BW (MHz)
2412.00000	Digital Transmission System (DTS)	20	1	1	13.300
2442.00000	Digital Transmission System (DTS)	20	1	1	13.300
2462.00000	Digital Transmission System (DTS)	20	1	1	13.300

Modulation: 802.11g (OFDM 6 Mbit/s)

Results

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Port	Occ Ch BW (MHz)
2412.00000	Digital Transmission System (DTS)	20	1	1	16.700
2442.00000	Digital Transmission System (DTS)	20	1	1	16.600
2462.00000	Digital Transmission System (DTS)	20	1	1	16.600

Modulation: 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)

Results

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Port	Occ Ch BW (MHz)
2412.00000	Digital Transmission System (DTS)	20	1	1	16.600
2442.00000	Digital Transmission System (DTS)	20	1	1	16.600
2462.00000	Digital Transmission System (DTS)	20	1	1	16.600

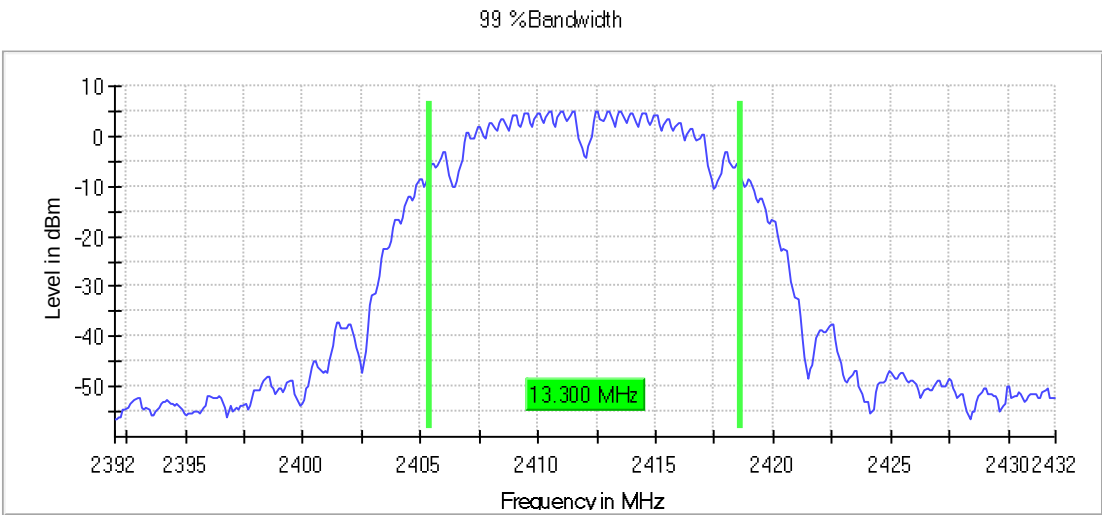
Verdict

Pass

Attachments

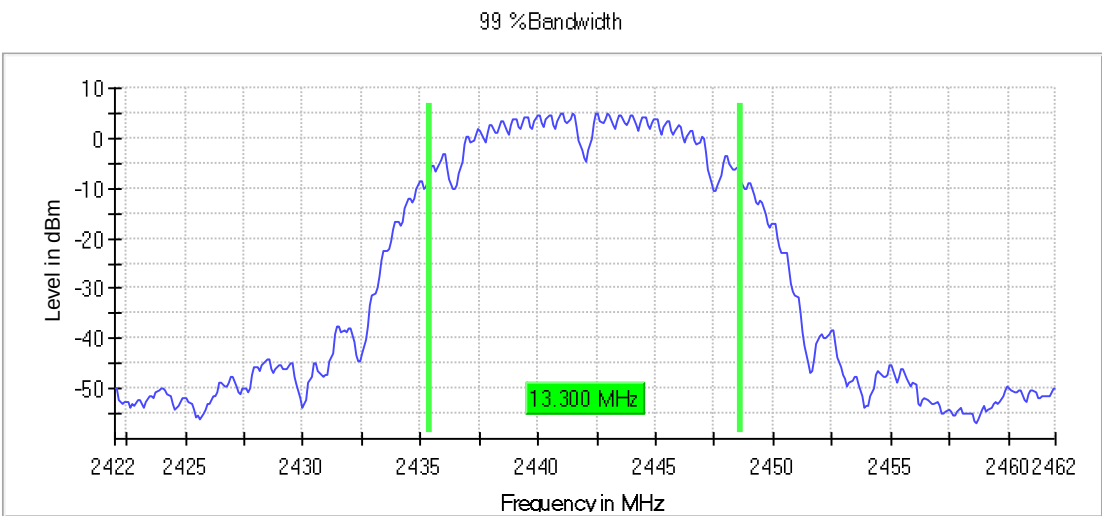
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Modulation = 802.11b (DSSS 1 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



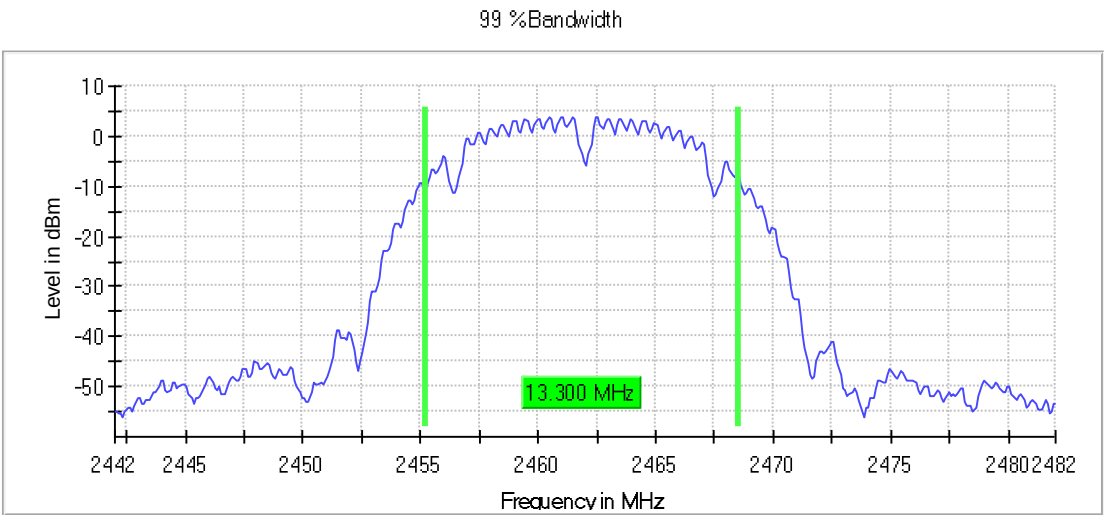
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Images:



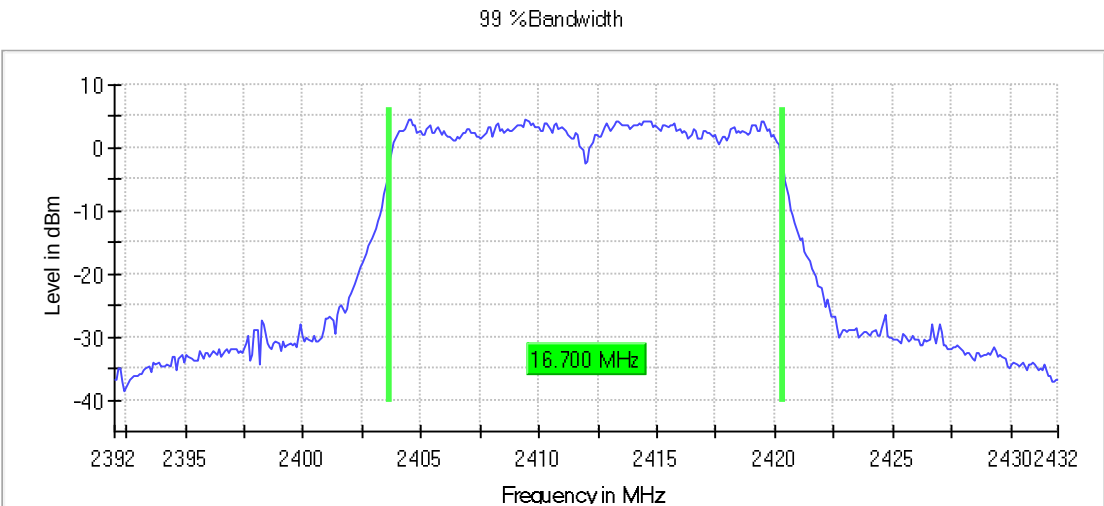
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Modulation = 802.11b (DSSS 1 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



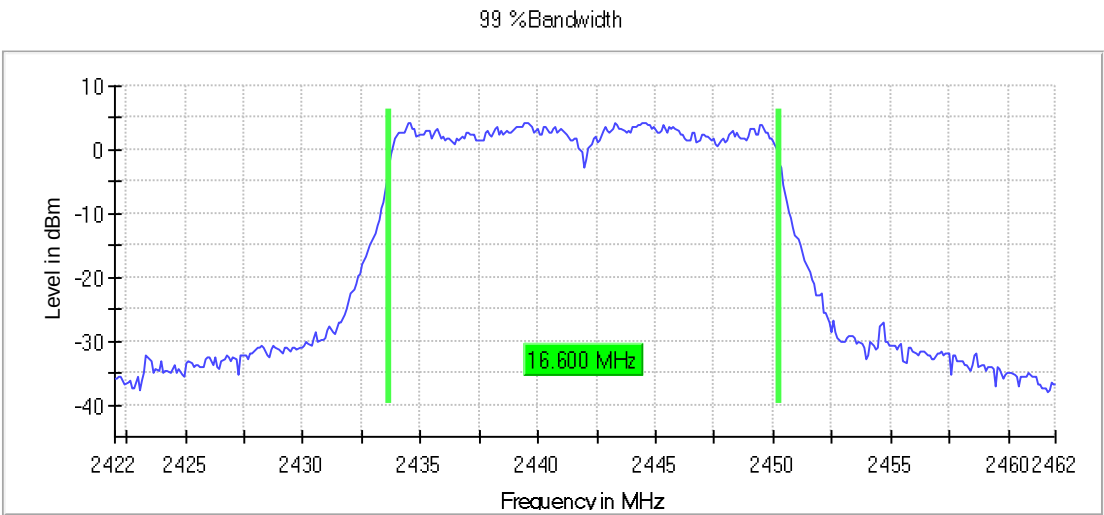
Frequency MHz = 2412.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11g (OFDM 6 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



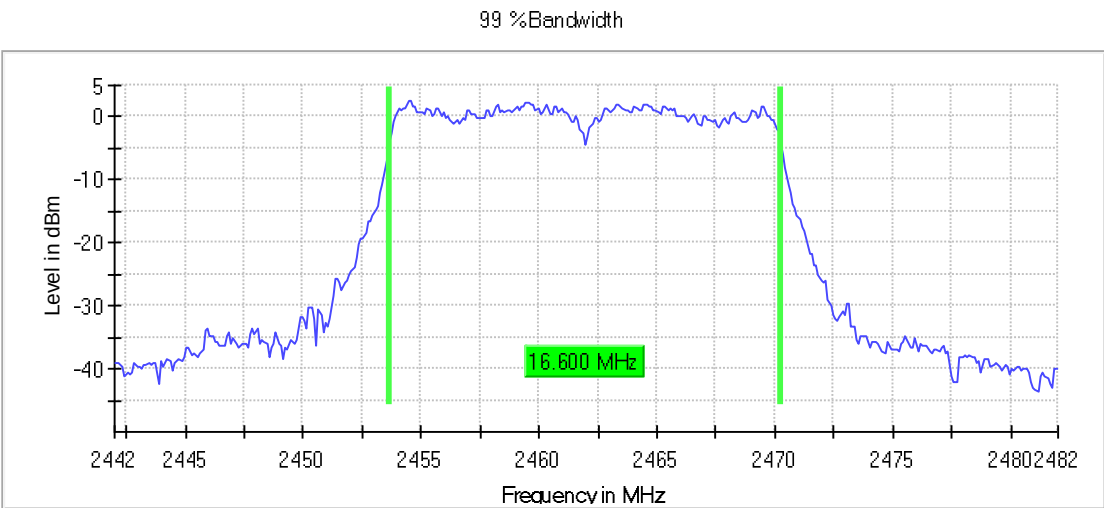
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Modulation = 802.11g (OFDM 6 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



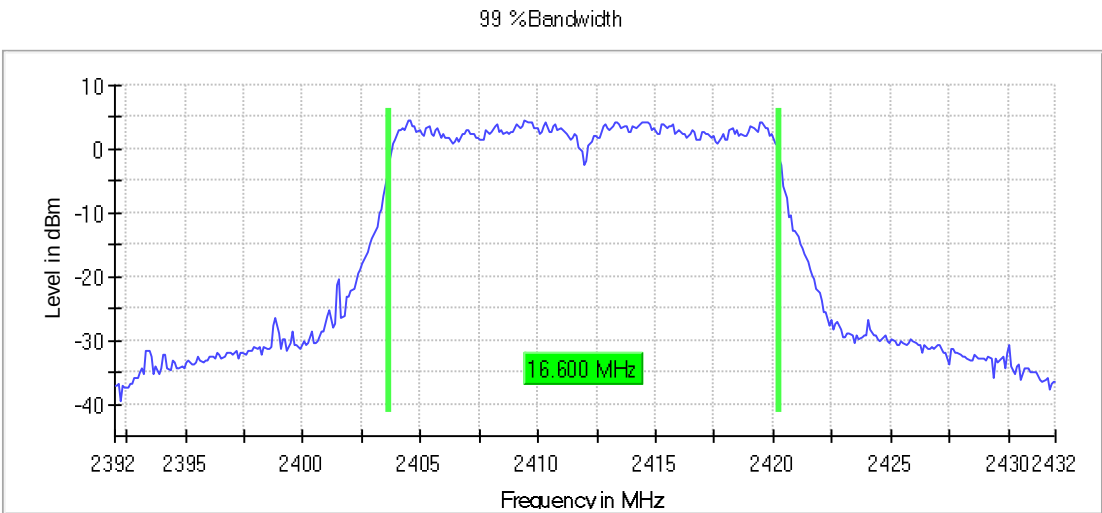
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Modulation = 802.11g (OFDM 6 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



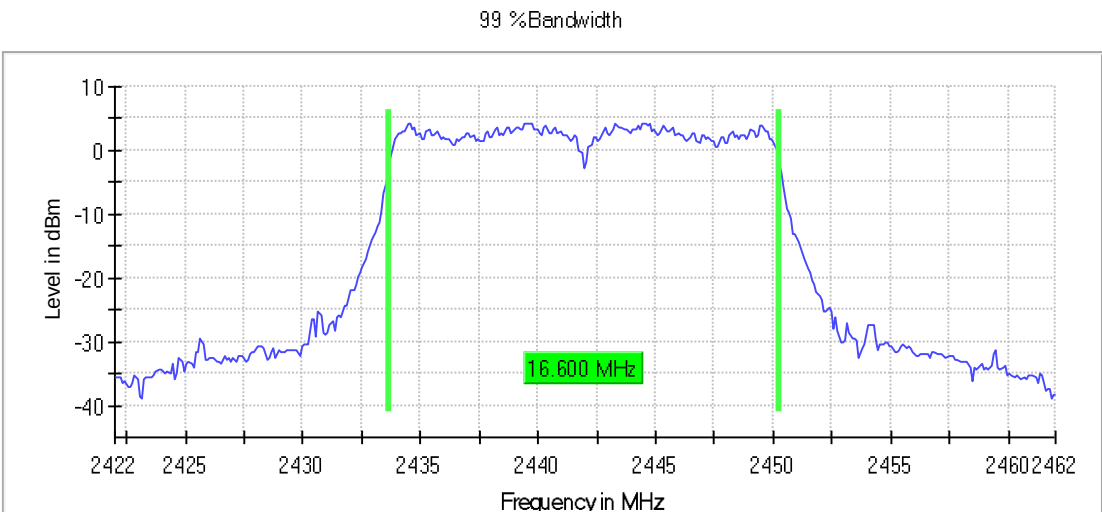
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Modulation = 802.11n HT20 (OFDM MCS1), Number of Transmission Chains = 1, Active Port = 1

Images:



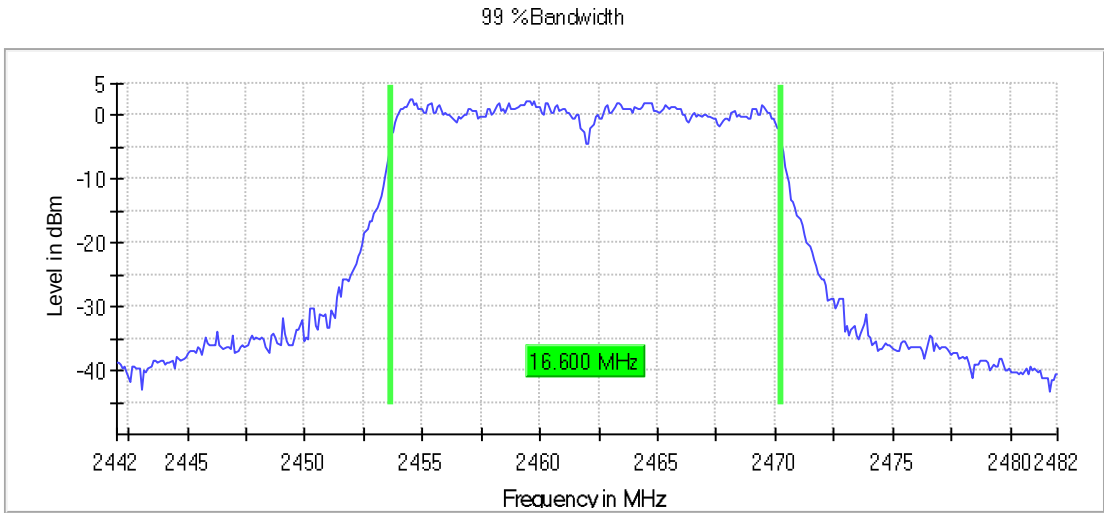
Frequency MHz = 2442.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11n HT20 (OFDM MCS1), Number of Transmission Chains = 1, Active Port = 1

Images:



Frequency MHz = 2462.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11n HT20 (OFDM MCS1), Number of Transmission Chains = 1, Active Port = 1

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value	Instrument Value	Instrument Value
Start Frequency	2.39200 GHz	2.41700 GHz	2.44200 GHz
Stop Frequency	2.43200 GHz	2.45700 GHz	2.48200 GHz
Span	40.00 MHz	40.000 MHz	40.000 MHz
RBW	200.000 kHz	200.000 kHz	200.000 kHz
VBW	1.000 MHz	1.000 MHz	1.000 MHz
Sweep Points	400	400	400
Sweep time	28.447 μs	28.447 μs	28.447 μs
Reference Level	10.000 dBm	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	30.000 dB	30.000 dB
Detector	MaxPeak	MaxPeak	MaxPeak
Sweep Count	100	100	100
Filter	3 dB	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Max Hold
Sweep type	FFT	FFT	FFT
Preamp	off	off	off
Stable mode	Trace	Trace	Trace
Stable value	0.50 dB	0.50 dB	0.50 dB
Run	15 / max. 150	16 / max. 150	16 / max. 150
Stable	3 / 3	3 / 3	3 / 3
Max Stable Difference	0.04 dB	0.02 dB	0.32 dB

RSS-247 5.2 (b) / FCC 15.247 (e) [Psd] Power spectral density

Limits

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Modulation: 802.11b (DSSS 1 Mbit/s)

Results

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Port	PSD (dBm)
2412.00000	Digital Transmission System (DTS)	20	1	1	3.958
2442.00000	Digital Transmission System (DTS)	20	1	1	3.859
2462.00000	Digital Transmission System (DTS)	20	1	1	1.962

Modulation: 802.11g (OFDM 6 Mbit/s)

Results

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Port	PSD (dBm)
2412.00000	Digital Transmission System (DTS)	20	1	1	0.376
2442.00000	Digital Transmission System (DTS)	20	1	1	0.186
2462.00000	Digital Transmission System (DTS)	20	1	1	-1.908

Modulation: 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)

Results

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Port	PSD (dBm)
2412.00000	Digital Transmission System (DTS)	20	1	1	0.440
2442.00000	Digital Transmission System (DTS)	20	1	1	0.171
2462.00000	Digital Transmission System (DTS)	20	1	1	-1.899

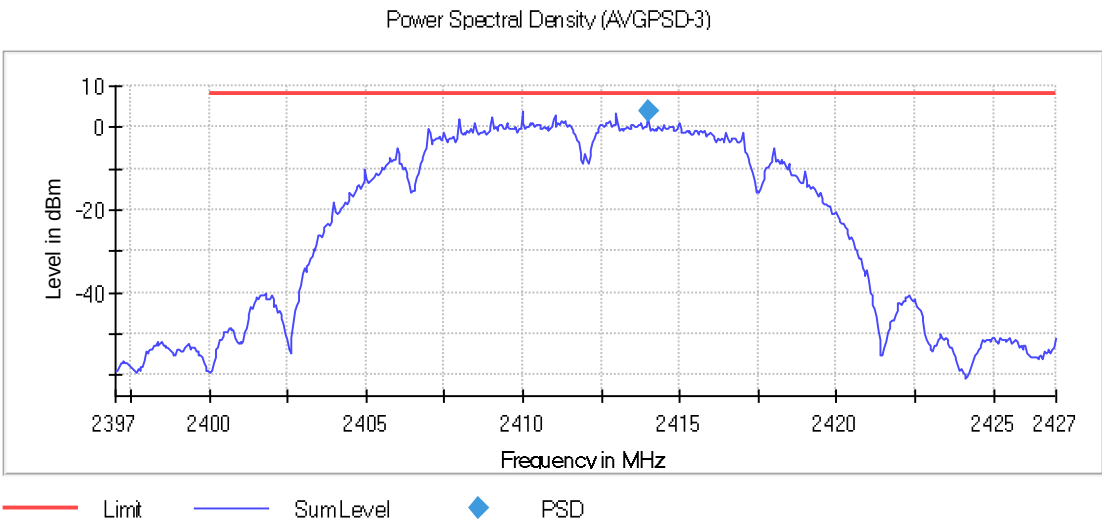
Verdict

Pass

Attachments

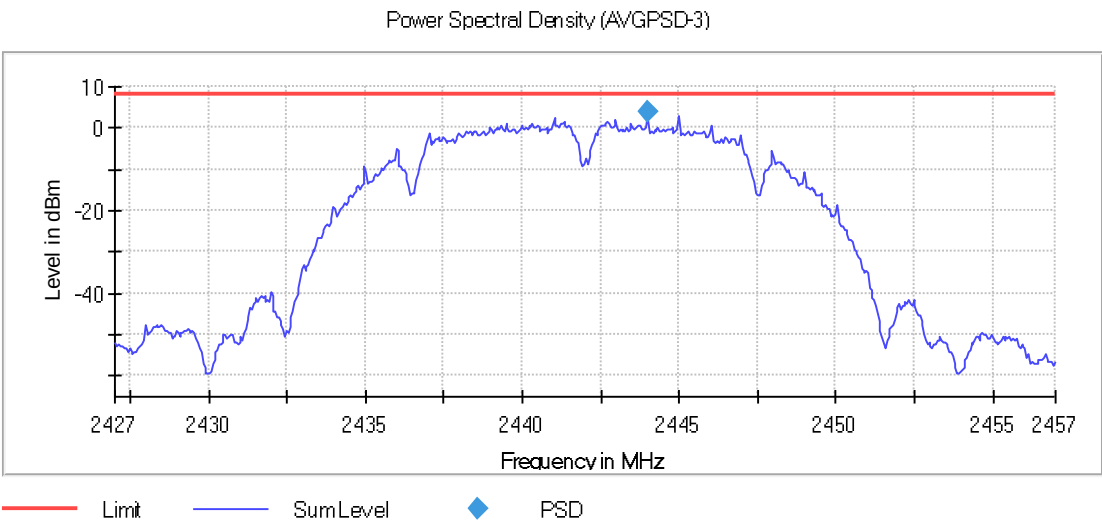
Frequency MHz = 2412.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11b (DSSS 1 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



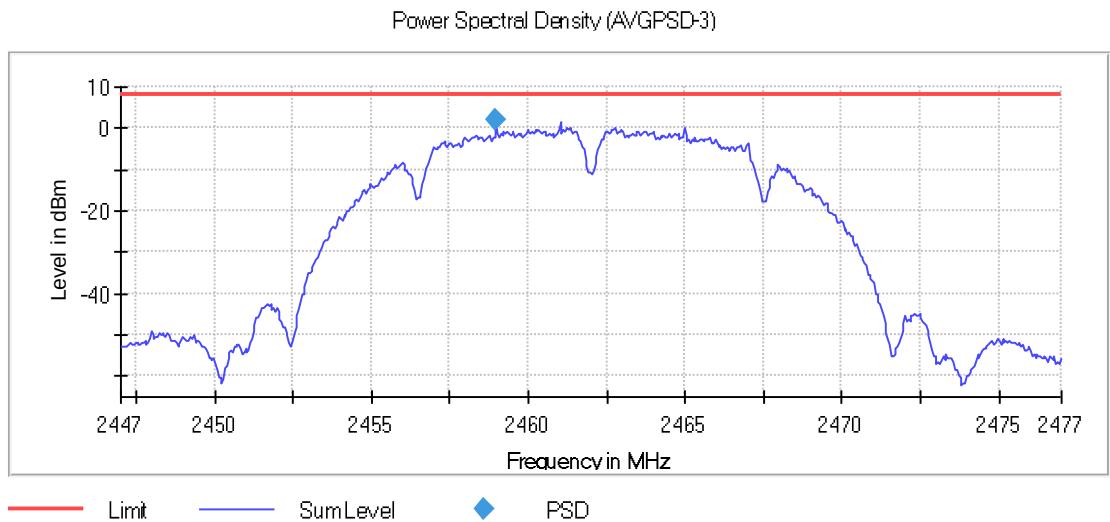
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Modulation = 802.11b (DSSS 1 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



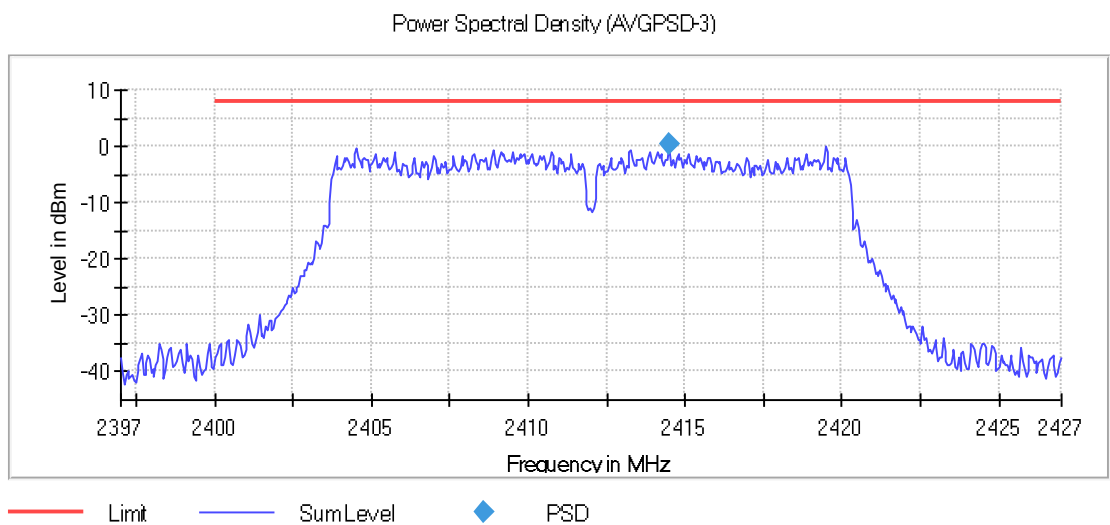
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Modulation = 802.11b (DSSS 1 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



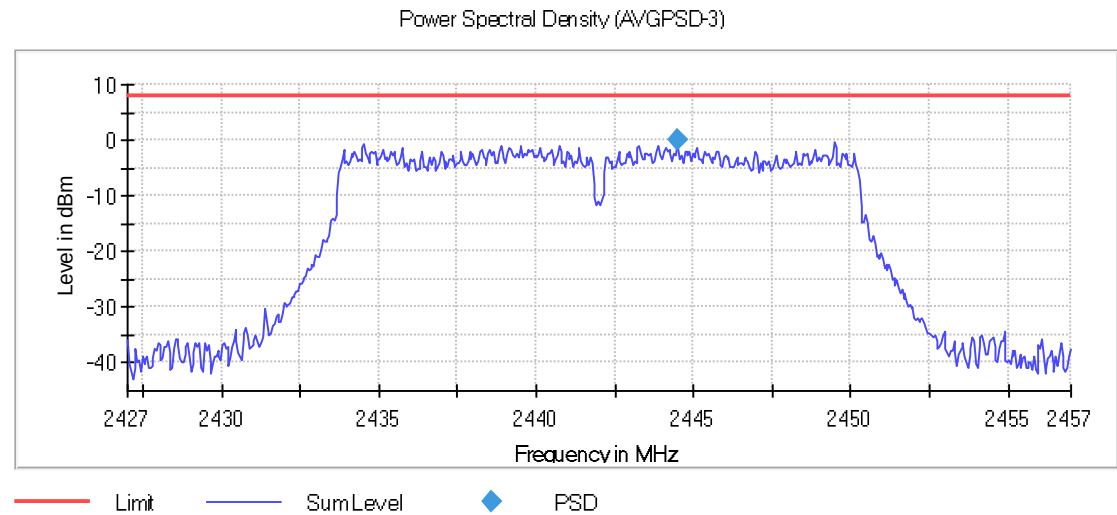
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Modulation = 802.11g (OFDM 6 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



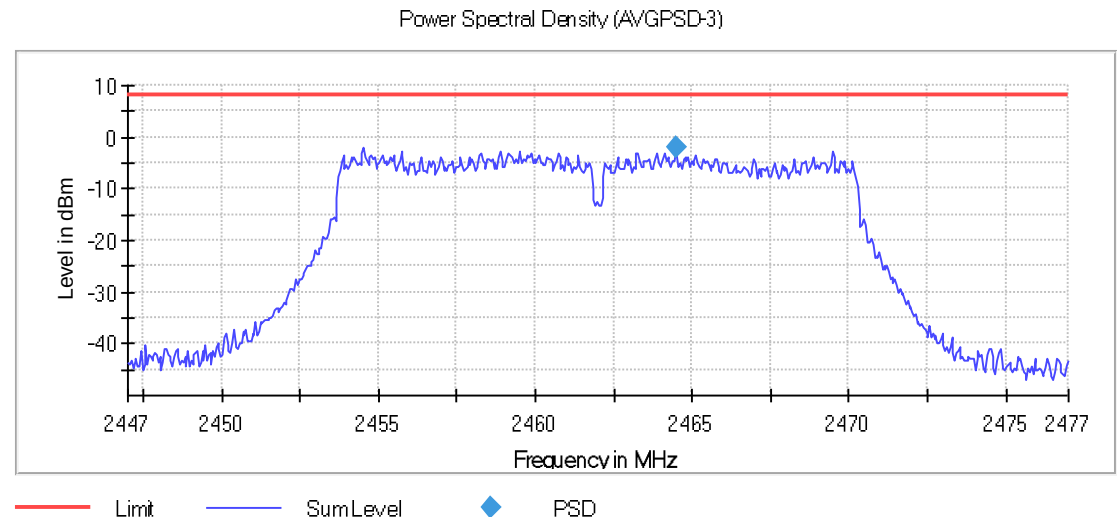
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Modulation = 802.11g (OFDM 6 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



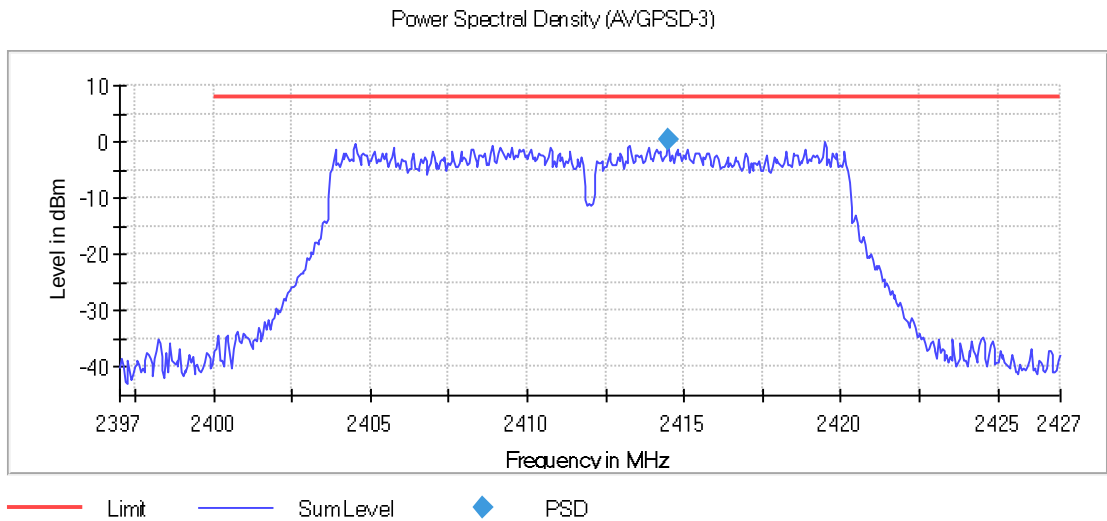
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Modulation = 802.11g (OFDM 6 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



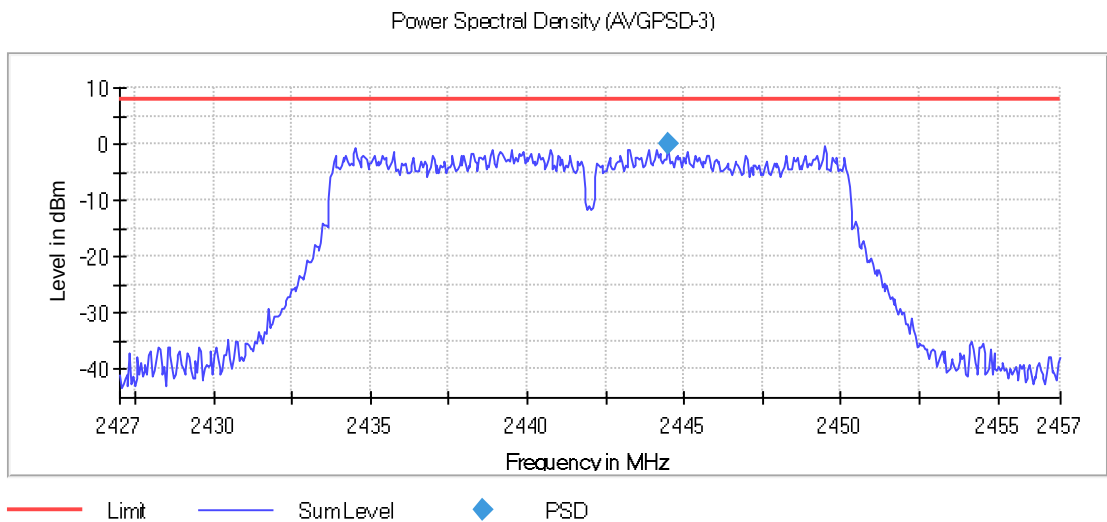
Frequency MHz = 2412.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11n HT20 (OFDM MCS1), Number of Transmission Chains = 1, Active Port = 1

Images:



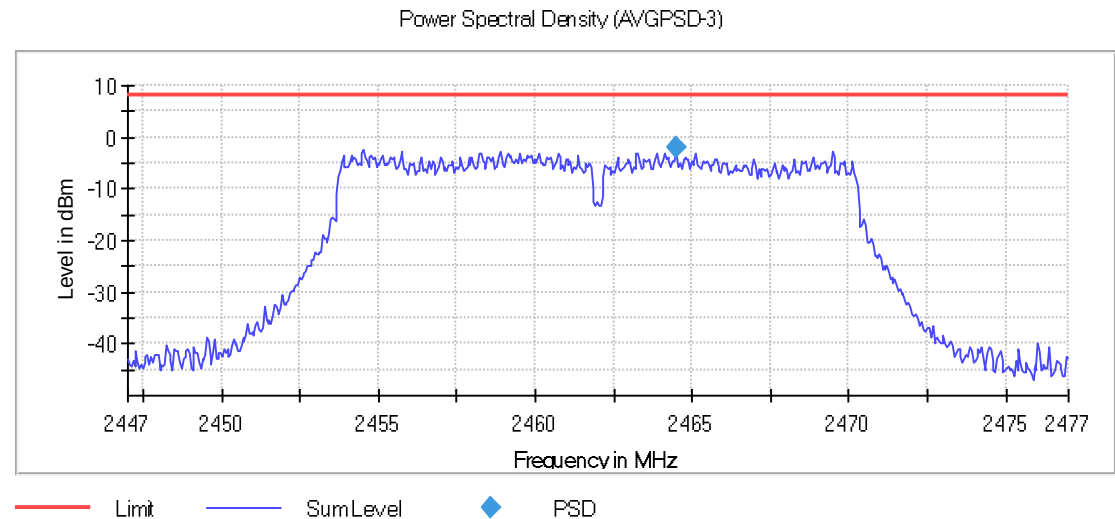
Frequency MHz = 2442.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11n HT20 (OFDM MCS1), Number of Transmission Chains = 1, Active Port = 1

Images:



Frequency MHz = 2462.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11n HT20 (OFDM MCS1), Number of Transmission Chains = 1, Active Port = 1

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value	Instrument Value	Instrument Value
Start Frequency	2.39700 GHz	2.42200 GHz	2.44700 GHz
Stop Frequency	2.42700 GHz	2.45200 GHz	2.47700 GHz
Span	30.000 MHz	30.000 MHz	30.000 MHz
RBW	100.000 kHz	100.000 kHz	100.000 kHz
VBW	300.000 kHz	300.000 kHz	300.000 kHz
Sweep Points	600	600	600
Sweep time	12.000 ms	12.000 ms	12.000 ms
Reference Level	10.000 dBm	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	30.000 dB	30.000 dB
Detector	RMS	RMS	RMS
Sweep Count	1	1	1
Filter	3 dB	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Max Hold
Sweep type	Sweep	Sweep	Sweep
Preamplifier	off	off	off
Stable mode	Trace	Trace	Trace
Stable value	0.50 dB	0.50 dB	0.50 dB
Run	79 / max.150	83 / max. 150	94 / max. 150
Stable	3 / 3	3 / 3	3 / 3
Max Stable Difference	0.05 dB	0.46 dB	0.25 dB

RSS-247 5.4 (d) / FCC 15.247 (b) (1) [Avcp] Maximum Average Conducted output Power

Limits

systems using digital modulation in the 2400 -2483.5 MHz band: 1 watt (30 dBm).
The e.i.r.p. shall not exceed 4 W (36 dBm) (RSS-247).

Maximum declared antenna gain: -2.5 dBi

Modulation: 802.11b (DSSS 1 Mbit/s)
Results

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Port	Avg Power (dBm)	E.I.R.P. (dBm)
2412.00000	Digital Transmission System (DTS)	20	1	1	14.2	11.7
2442.00000	Digital Transmission System (DTS)	20	1	1	13.9	11.4
2462.00000	Digital Transmission System (DTS)	20	1	1	12.7	10.2

Modulation: 802.11g (OFDM 6 Mbit/s)
Results

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Port	Avg Power (dBm)	E.I.R.P. (dBm)
2412.00000	Digital Transmission System (DTS)	20	1	1	14.8	12.3
2442.00000	Digital Transmission System (DTS)	20	1	1	14.4	11.9
2462.00000	Digital Transmission System (DTS)	20	1	1	12.5	10.0

Modulation: 802.11n HT20 (OFDM MCS0 6.5 Mbit/s)
Results

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Port	Avg Power (dBm)	E.I.R.P. (dBm)
2412.00000	Digital Transmission System (DTS)	20	1	1	14.7	12.2
2442.00000	Digital Transmission System (DTS)	20	1	1	14.4	11.9
2462.00000	Digital Transmission System (DTS)	20	1	1	12.5	10.0

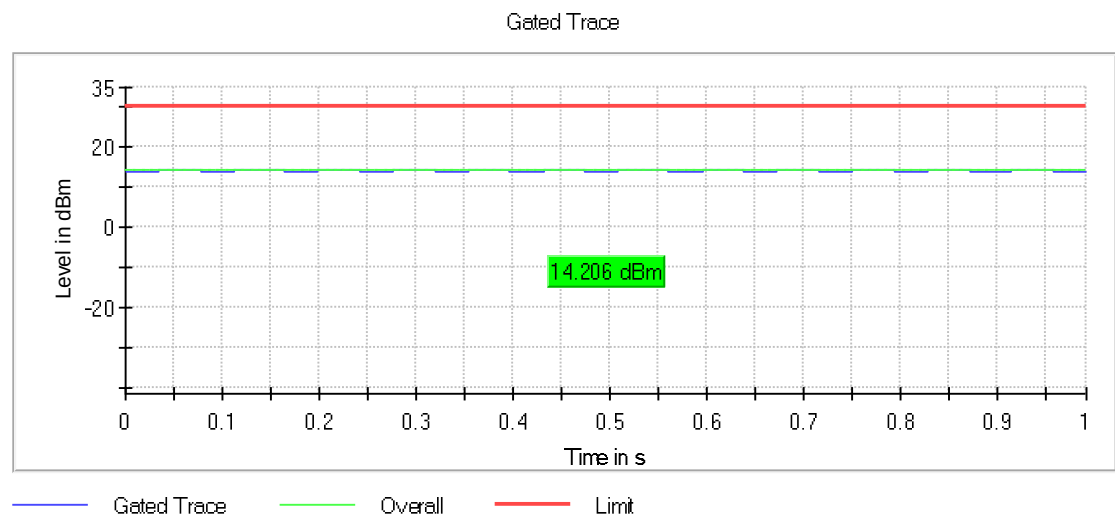
Verdict

Pass

Attachments

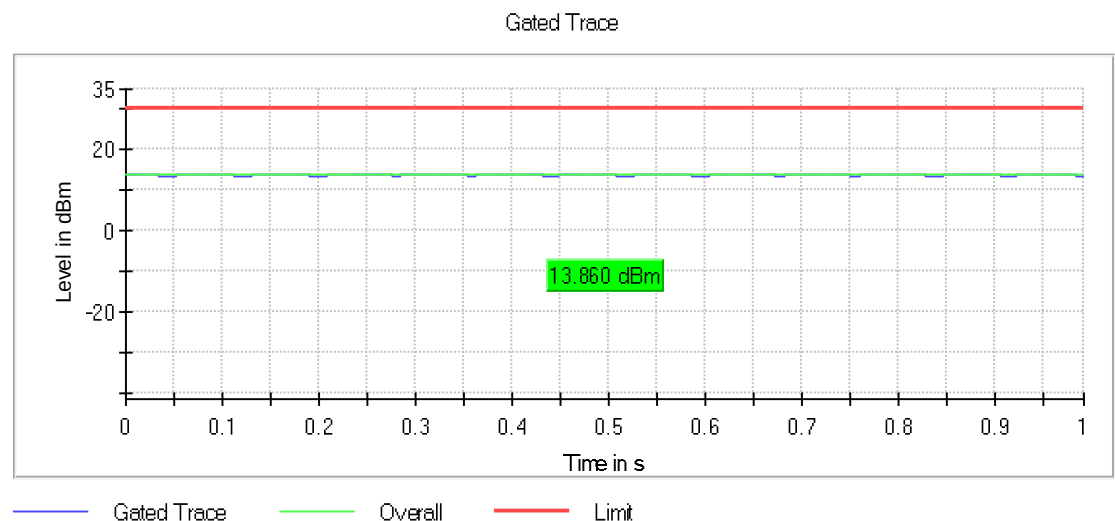
Frequency MHz = 2412.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11b (DSSS 1 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



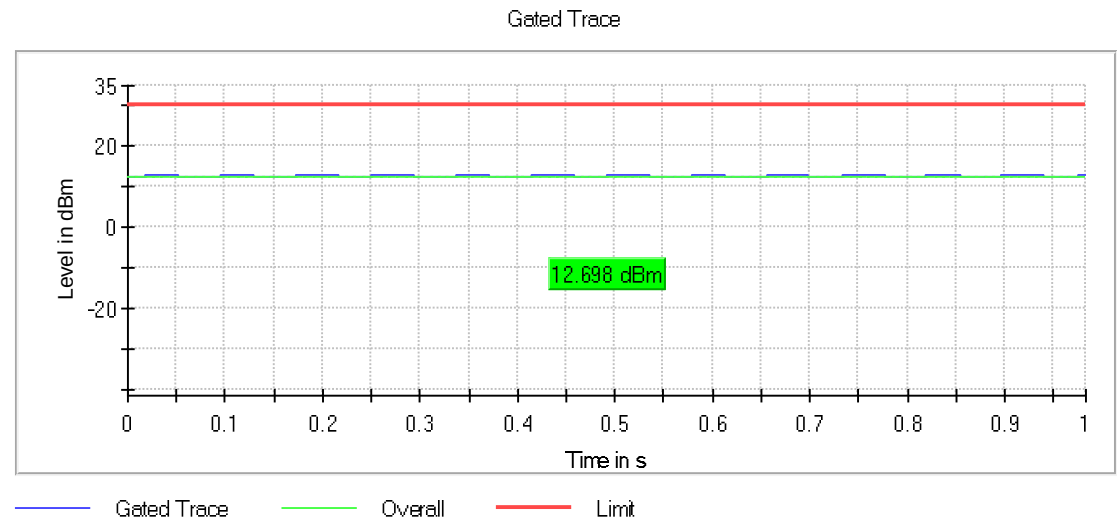
Frequency MHz = 2442.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11b (DSSS 1 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



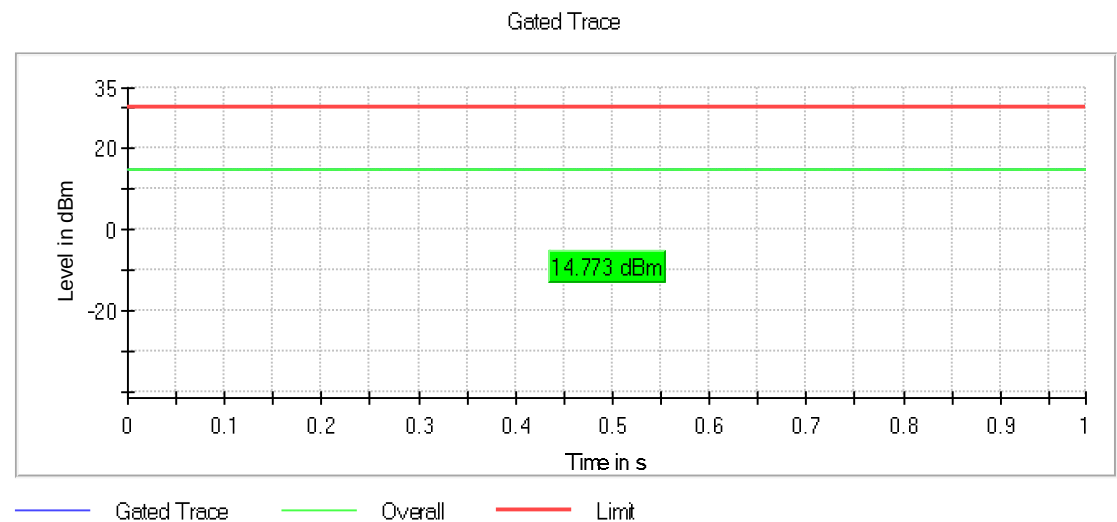
Frequency MHz = 2462.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11b (DSSS 1 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



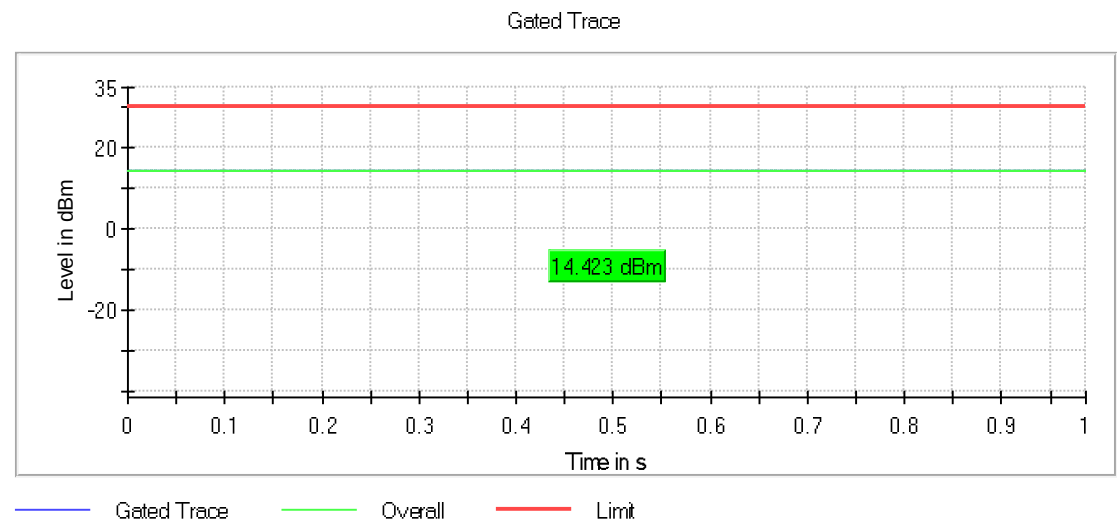
Frequency MHz = 2412.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11g (OFDM 6 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



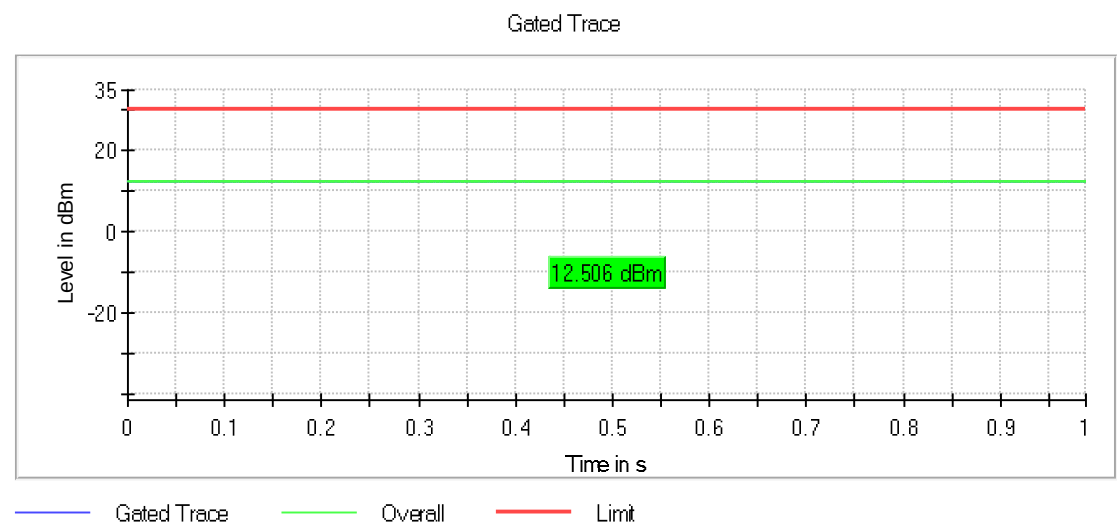
Frequency MHz = 2442.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11g (OFDM 6 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



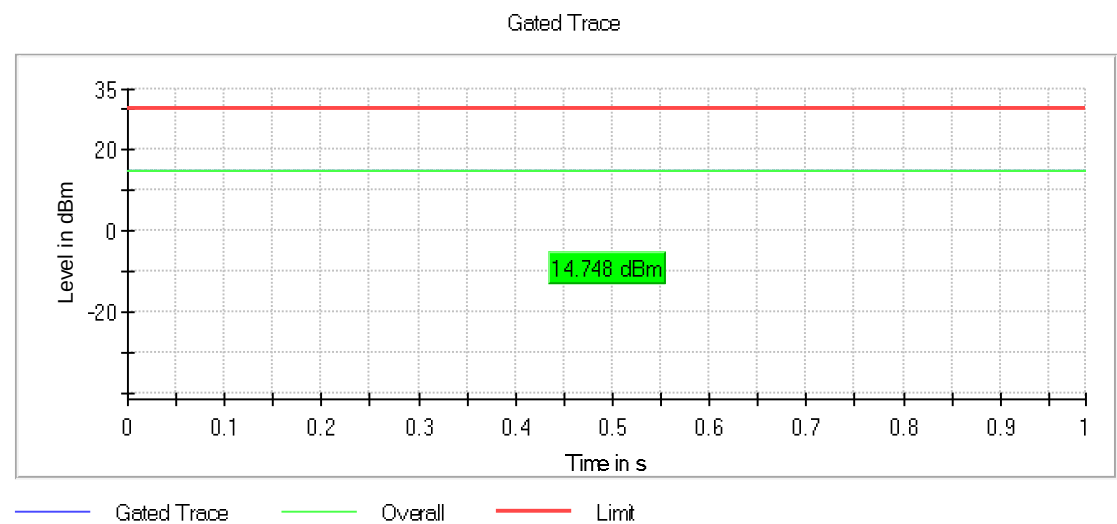
Frequency MHz = 2462.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11g (OFDM 6 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



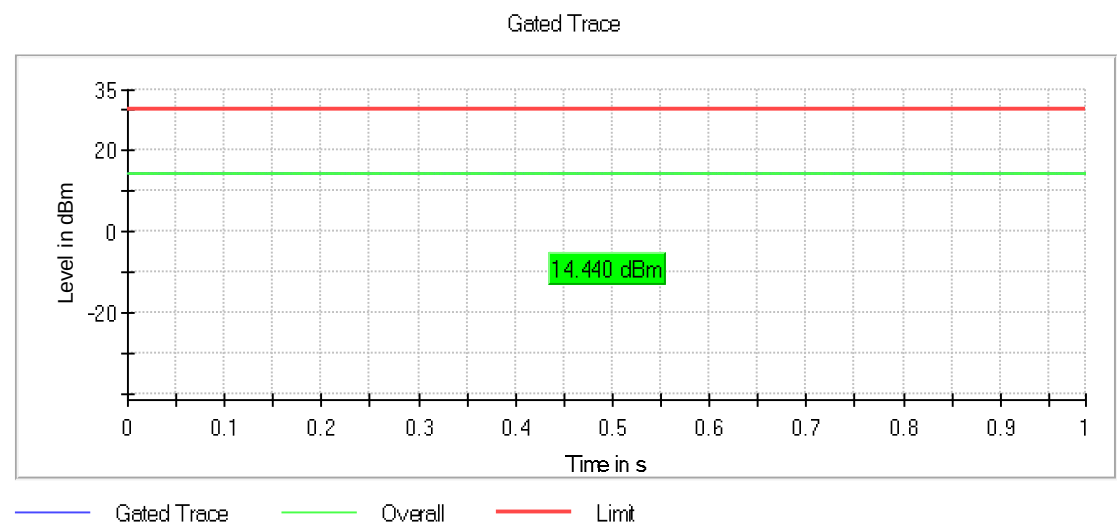
Frequency MHz = 2412.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



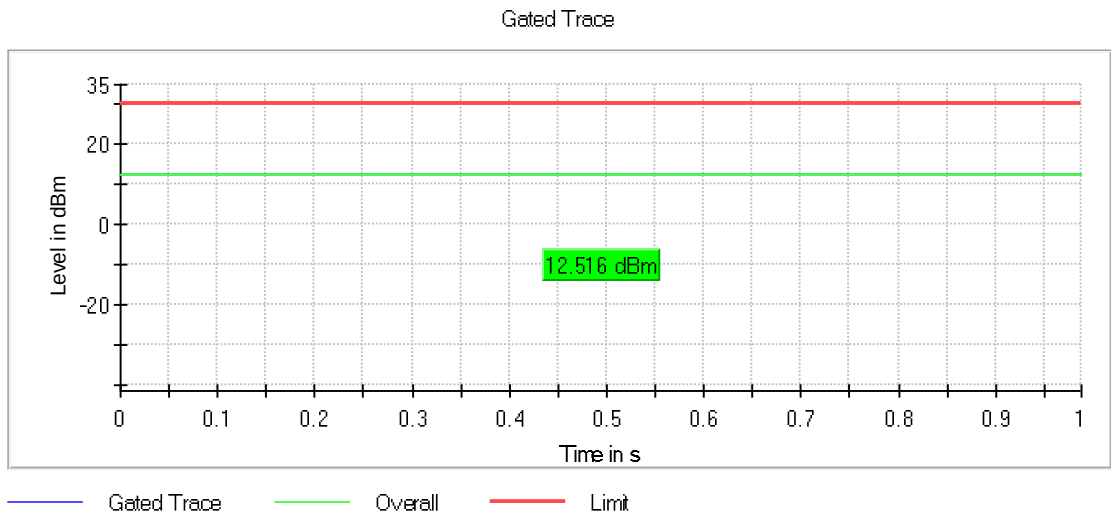
Frequency MHz = 2442.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



Frequency MHz = 2462.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11n HT20 (OFDM MCS0 6.5 Mbit/s), Number of Transmission Chains = 1, Active Port = 1

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value
Measurement Time	1.000 s
Points	1000000
Time resolution	1.000 μs

RSS-247 5.5 / FCC 15.247 (d) Band-edge emissions compliance (Transmitter) - Conducted

Limits

In any 100 kHz bandwidths outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. 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.

Modulation: 802.11b (DSSS 1 Mbit/s)

Results

DUT Frequency	Result
2412.000000	PASS

DUT Frequency	Result
2462.000000	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2398.475000	-47.5	22.1	-25.4	PASS
2398.525000	-47.7	22.3	-25.4	PASS
2399.475000	-48.3	22.9	-25.4	PASS
2398.425000	-48.7	23.2	-25.4	PASS
2398.975000	-49.2	23.8	-25.4	PASS
2399.525000	-49.3	23.9	-25.4	PASS
2399.425000	-49.5	24.1	-25.4	PASS
2399.025000	-49.6	24.1	-25.4	PASS
2398.375000	-49.9	24.4	-25.4	PASS
2398.325000	-49.9	24.5	-25.4	PASS
2398.625000	-49.9	24.5	-25.4	PASS
2398.675000	-50.0	24.6	-25.4	PASS
2398.575000	-50.1	24.7	-25.4	PASS
2399.225000	-50.2	24.7	-25.4	PASS
2398.225000	-50.3	24.9	-25.4	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2498.475000	-52.1	25.2	-26.9	PASS
2498.425000	-52.9	26.0	-26.9	PASS
2498.975000	-54.3	27.4	-26.9	PASS
2498.575000	-54.5	27.6	-26.9	PASS
2498.025000	-54.5	27.6	-26.9	PASS
2498.525000	-54.6	27.6	-26.9	PASS
2497.575000	-54.8	27.9	-26.9	PASS
2498.625000	-54.8	27.9	-26.9	PASS
2484.725000	-55.2	28.3	-26.9	PASS
2486.975000	-55.3	28.4	-26.9	PASS
2497.525000	-55.3	28.4	-26.9	PASS
2484.025000	-55.4	28.5	-26.9	PASS
2499.025000	-55.5	28.6	-26.9	PASS
2497.925000	-55.5	28.6	-26.9	PASS
2484.675000	-55.5	28.6	-26.9	PASS

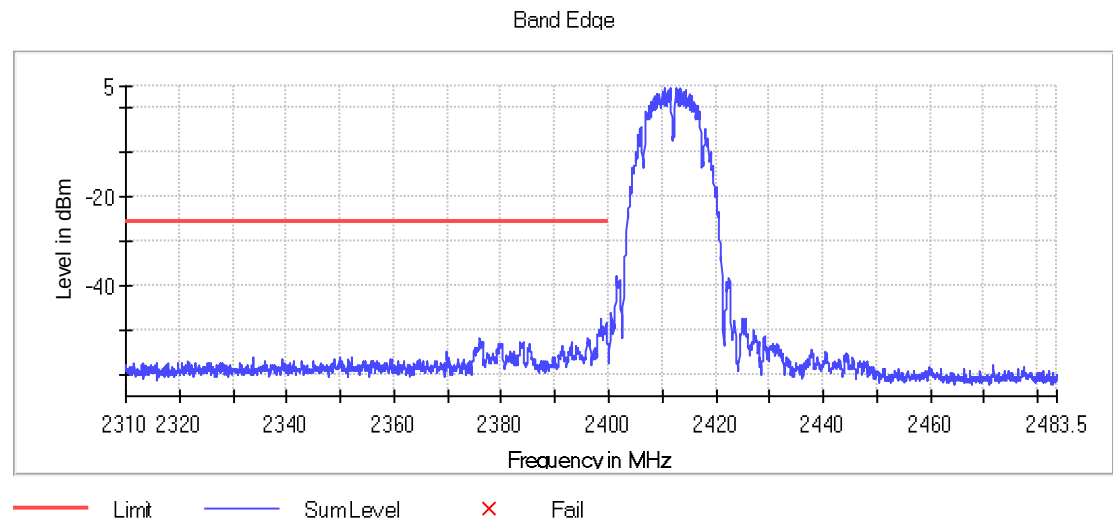
Verdict

Pass

Attachments

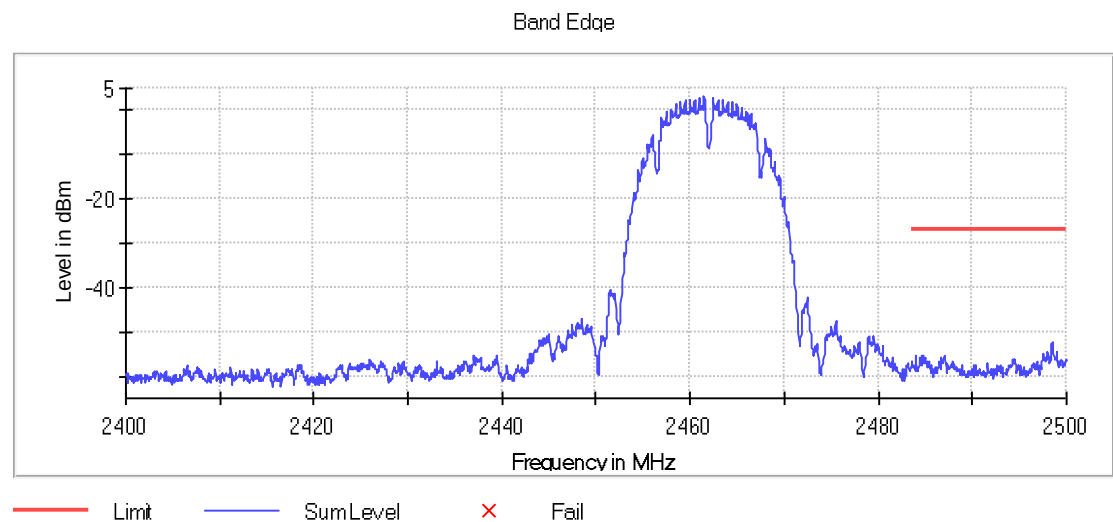
Frequency MHz = 2412.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11b (DSSS 1 Mbit/s), Number of Transmission Chains = 1, Measurement Point = 1,
Active Port = 1

Images:



Frequency MHz = 2462.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11b (DSSS 1 Mbit/s), Number of Transmission Chains = 1, Measurement Point = 1,
Active Port = 1

Images:



Modulation: 802.11g (OFDM 6 Mbit/s)

Results

DUT Frequency	Result
2412.000000	PASS

DUT Frequency	Result
2462.000000	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2397.825000	-28.1	1.7	-26.4	PASS
2397.875000	-28.2	1.8	-26.4	PASS
2397.775000	-28.4	2.0	-26.4	PASS
2397.925000	-29.3	2.9	-26.4	PASS
2397.725000	-29.8	3.4	-26.4	PASS
2397.975000	-32.1	5.7	-26.4	PASS
2397.675000	-32.5	6.1	-26.4	PASS
2399.025000	-33.8	7.3	-26.4	PASS
2399.975000	-33.8	7.4	-26.4	PASS
2398.975000	-33.8	7.4	-26.4	PASS
2398.275000	-33.9	7.5	-26.4	PASS
2398.325000	-34.0	7.6	-26.4	PASS
2398.225000	-34.0	7.6	-26.4	PASS
2398.175000	-34.1	7.7	-26.4	PASS
2399.675000	-34.1	7.7	-26.4	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2484.125000	-45.6	16.8	-28.8	PASS
2484.175000	-45.7	16.9	-28.8	PASS
2483.525000	-46.3	17.5	-28.8	PASS
2483.625000	-46.6	17.8	-28.8	PASS
2483.675000	-47.2	18.3	-28.8	PASS
2485.275000	-47.7	18.9	-28.8	PASS
2484.225000	-47.7	18.9	-28.8	PASS
2483.875000	-47.8	19.0	-28.8	PASS
2484.925000	-47.9	19.1	-28.8	PASS
2484.975000	-47.9	19.1	-28.8	PASS
2484.375000	-48.1	19.3	-28.8	PASS
2485.325000	-48.1	19.3	-28.8	PASS
2484.325000	-48.2	19.3	-28.8	PASS
2486.575000	-48.2	19.4	-28.8	PASS
2483.725000	-48.2	19.4	-28.8	PASS

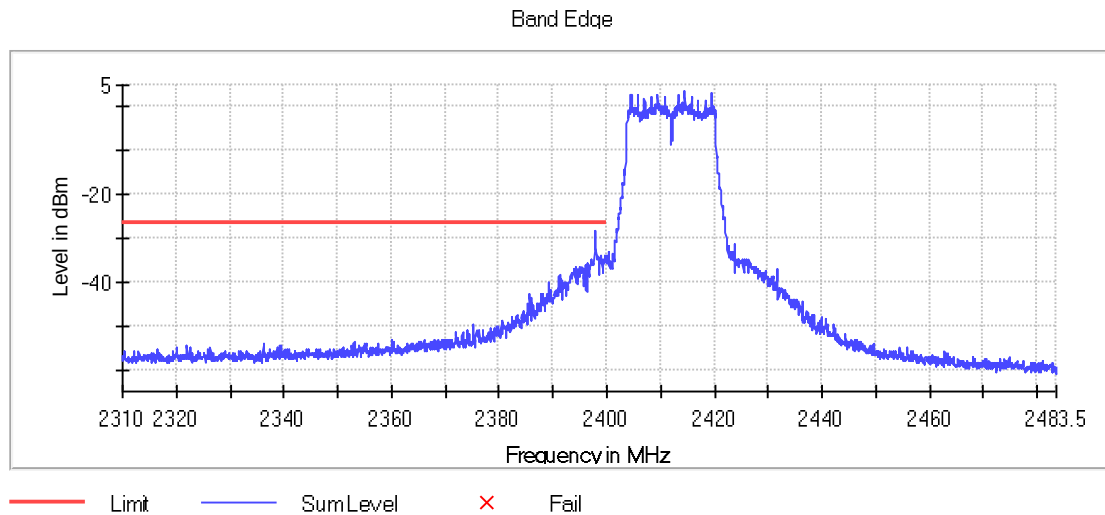
Verdict

Pass

Attachments

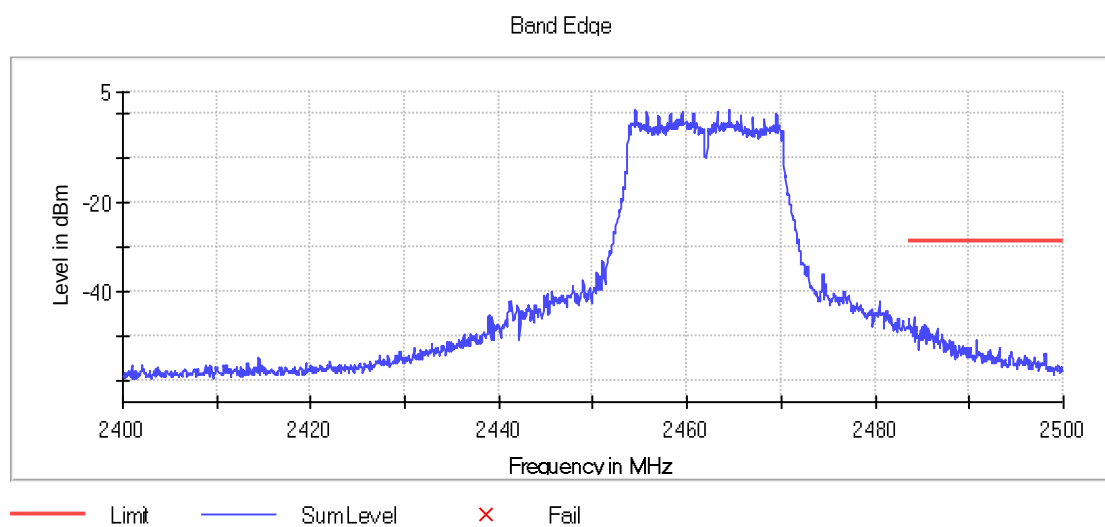
Frequency MHz = 2412.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11g (OFDM 6 Mbit/s), Number of Transmission Chains = 1, Measurement Point = 1,
Active Port = 1

Images:



Frequency MHz = 2462.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11g (OFDM 6 Mbit/s), Number of Transmission Chains = 1, Measurement Point = 1,
Active Port = 1

Images:





Modulation: 802.11n HT20 (OFDM MCS1)
Results

DUT Frequency	Result
2412.000000	PASS

DUT Frequency	Result
2462.000000	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.825000	-30.0	3.5	-26.5	PASS
2399.775000	-30.0	3.5	-26.5	PASS
2399.725000	-30.8	4.3	-26.5	PASS
2399.875000	-31.4	4.9	-26.5	PASS
2396.325000	-32.2	5.7	-26.5	PASS
2396.375000	-32.4	5.9	-26.5	PASS
2399.675000	-32.4	5.9	-26.5	PASS
2398.925000	-32.4	5.9	-26.5	PASS
2397.525000	-32.6	6.1	-26.5	PASS
2398.975000	-32.6	6.1	-26.5	PASS
2395.075000	-33.0	6.6	-26.5	PASS
2398.825000	-33.1	6.6	-26.5	PASS
2396.125000	-33.1	6.6	-26.5	PASS
2395.125000	-33.1	6.7	-26.5	PASS
2397.575000	-33.1	6.7	-26.5	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2484.075000	-46.6	17.8	-28.8	PASS
2484.125000	-46.7	17.9	-28.8	PASS
2485.375000	-47.0	18.2	-28.8	PASS
2485.275000	-47.1	18.3	-28.8	PASS
2483.625000	-47.1	18.3	-28.8	PASS
2485.325000	-47.3	18.5	-28.8	PASS
2484.525000	-47.6	18.8	-28.8	PASS
2486.325000	-47.9	19.1	-28.8	PASS
2484.575000	-47.9	19.1	-28.8	PASS
2485.425000	-48.1	19.3	-28.8	PASS
2484.825000	-48.3	19.6	-28.8	PASS
2483.875000	-48.4	19.6	-28.8	PASS
2484.225000	-48.4	19.6	-28.8	PASS
2484.625000	-48.4	19.6	-28.8	PASS
2483.675000	-48.6	19.8	-28.8	PASS

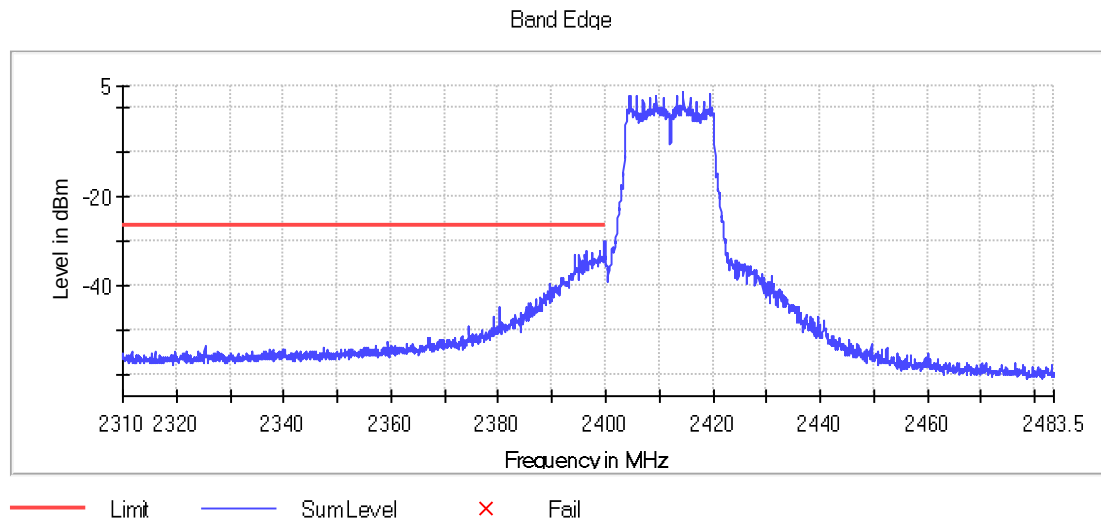
Verdict

Pass

Attachments

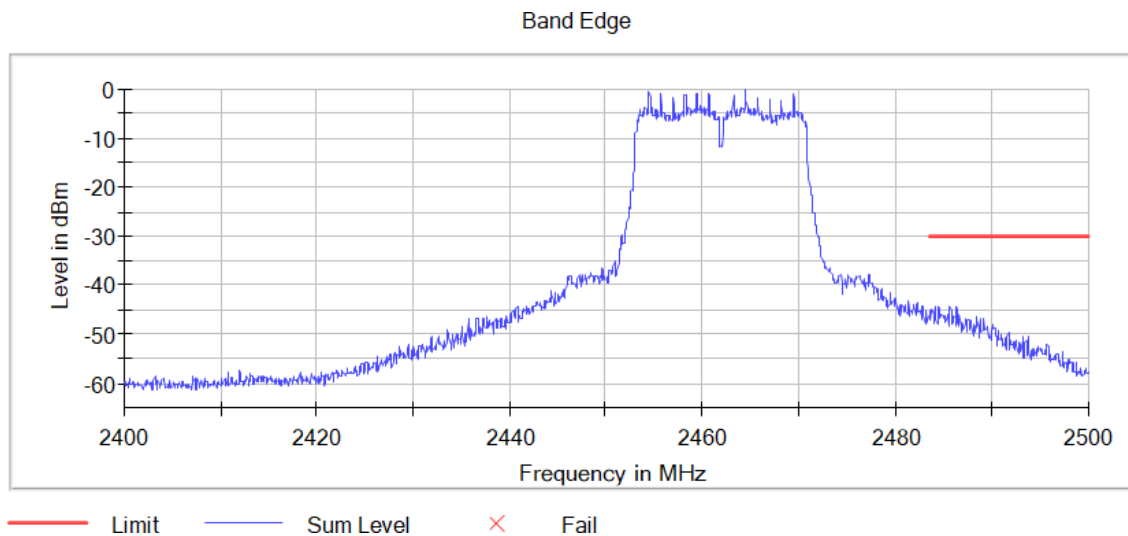
Frequency MHz = 2412.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11n HT20 (OFDM MCS1), Number of Transmission Chains = 1, Measurement Point = 1,
Active Port = 1

Images:



Frequency MHz = 2462.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11n HT20 (OFDM MCS1), Number of Transmission Chains = 1, Measurement Point = 1,
Active Port = 1

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value	Instrument Value
Start Frequency	2.31000 GHz	2.40000 GHz
Stop Frequency	2.40000 GHz	2.48350 GHz
Span	90.000 MHz	83.500 MHz
RBW	100.000 kHz	100.000 kHz
VBW	300.000 kHz	300.000 kHz
SweepPoints	1800	1670
Sweeptime	113.672 μ s	94.727 μ s
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	30.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	FFT
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	4 / max. 150	9 / max. 150
Stable	3 / 3	3 / 3
Max Stable Difference	0.00 dB	0.07 dB

RSS-247 5.5 / FCC 15.247 (d) Emissions compliance (Transmitter) - Conducted

Limits

In any 100 kHz bandwidth outside the frequency band in which the digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB.

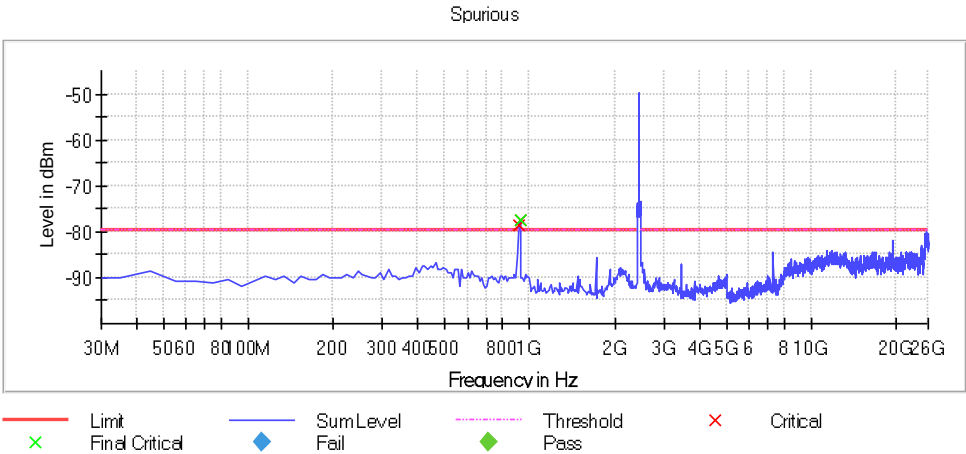
The following tables and plots show the results for the worst case

Modulation: 802.11b

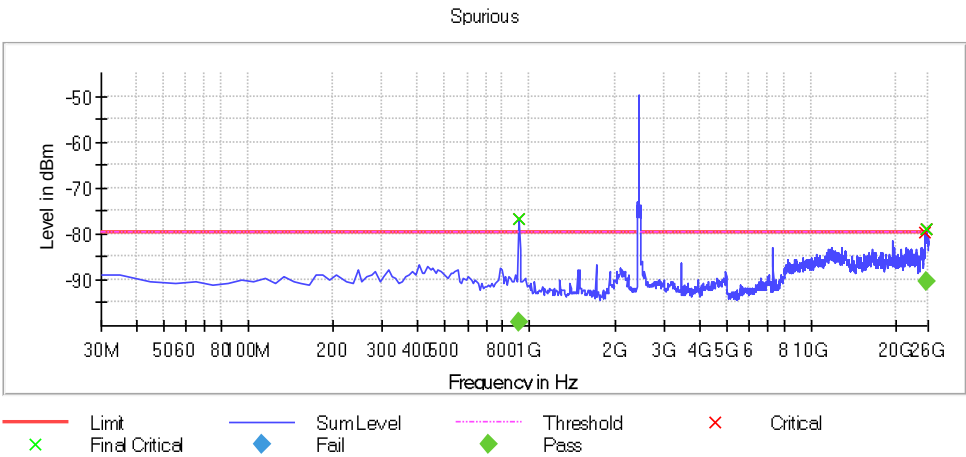
Results

Conducted spurious signals detected were minimum 16 dB respect to the limit for the lowest, middle and highest operating channels.

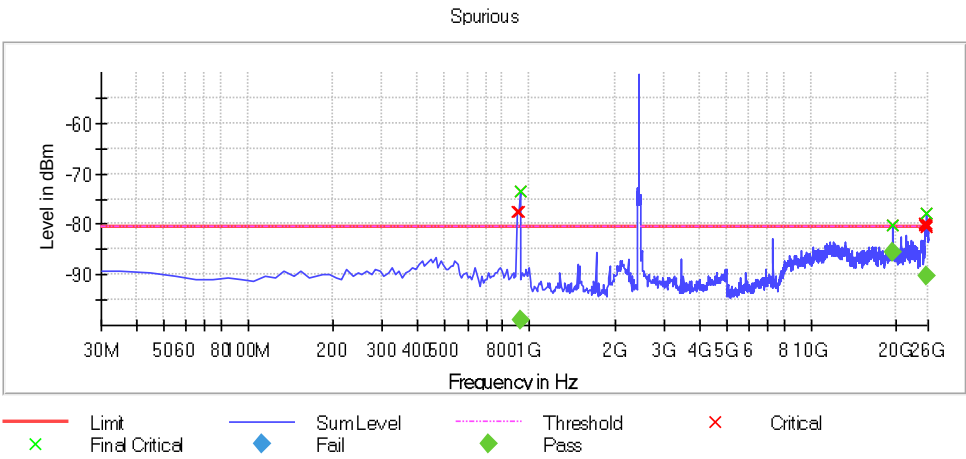
Lowest Channel



Middle Channel



Highest Channel



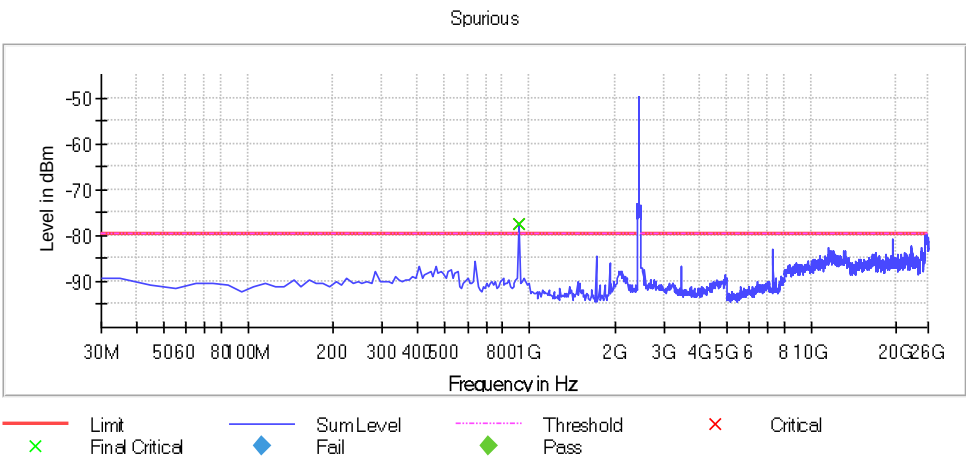
Verdict

Pass

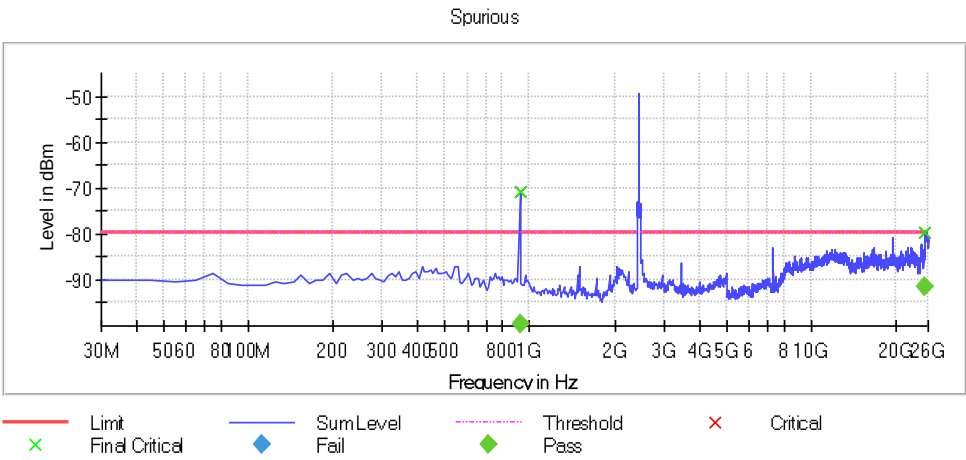
Modulation: 802.11n HT20 (OFDM MCS1)
Results

Conducted spurious signals detected were minimum 10 dB respect to the limit for the lowest, middle and highest operating channels.

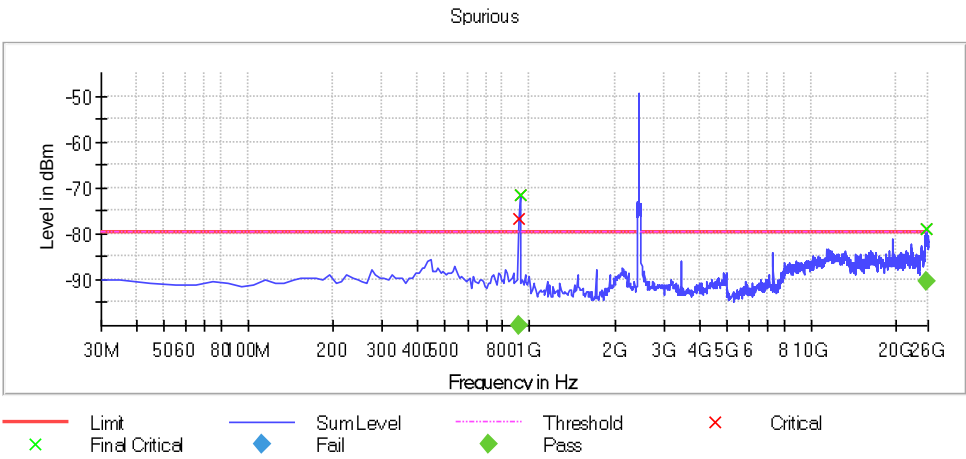
Lowest Channel



Middle Channel



Highest Channel



Verdict

Pass

Spectrum Analyzer Parameters

Setting	Instrument Value	Instrument Value	Instrument Value
RBW	100.000 kHz	100.000 kHz	100.000 kHz
VBW	300.000 kHz	300.000 kHz	300.000 kHz
SweepPoints	238	238	238
SweepTime	23.700 ms	23.700 ms	23.700 ms
Reference Level	-20.000 dBm	-20.000 dBm	-20.000 dBm
Attenuation	10.000 dB	10.000 dB	10.000 dB
Detector	MaxPeak	MaxPeak	MaxPeak
SweepCount	3	3	3
Filter	3 dB	3 dB	3 dB
Trace Mode	Max Hold	Max Hold	Max Hold
SweepType	Sweep	Sweep	Sweep
Preamp	off	off	off
Stablemode	Trace	Trace	Trace
Stablevalue	0.50 dB	0.50 dB	0.50 dB
Run	4 / max. 40	5 / max. 40	8 / max. 40
Stable	3 / 3	3 / 3	3 / 3
Max Stable Difference	0.00 dB	0.00 dB	0.00 dB

RSS-247 5.5 / FCC 15.247 (d) Emissions compliance (Transmitter) - Radiated

Limits

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c) / RSS-Gen):

Frequency Range (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RSS-247. Attenuation below the general field strength limits specified in RSS-Gen is not required

The following tables and plots show the results for the worst case

Verdict

Pass

Modulation: 802.11b (DSSS 1 Mbit/s)

Results

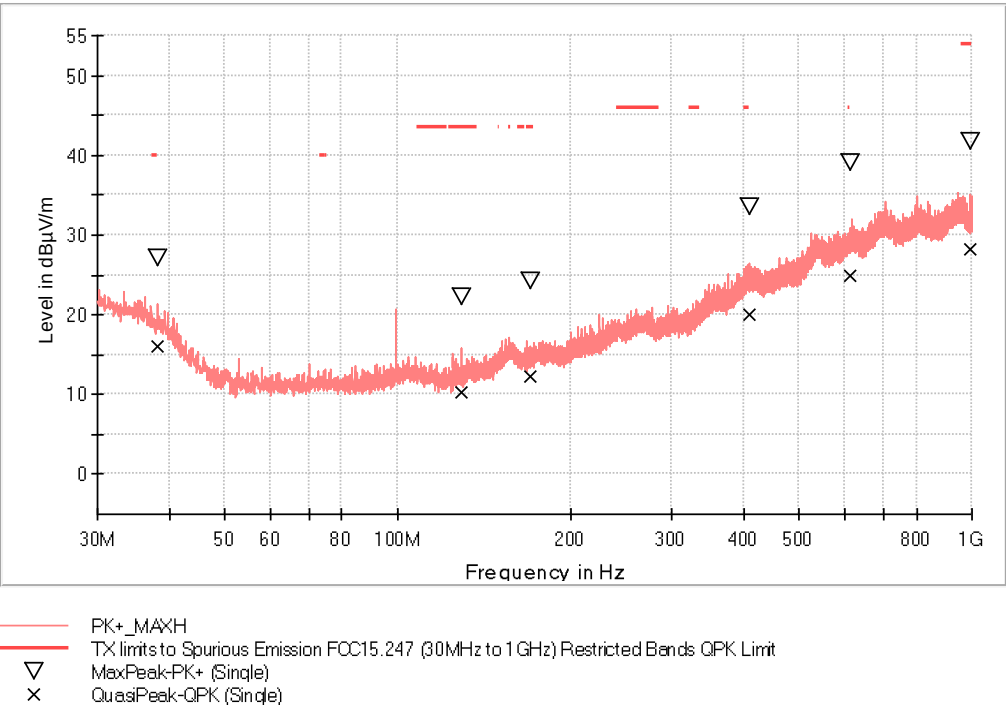
Frequency range 0.03 - 1 GHz

The spurious emissions below 1 GHz do not depend on the operating channel selected in the EUT.

Middle Channel

Frequency MHz = 2437.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11b (DSSS 1 Mbit/s), Frequency Range GHz = [0.03, 1]

Images:



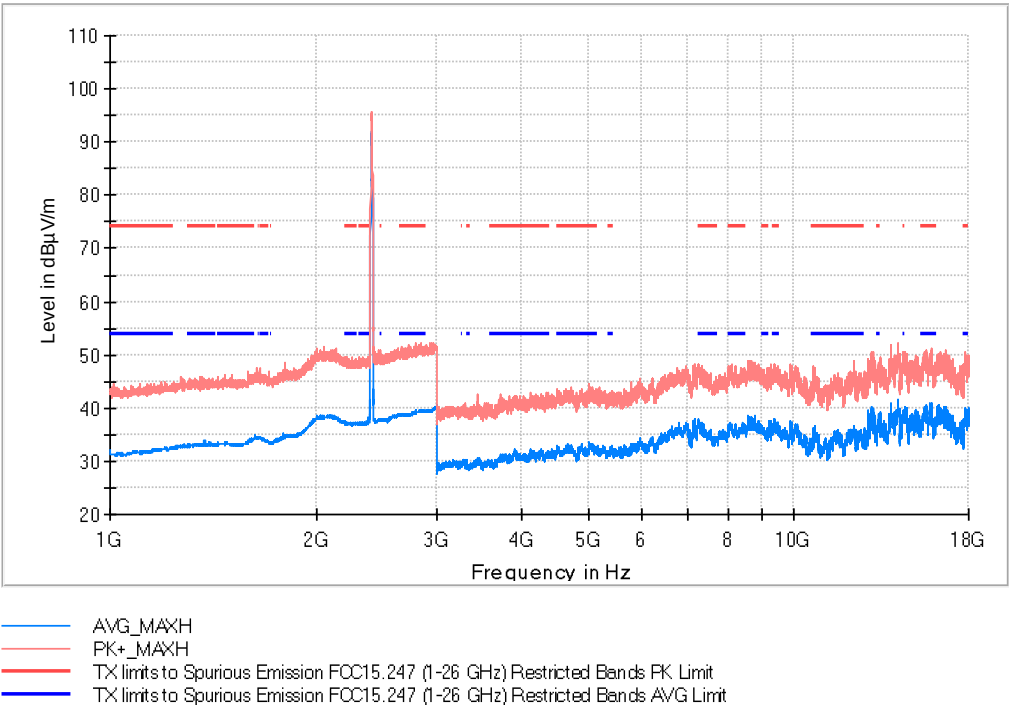
Frequency (MHz)	MaxPeak (dBμV/m)	QuasiPeak (dBμV/m)	Pol	Margin - QPK (dB)	Limit - QPK (dBμV/m)
38.148000	27.1	16.1	V	24.0	40.0
128.988500	22.3	10.2	V	33.3	43.5
170.310500	24.2	12.3	H	31.2	43.5
408.591000	33.4	19.9	V	26.1	46.0
612.436500	39.1	24.9	V	21.1	46.0

Frequency range 1 - 18 GHz

Lowest Channel

Frequency MHz = 2412.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11b (DSSS 1 Mbit/s), Frequency Range GHz = [1, 18]

Images:



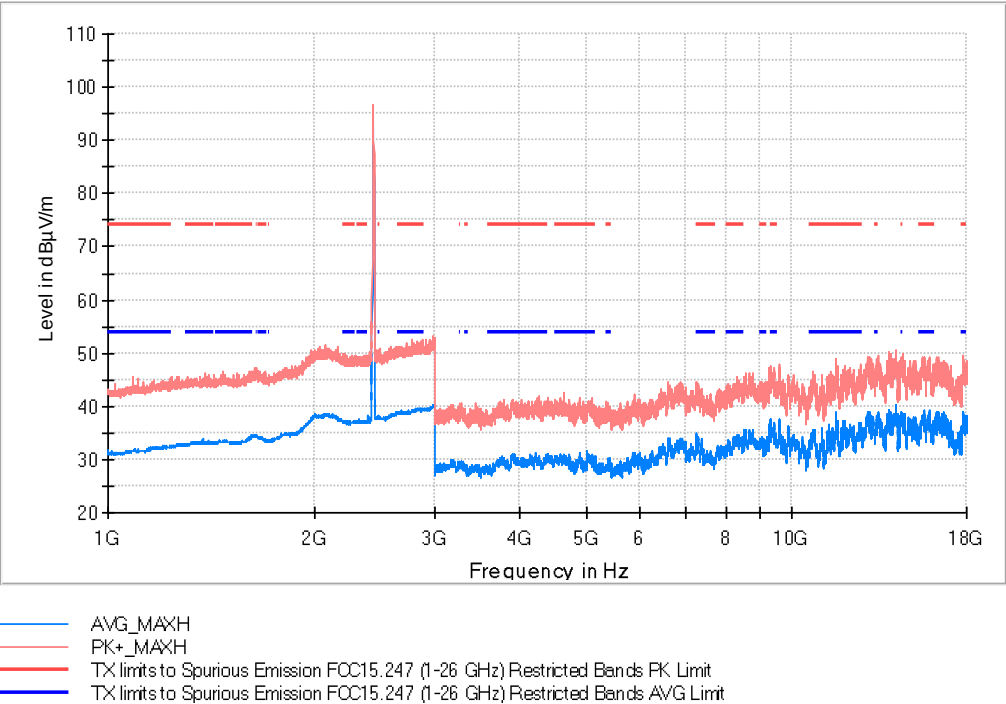
Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
2411.000000	95.7	92.0	H	---	---	Fundamental
15874.50000	50.3	40.9	V	13.1	54.0	
17830.00000	48.9	40.1	H	13.9	54.0	

Frequency range 1 - 18 GHz

Middle Channel

Frequency MHz = 2442.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11b (DSSS 1 Mbit/s), Frequency Range GHz = [1, 18]

Images:



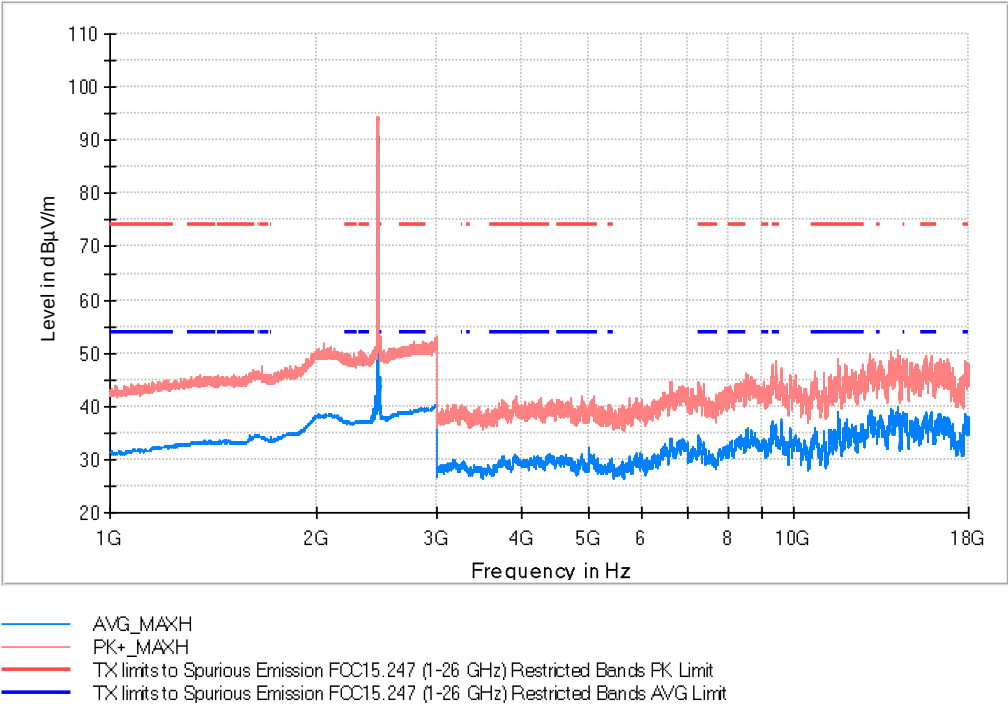
Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
2439.50000	96.4	93.3	H	---	---	Fundamental
9394.50000	46.1	37.1	V	16.9	54.0	
15874.0000	48.4	39.3	V	14.7	54.0	

Frequency range 1 - 18 GHz

Highest Channel

Frequency MHz = 2462.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11b (DSSS 1 Mbit/s), Frequency Range GHz = [1, 18]

Images:



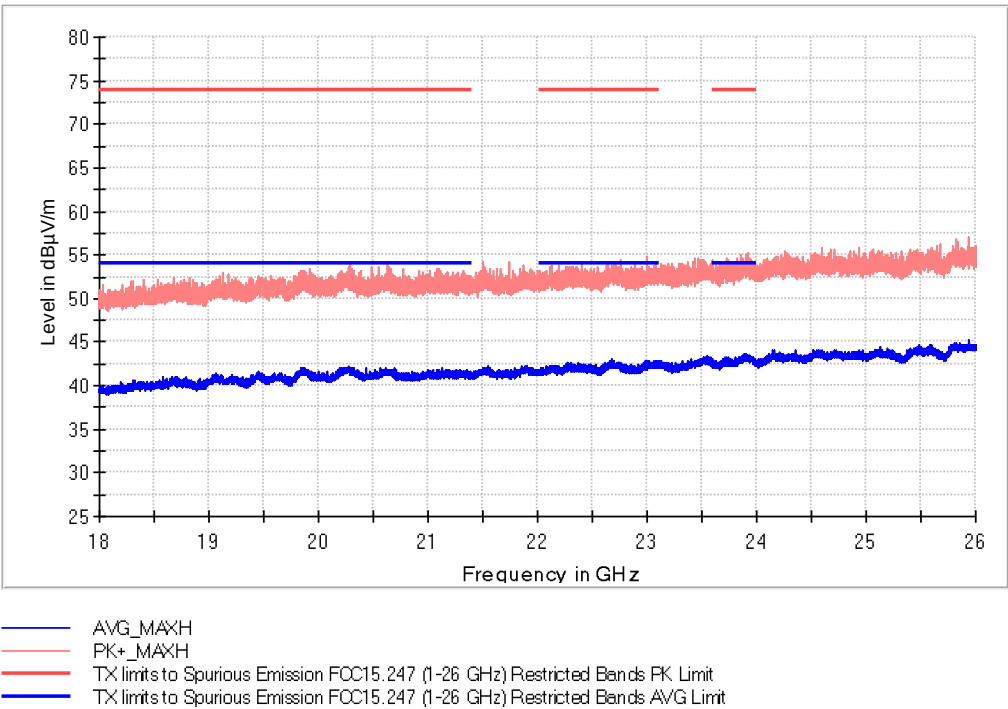
Frequency (MHz)	PK+ MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
2463.000000	94.2	90.6	H	---	---	Fundamental
11602.500000	47.3	38.8	V	15.2	54.0	
17828.000000	47.9	38.7	V	15.3	54.0	

Frequency range 18 - 26 GHz

Lowest Channel

Frequency MHz = 2412.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11b (DSSS 1 Mbit/s), Frequency Range GHz = [18, 26]

Images:



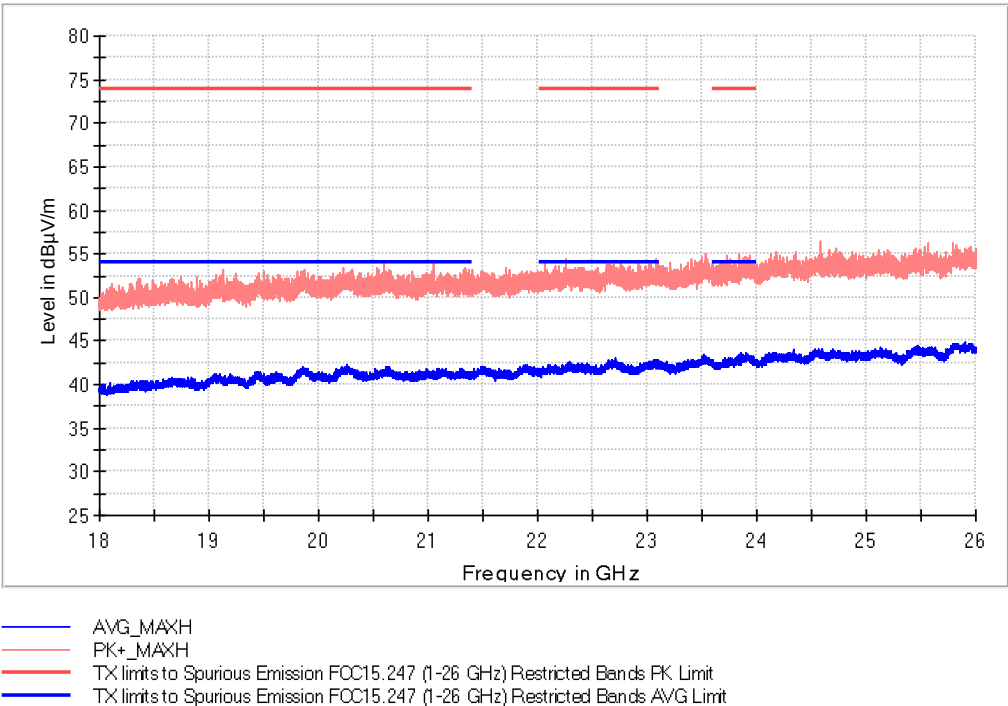
Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
23887.500000	54.1	43.8	H	10.2	54.0

Frequency range 18 - 26 GHz

Middle Channel

Frequency MHz = 2442.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11b (DSSS 1 Mbit/s), Frequency Range GHz = [18, 26]

Images:



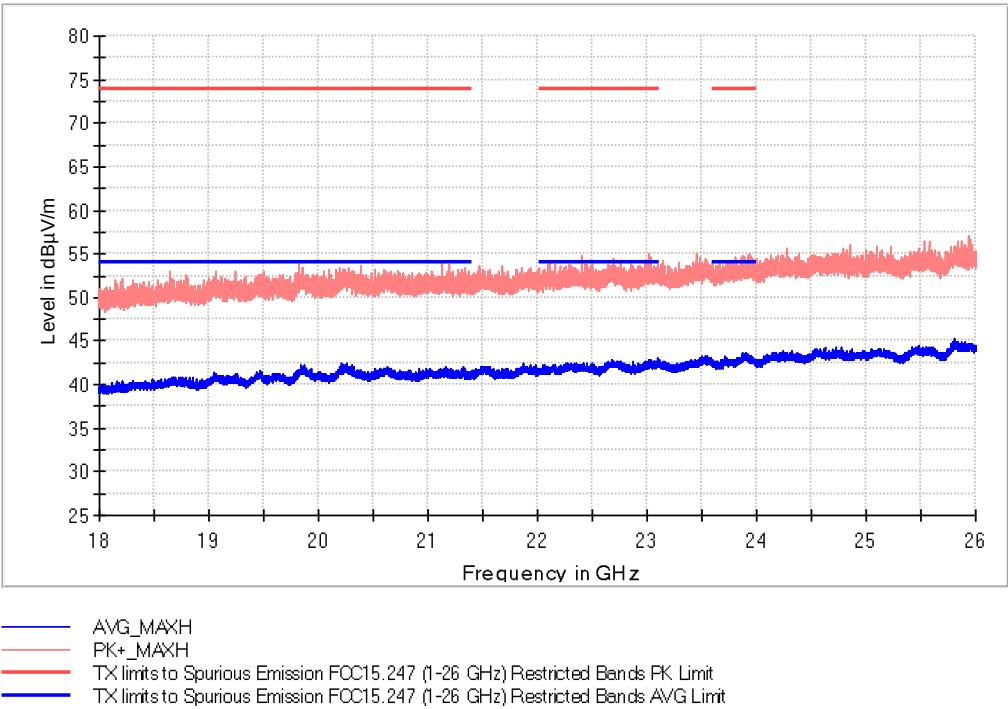
Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
23862.000000	52.2	43.6	H	10.4	54.0

Frequency range 18 - 26 GHz

Highest Channel

Frequency MHz = 2462.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11b (DSSS 1 Mbit/s), Frequency Range GHz = [18, 26]

Images:

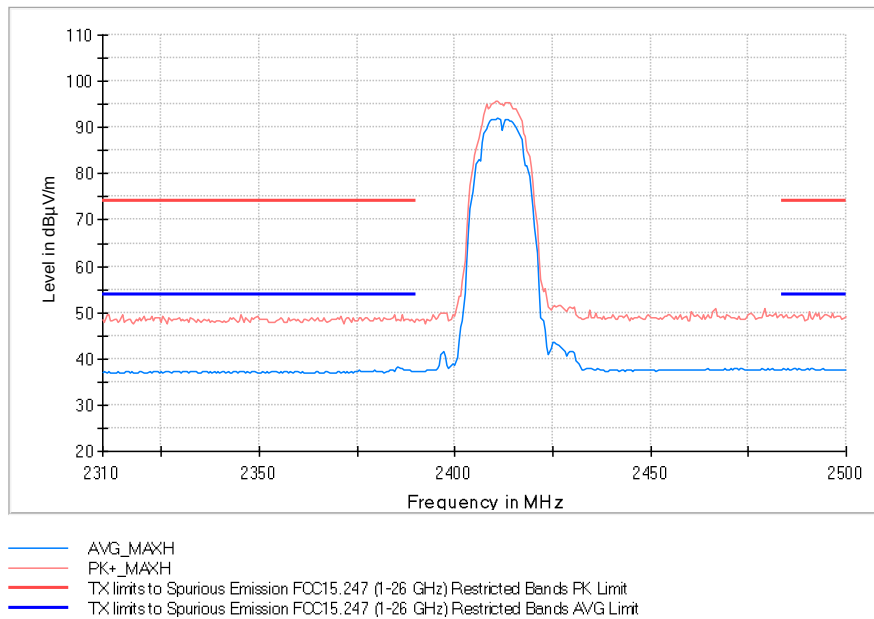


Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
23910.000000	53.6	43.6	H	10.4	54.0

Restricted Bands (2.31 GHz - 2.5 GHz)

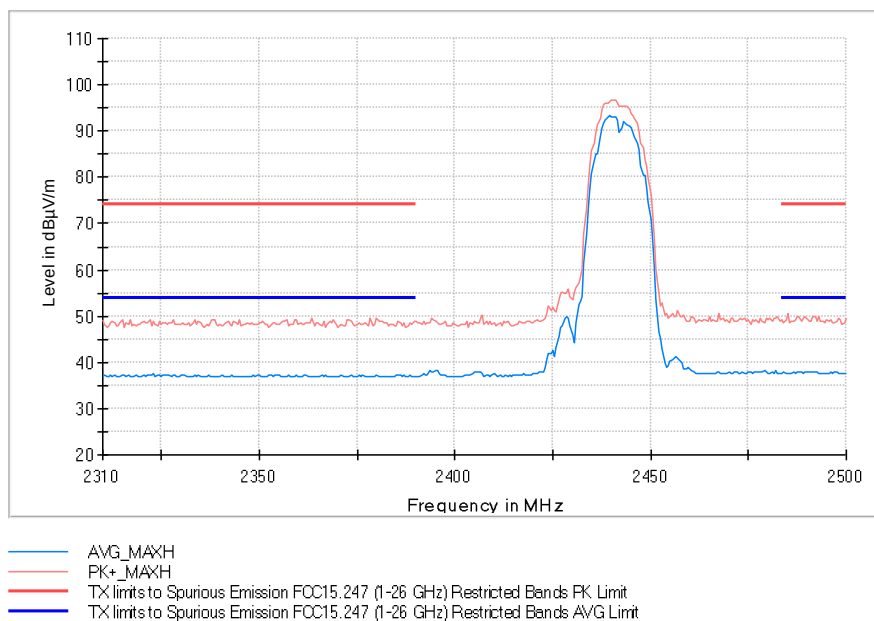
Lowest Channel

Frequency MHz = 2412.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11b (DSSS 1 Mbit/s), Frequency Range GHz = [1, 18]

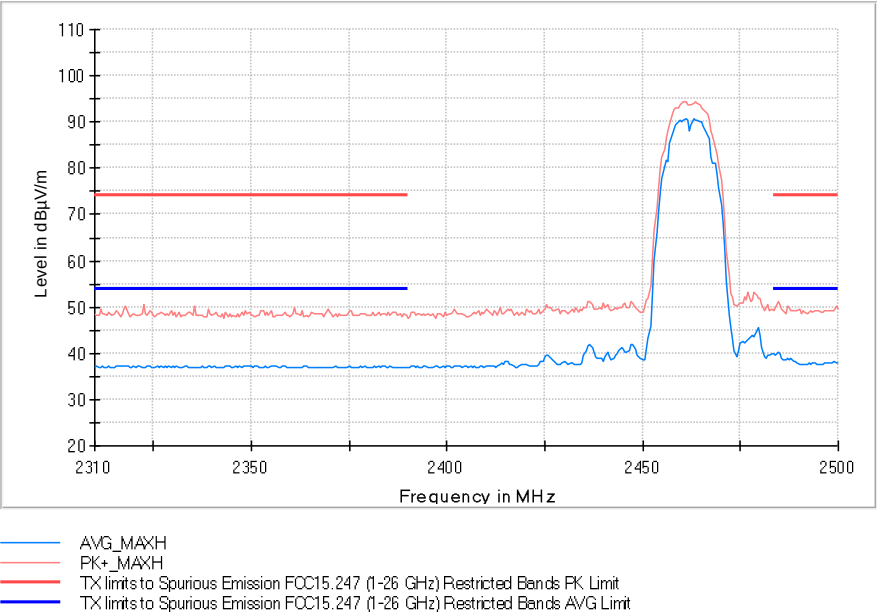


Middle Channel

Frequency MHz = 2442.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11b (DSSS 1 Mbit/s), Frequency Range GHz = [1, 18]



Frequency MHz = 2462.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11b (DSSS 1 Mbit/s), Frequency Range GHz = [1, 18]



Modulation: 802.11g (OFDM 6 Mbit/s)

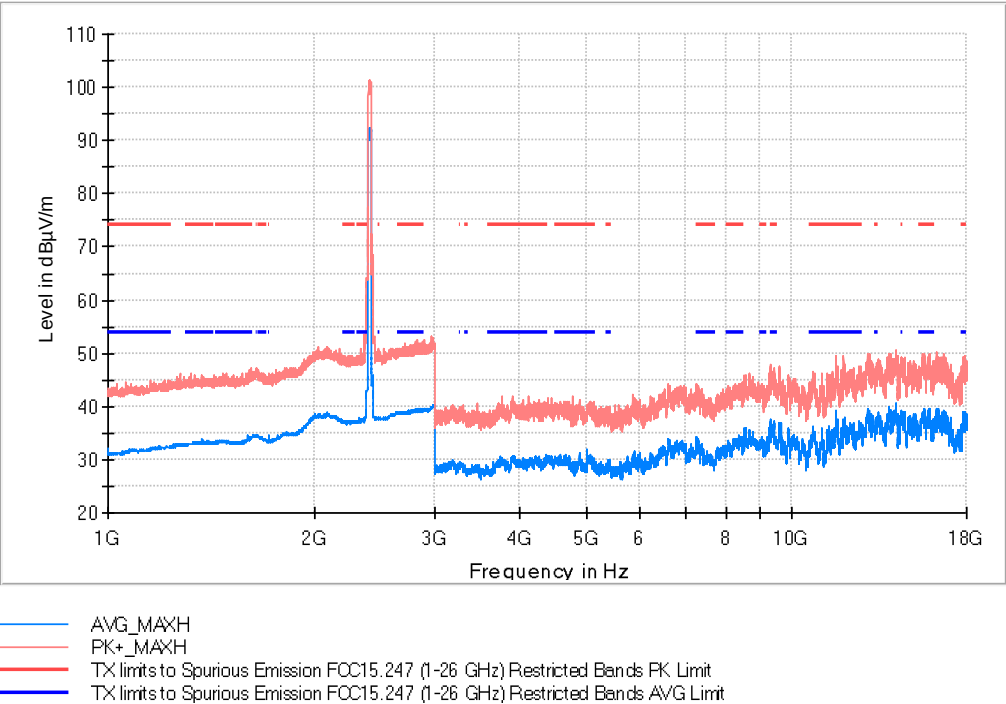
Results

Frequency range 1 - 18 GHz

Lowest Channel

Frequency MHz = 2412.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11g (OFDM 6 Mbit/s), Frequency Range GHz = [1, 18]

Images:



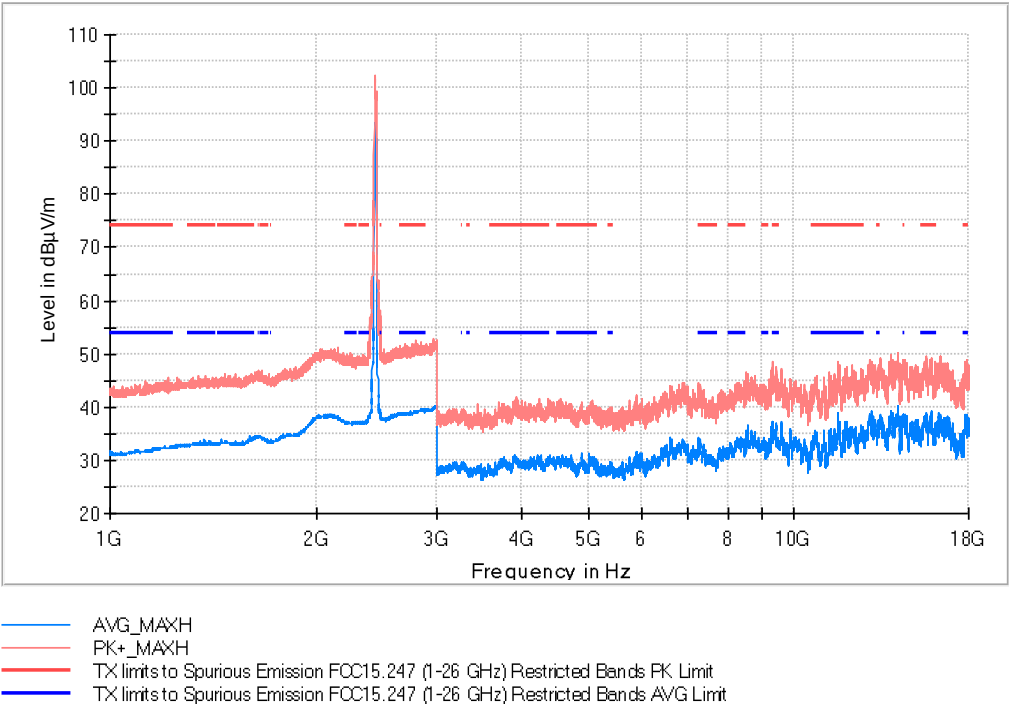
Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
2409.500000	101.5	92.3	H	---	---	Fundamental
2813.500000	50.6	39.7	V	14.3	54.0	
11602.50000	49.4	39.4	V	14.6	54.0	

Frequency range 1 - 18 GHz

Middle Channel

Frequency MHz = 2442.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20, Modulation = 802.11g (OFDM 6 Mbit/s), Frequency Range GHz = [1, 18]

Images:



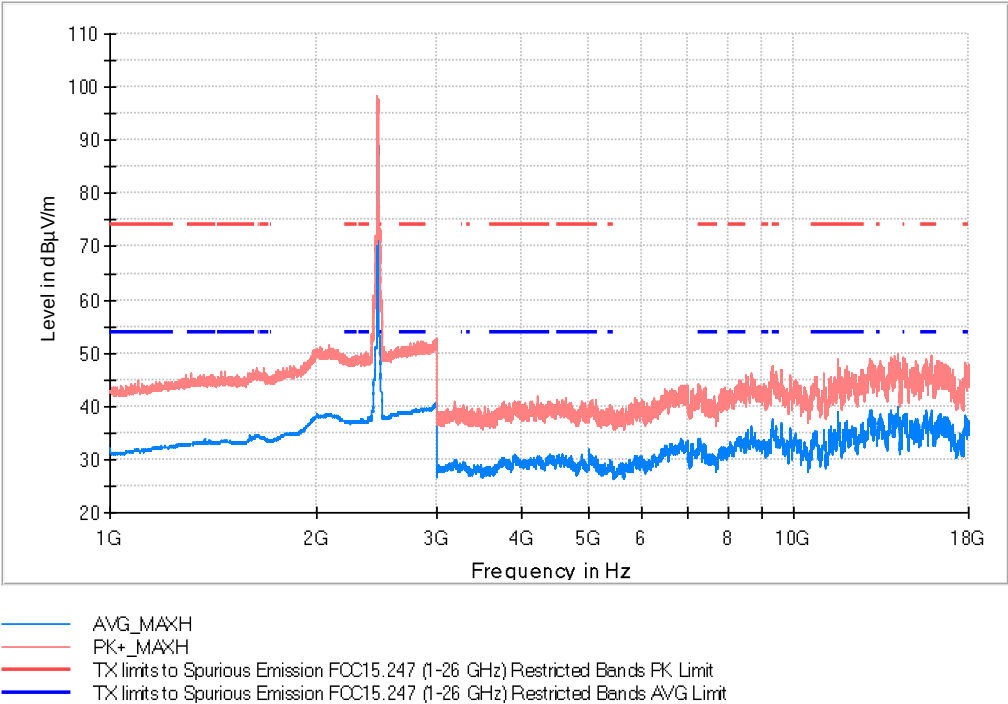
Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
2435.000000	102.3	93.4	H	---	---	Fundamental
2863.000000	50.2	39.6	V	14.4	54.0	
15872.500000	48.7	39.1	H	14.9	54.0	

Frequency range 1 - 18 GHz

Highest Channel

Frequency MHz = 2462.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20, Modulation = 802.11g (OFDM 6 Mbit/s), Frequency Range GHz = [1, 18]

Images:



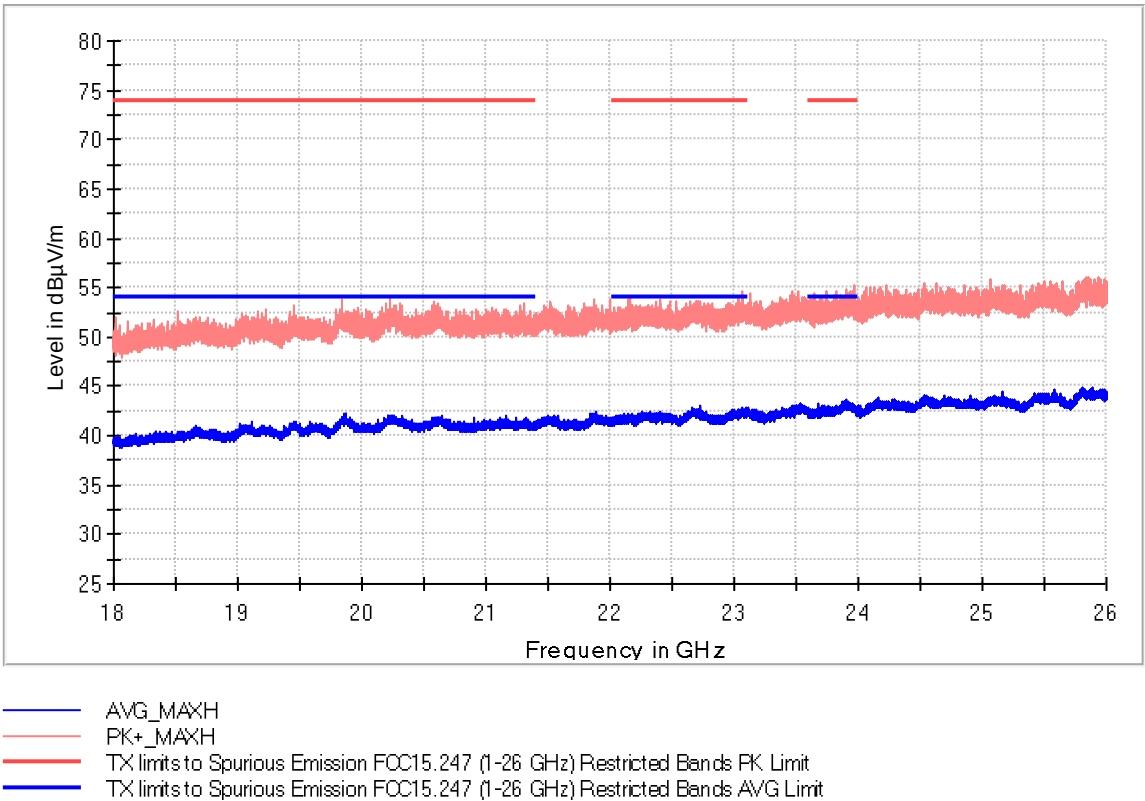
Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
2459.500000	98.2	89.2	H	---	---	Fundamental
2805.000000	50.4	39.7	V	14.3	54.0	
15854.500000	49.7	37.7	V	16.3	54.0	

Frequency range 18 - 26 GHz

Lowest Channel

Frequency MHz = 2412.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11g (OFDM 6 Mbit/s), Frequency Range GHz = [18, 26]

Images:



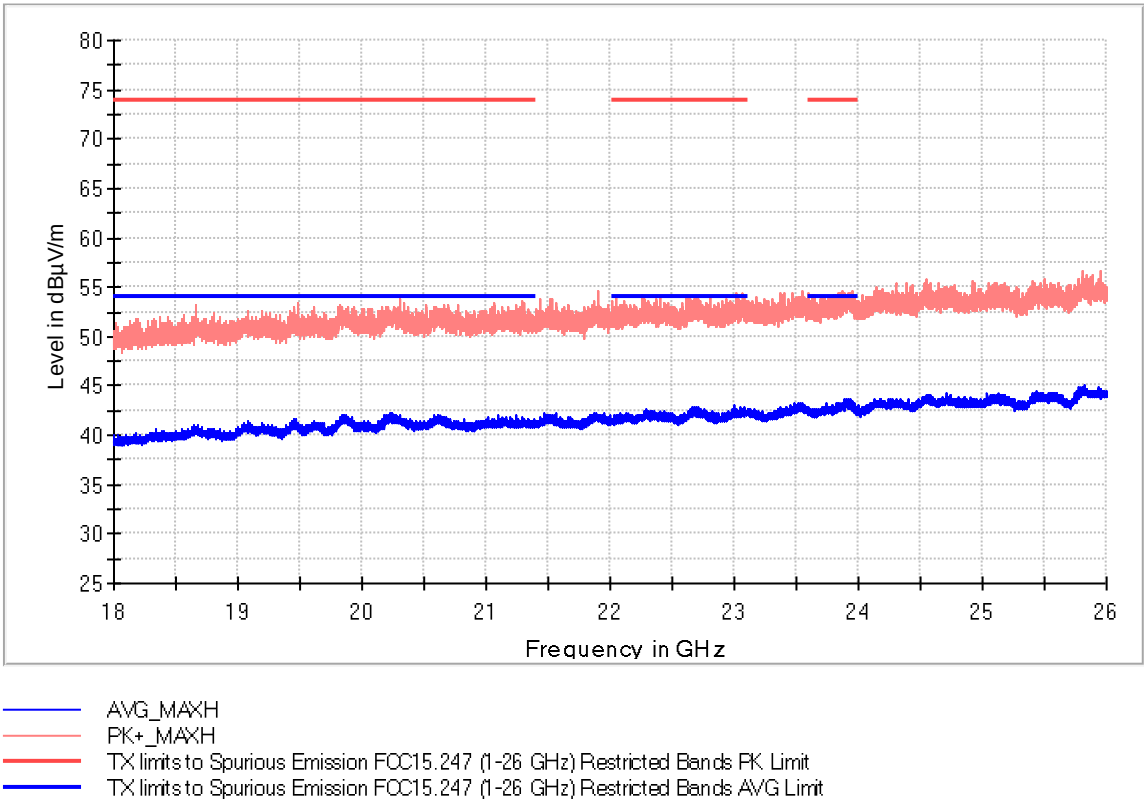
Frequency (MHz)	PK+_MAXH (dBμV/m)	AVG_MAXH (dBμV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBμV/m)
20233.000000	54.0	41.9	V	12.1	54.0
23071.000000	54.5	42.5	V	11.5	54.0
23962.500000	55.2	43.1	V	10.9	54.0

Frequency range 18 - 26 GHz

Middle Channel

Frequency MHz = 2442.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11g (OFDM 6 Mbit/s), Frequency Range GHz = [18, 26]

Images:



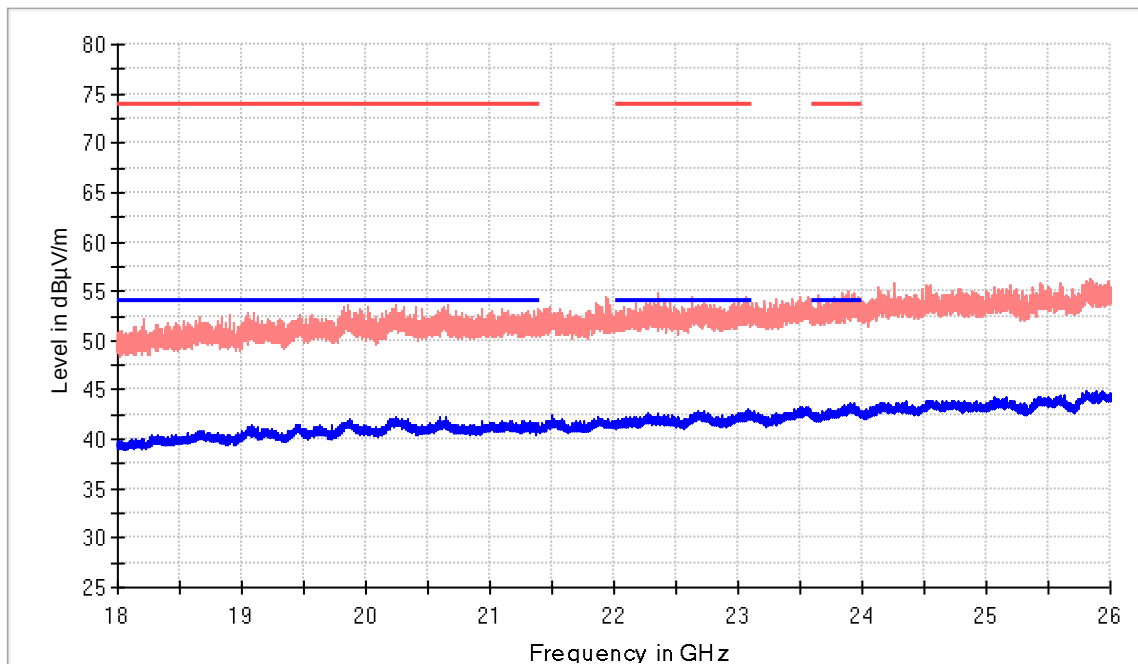
Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
20246.500000	52.2	42.3	H	11.7	54.0
22997.000000	52.9	43.0	V	11.0	54.0
23913.000000	53.0	43.7	H	10.3	54.0

Frequency range 18 - 26 GHz

Highest Channel

Frequency MHz = 2462.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11g (OFDM 6 Mbit/s), Frequency Range GHz = [18, 26]

Images:



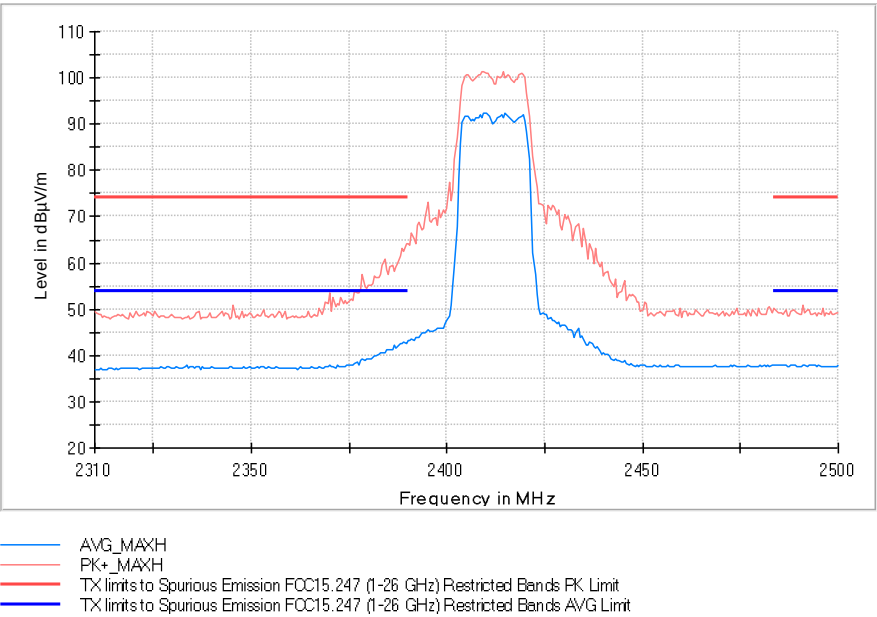
— AVG_MAXH
— PK+_MAXH
— TX limits to Spurious Emission FCC15.247 (1-26 GHz) Restricted Bands PK Limit
— TX limits to Spurious Emission FCC15.247 (1-26 GHz) Restricted Bands AVG Limit

Frequency (MHz)	PK+_MAXH (dBμV/m)	AVG_MAXH (dBμV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBμV/m)
22356.500000	54.9	42.1	V	11.9	54.0
23645.000000	54.6	42.2	V	11.8	54.0
23892.500000	55.0	43.2	V	10.8	54.0

Restricted Bands (2.31 GHz - 2.5 GHz)

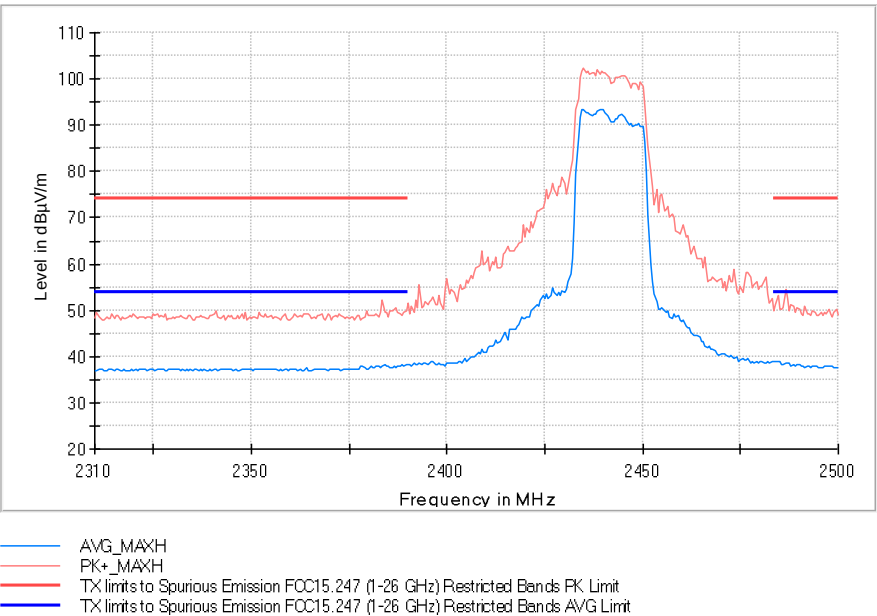
Lowest Channel

Frequency MHz = 2412.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11g (OFDM 6 Mbit/s), Frequency Range GHz = [1, 18]



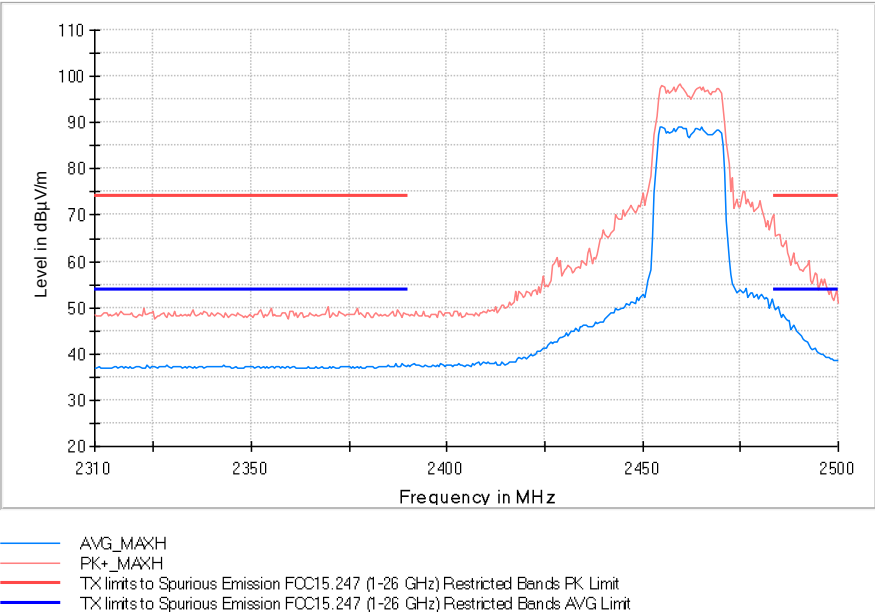
Middle Channel

Frequency MHz = 2442.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11g (OFDM 6 Mbit/s), Frequency Range GHz = [1, 18]



Highest Channel

Frequency MHz = 2462.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 20,
Modulation = 802.11g (OFDM 6 Mbit/s), Frequency Range GHz = [1, 18]



Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	48.5 kHz	RMS ; PK+	100 kHz	1 s	20 dB

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
1 GHz - 3 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s	20 dB
3 GHz - 18 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s	20 dB

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
18 GHz - 26 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s	20 dB