DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
C.I.F. A29507456

ISED CABid: ES1909

Lab. Company Number: 4621A

Test Report No:
73315RRF.001A2

Partial Test Report

USA FCC Part 15.247, 15.209
CANADA RSS-247, RSS-Gen

(*) Identification of item tested	SCG2229
(*) Trademark	SEPURA
(*) Model and /or type reference	SCG2229
Other identification of the product	FCC ID: XX6SCG2229M IC: 8739A-SCG2229ME
(*) Features	TETRA (380-470 MHz), BT, BLE, GNSS, 802.11 b,g,n (20 MHz, 2.4 GHz) HW version: PLX-890155A0-01 (H/W mod state 7) SW version: 1810 002 10138
Applicant	Sepura Limited 9000 Cambridge Research Park, Beach Drive, Waterbeach, Cambridge CB25 9TL, UK
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.
Approved by (name / position & signature)	José Manuel Gómez Galván EMC Consumer & RF Lab. Manager Firmado digitalmente por 53680346W JOSE MANUEL GOMEZ (C:A29507456)
Date of issue	2023-05-17
Report template No	FDT08_24 (*) "Data provided by the client"

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Acronyms

Acronym ID	Acronym Description
# of Tx Chains	Number of Transmission Chains
Avg Power	Maximum Average Conducted Output Power
BW	Bandwidth
Detector	Detector used
Ebw	Emission Bandwidth
Equipment	Equipment Type
Freq	Frequency
Freq Rng	Frequency Range
Inband Peak Lvl	Inband Peak Level
Lvl	Level
MP	Measurement Point
Mod	Modulation
Occ Ch BW	Occupied Channel Bandwidth
PSD	Power Spectrum Density
Pol	Polarization
Port	Active Port
Unwanted Freq	Unwanted Emissions Frequency
Unwanted Lvl	Unwanted Emissions Level
EIRP	Effective Isotropic Radiated Power

Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification is an FCC-recognized accredited testing laboratory with appropriate scope of accreditation that covers the performed tests in this report.

DEKRA Testing and Certification is an ISED-recognized accredited testing laboratory, CABid: ES1909, Company Number: 4621A, with the appropriate scope of accreditation that covers the performed tests in this report.

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

DEKRA Testing and Certification S.A.U. 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 Testing and Certification S.A.U. at the time of performance of the test.

DEKRA Testing and Certification S.A.U. 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

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification S.A.U.
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Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

The total uncertainty of the measurement system for the radiated emissions of EUT from 30 MHz to 1 GHz is:
Measurement uncertainty ≤ ± 5,35 dB with factor (k = 2).

The total uncertainty of the measurement system for the radiated emissions of EUT from 1 GHz to 17 GHz is:
Measurement uncertainty ≤ ± 4,32 dB with factor (k = 2).

The total uncertainty of the measurement system for the radiated emissions of EUT from 17 GHz to 26 GHz is:
Measurement uncertainty ≤ ± 5,51 dB with factor (k = 2).

The total uncertainty of the measurement system for the conducted testing of EUT is:
RF Peak Output Power: Measurement uncertainty ≤ ± 0,80 dB
RF Average Output Power: Measurement uncertainty ≤ ± 0,99 dB
Power Spectral Density: Measurement uncertainty ≤ ± 0,99 dB
6dB Bandwidth: Measurement uncertainty ≤ ± 2,84 %
Occupied Channel Bandwidth: Measurement uncertainty ≤ ± 1,17 %
Conducted Band-edge spurious emissions: Measurement uncertainty ≤ ± 1,76 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 a SCG2229. TETRA mobile radio in frequency range 380-470MHz with BT, Wi-Fi and GNSS option.

3. Derived variants not tested. These variants have been declared by the supplier of the sample as being the same as the model under test.

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06 February 2023

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www.sepura.com

Declaration of different variants of SCG2229

Defining all different variants of SCG2229

.

The units will all be marketed under the Product Marketing Name (PMN) of SCG2229.

There are 4 hardware variants under the family application, these relate to Sepura's commercial part numbers:

1-89*A0-0****, 1-89*60-0****, 1-89*50-0****, 1-89*00-0****

where * may be any digit or character.

Commercial part number 1-89*A0-0**** is the variant currently tested.

The following table summarises the differences between the variants:

Hardware Variant	RF Interfaces	Non-RF Interfaces
1-89*A0-0****	TETRA Bluetooth WLAN GNSS	Ethernet GPIO Front Console Port Rear Console Port Power Input USB/GPIO SD Card
1-89*60-0****	TETRA Bluetooth WLAN GNSS	Rear Console Port Power Input USB/GPIO SD Card
1-89*50-0****	TETRA GNSS	Rear Console Port Power Input USB/GPIO SD Card
1-89*00-0****	TETRA GNSS	Rear Console Port Power Input USB/GPIO

Port Identification – Front Panel

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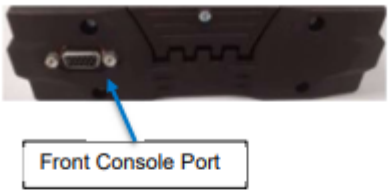
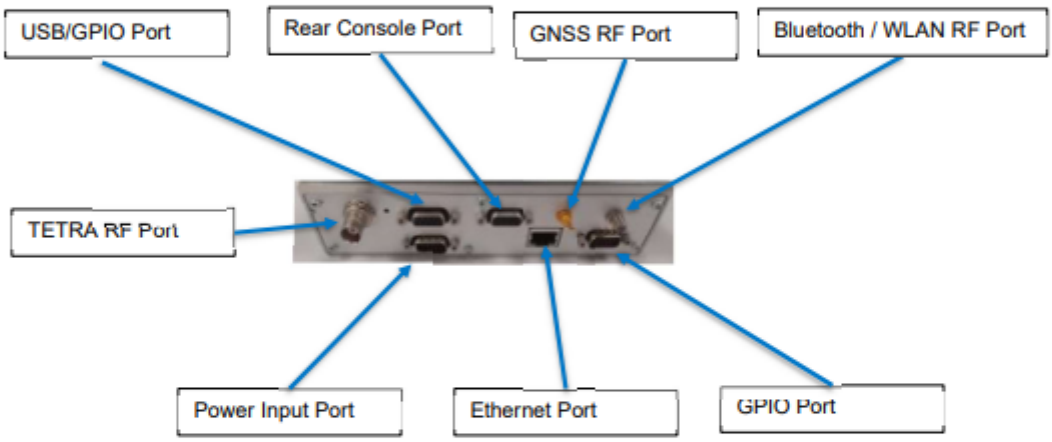


Port Identification – Rear Panel



The following table shows the difference between the front and rear panels on the variants:

Hardware Variant	Front Panel	Rear Panel
1-89*A0-0****		
1-89*60-0****		
1-89*50-0****		

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Hardware Variant	Front Panel	Rear Panel
1-89*00-0****		

Differences in radio frequency and RF output power: Where the RF interface is provided it has the same RF interface, with the same RF performance and same RF output power, as other variants.

Hardware Variant	TETRA	Bluetooth	WLAN	GNSS
1-89*A0-0****	40 dBm ±0.5dB	4.2	802.11 b, g, n	GPS, Galileo etc
1-89*60-0****	40 dBm ±0.5dB	4.2	802.11 b, g, n	GPS, Galileo etc
1-89*50-0****	40 dBm ±0.5dB	No Bluetooth	No WLAN	GPS, Galileo etc
1-89*00-0****	40 dBm ±0.5dB	No Bluetooth	No WLAN	GPS, Galileo etc

Differences in radio frequency circuitry. There is no difference between the RF circuitry of any of the variants. The only difference is whether the Bluetooth / WLAN module is included. All variants have TETRA and GNSS capability.

Differences in functional characteristics

Hardware Variant	Description
1-89*A0-0****	This is a fully populated variant with Ethernet port, GPIO port, front and rear console ports, USB/GPIO port, power input port and SD card. This fully populated unit has been Certified under ISED ID 8739A-SCG2229
1-89*60-0****	This variant is based on the fully populated 1-89*A0-0**** variant but has the Ethernet port, GPIO port and front console port removed. Other than the removal of this functionality there are no changes made to the circuitry or RF performance of this variant compared with the 1-89*A0-0**** variant
1-89*50-0****	This variant is based on the 1-89*60-0**** variant. It has the Bluetooth/WLAN module removed, but other than that is the same. There are no other changes to the circuitry or RF performance of this variant compared with the 1-89*60-0**** variant.
1-89*00-0****	This variant is based on the 1-89*50-0**** variant. It has the SD card removed, but other than that is the same. There are no other changes to the circuitry or RF performance of this variant compared with the 1-89*50-0**** variant.

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As can be seen by the information provided in this letter and exhibits in this application, all variants are subsets of the main variant tested and the test results are applicable to all variants. No changes have been made to the circuitry, PCB layouts, RF performance or functionality between the variants, other than removal of functions.

Sincerely,

Company Officer:	Prakriti Gupta
Telephone Number:	+44 (01223) 876000
Email:	prakriti.gupta@sepura.com
Position:	Conformance Team Leader

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Usage of samples

Samples undergoing test have been selected by: The client.

Id	Control Number	Description	Model	Serial Nº	Date of Reception	Application
S/01	73315C_1.1	Laptop (EMC)	Latitude 7280	95PVNH2	2022-10-03	Auxiliary Element
S/01	73315C_8.1	AC/DC adapter	LA65NS2-01	--	2022-10-03	Auxiliary Element
S/01	73315C_23.1	Programming cable	300-02009	--	2022-10-03	Auxiliary Element
S/01	73315C_38.1	12V DC Cable	300-02010	--	2022-10-06	Element Under Test
S/01	73315C_45.1	Mobile Radio	TG01STUAW0(7000)	1PR000676NE	2022-10-06	Element Under Test
S/01	73315C_48.1	Remote Control	--	1PS602110CCW6MQ	2022-10-06	Auxiliary Element
S/01	73315C_50.1	Loudspeaker	300-00719	--	2022-10-06	Auxiliary Element
S/01	73315C_13.1	HBC Interface	300-00670	--	2022-10-03	Auxiliary Element
S/01	73315C_15.1	SCC3 module	300-01808	--	2022-10-03	Auxiliary Element
S/01	73315C_66.1	Antenna (1dBi)	--	--	2022-12-01	Element Under Test
S/02	73315C_38.1	12V DC Cable	300-02010	--	2022-10-06	Element Under Test
S/02	73315C_45.1	Mobile Radio	TG01STUAW0(7000)	1PR000676NE	2022-10-06	Element Under Test

Notes referenced to samples during the project:

Id	Type
S/01	Radiated
S/02	Conducted

Test sample description

Ports……. :	Port name and description	Cable			
		Specified max length [m]	Attached during test	Shielded	Coupled to patient(3)
	TETRA ant port	.....	[X]	[X]	[ ]
	BT and Wi-Fi port	.....	[ ]	[ ]	[ ]
	GNSS port	.....	[X]	[ ]	[ ]
	Ethernet	.....	[X]	[ ]	[ ]
	Power (way D sub male)	.....	[X]	[ ]	[ ]
	Console 1 and 2 (15 way D sub female)	.....	[X]	[X]	[ ]
Supplementary information to the ports……. :	.....				

Rated power supply .....:	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	[ ]	AC:	[ ]	[ ]	[ ]	[ ]	[ ]
	[X]	DC: 10.8-15.6V					

Rated Power .....:	12V DC rated 90W	
Clock frequencies.....:	.....	
Other parameters .....:	.....	
Software version .....:	Not provided	
Hardware version .....:	PLX-890155A0-01 (H/W mod state 7)	
Dimensions in cm (W x H x D) ....:	.....	
Mounting position .....:	[ ]	Table top equipment
	[ ]	Wall/Ceiling mounted equipment
	[ ]	Floor standing equipment
	[ ]	Hand-held equipment
	[X]	Other: vehicle installation

Modules/parts.....:	Module/parts of test item	Type	Manufacturer
	BT/WiFi module	1LV	Murata
	GNSS module	M-10	U -Blox
Accessories (not part of the test item) .....:	Description	Type	Manufacturer
	.....	.....	.....
Documents as provided by the applicant.....:	Description	File name	Issue date
	safety guide	DOC-00170	.....
	quick ref guide	DOC-03196	.....
	SCG2229 full installtion guide	DOC-04384	.....

(3) Only for Medical Equipment

Identification of the client

Sepura Limited
9000 Cambridge Research Park, Beach Drive, Waterbeach, Cambridge CB25 9TL, UK

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2022-11-09
Date (finish)	2023-05-16

Document history

Report number	Date	Description
73315RRF.001	2023-02-07	First release.
73315RRF.001A1	2023-04-03	Second release. This report is modified due to minor typos. This modification test report cancels and replaces the test report 73315RRF001.
73315RRF.001A2	2023-05-17	Third release. This report is modified due some corrections on the test cases related with 802.11 modulation and others minor typos. This modification test report cancels and replaces the test report 73315RRF001A1.

Environmental conditions

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

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

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

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

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

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

Remarks and comments

The tests have been performed by the technical personnel: Rafael Fernandez Martin, Sergio Carrasco.

Used instrumentation:

Control No.	Equipment	Model	Manufacturer	Next Calibration
6165	EMI TEST RECEIVER 9kHz-7GHz	ESR7	ROHDE AND SCHWARZ	2023-11-08
7796	EXTENSION FOR OPEN SWITCH UNIT UP TO 40GHz	OSP-B157Wx	ROHDE AND SCHWARZ	2024-03-16
6496	HORN ANTENNA 1-18GHz	BBHA 9120 D	SCHWARZBECK MESS-ELEKTRONIK	2023-08-24
4657	HORN ANTENNA 18-40GHz	BBHA 9170	SCHWARZBECK	2023-05-05
4578	HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	ETS LINDGREN	2023-04-30
8848	OPEN SWITCH UNIT UP TO 7.5 GHz	OSP-B157W8 PLUS	ROHDE & SCHWARZ	2023-08-20
0922	POWER SUPPLY DC 40 V / 40 A	NGPE 40/40	ROHDE AND SCHWARZ	N/A
8856	PRE-AMPLIFIER G>30dB 18-40GHz	BLMA 1840-4A	BONN ELEKTRONIK	2023-11-02
5705	PRE-AMPLIFIER G>40dB 1-18 GHz	BLMA 0118-1M	BONN ELEKTRONIK	2023-07-21
4825	SEMIANECHOIC ABSORBER LINED CHAMBER	FACT 3 200 STP	ETS LINDGREN	N/A
6793	SHIELDED ROOM	S101	ETS LINDGREN	N/A
7794	SIGNAL AND SPECTRUM ANALYZER 10Hz-40GHz	FSV40	ROHDE AND SCHWARZ	2023-02-26
4716	SIGNAL AND SPECTRUM ANALYZER 2Hz-50GHz	FSW50	ROHDE AND SCHWARZ	2024-08-12
7791	SIGNAL GENERATOR 8kHz-6GHz	SMB100B	ROHDE AND SCHWARZ	2023-11-03
7793	SIGNAL GENERATOR 8kHz-6GHz	SMBV100B	ROHDE AND SCHWARZ	2023-11-18
4848	SOFTWARE FOR EMC/RF TESTING	EMC32	ROHDE AND SCHWARZ	N/A
8847	VECTOR SIGNAL GENERATOR 100kHz-7.5GHz	SMW200A	ROHDE AND SCHWARZ	2023-08-20
7795	WIRELESS CONNECTIVITY TESTER BW 160 MHz	CMW270	ROHDE AND SCHWARZ	2023-12-29
7798	WMS32	WMS32	ROHDE AND SCHWARZ	N/A
5850	DIGITAL MULTIMETER	179	FLUKE	2023-11-02

Testing verdicts

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

Summary

Bluetooth EDR

Requirement – Test case FCC PART 15 PARAGRAPH / RSS-247	Verdict	Remark
RSS-247 5.1 (b) / FCC 15.247 (a) (1) 20 dB Bandwidth	N/M	(1)
RSS-247 5.1 (d) / FCC 15.247 (a) (1) (iii) Time of Occupancy (Dwell Time)	N/M	(1)
RSS-247 5.4. (b) / FCC 15.247 (b) Maximum peak output power and antenna gain	P*	(2)
RSS-247 5.1 (d) / FCC 15.247 (a) (1) (iii) Number of hopping channels	N/M	(1)
RSS-247 5.5 / FCC 15.247 (d) Band-edge emissions compliance (Transmitter)	N/M	(1)
RSS-247 5.5 / FCC 15.247 (d) Emission limitations radiated (Transmitter)	P	

Supplementary information and remarks:

(1) Test not requested

(2) Spotcheck requested only in middle channel for DH5 modulation as worst case according to RF output power.

Bluetooth Low Energy 5.0 (1M).

FCC PART 15 PARAGRAPH/ RSS-247			
Requirement – Test case		**Verdict**	**Remark**
FCC 15.247 (a)(2) / RSS-247 5.2. (a)	6 dB Bandwidth	N/M	(1)
FCC 15.247 (b) / RSS-247 5.4. (d)	Maximum output power and antenna gain	P*	(2)
FCC 15.247 (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	N/M	(1)
FCC 15.247 (e) / RSS-247 5.2. (b)	Power spectral density	N/M	(1)
FCC 15.247 (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	
Supplementary information and remarks: (1) Test not requested (2) Spotcheck requested only in high channel as worst case according to RF output power.			

802.11 b/g/n20 1x1

FCC PART 15 PARAGRAPH/ RSS-247			
Requirement – Test case		**Verdict**	**Remark**
FCC 15.247 (a)(2) / RSS-247 5.2. (a)	6 dB Bandwidth	P	
FCC 15.247 (b) / RSS-247 5.4. (d)	Maximum output power and antenna gain	P	
FCC 15.247 (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	P	
FCC 15.247 (e) / RSS-247 5.2. (b)	Power spectral density	P	
FCC 15.247 (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	
Supplementary information and remarks: None.			

Appendix A: Test results. Bluetooth EDR

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TEST CONDITIONS

(*): Data provided by the client.

POWER SUPPLY (*):

Vnominal:	10.8-15.6 V
Type of Power Supply:	External DC (Vehicle Battery).

ANTENNA (*):

Type of Antenna:	Ixxat 1.04.0085.00001 BT/WiFi Antenna with SMA Connector (226-2765 RS Components)(Not sold by Sepura)
Maximum Declared Antenna Gain:	+1 dBi

CONDUCTED TEST FREQUENCIES (*):

Middle Channel:	2441 MHz

RADIATED TEST FREQUENCIES (*):

Low Channel:	2402 MHz
Middle Channel:	2442 MHz
High Channel:	2480 MHz

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and it is connected to the TS8997 using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.

RADIATED MEASUREMENTS:

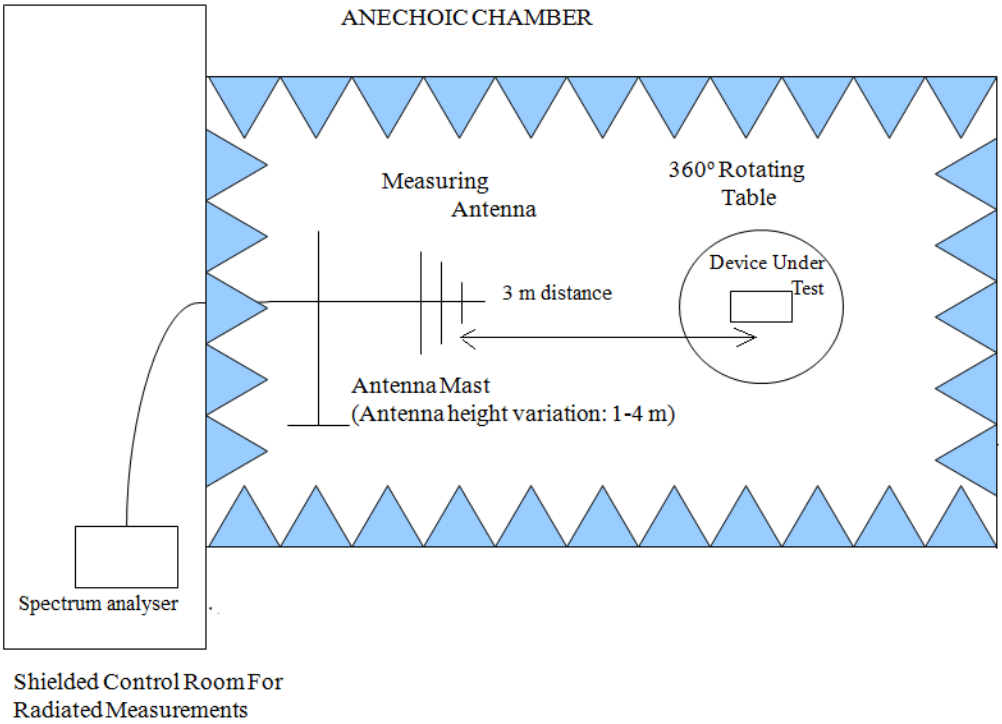
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz and 1 GHz-17 GHz Double ridge horn antenna) is situated at a distance of 3 m and at a distance of 1.5 m for the frequency range 17 GHz-26 GHz (17 GHz-40 GHz horn antenna).

For radiated emissions in the range 17 GHz-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.

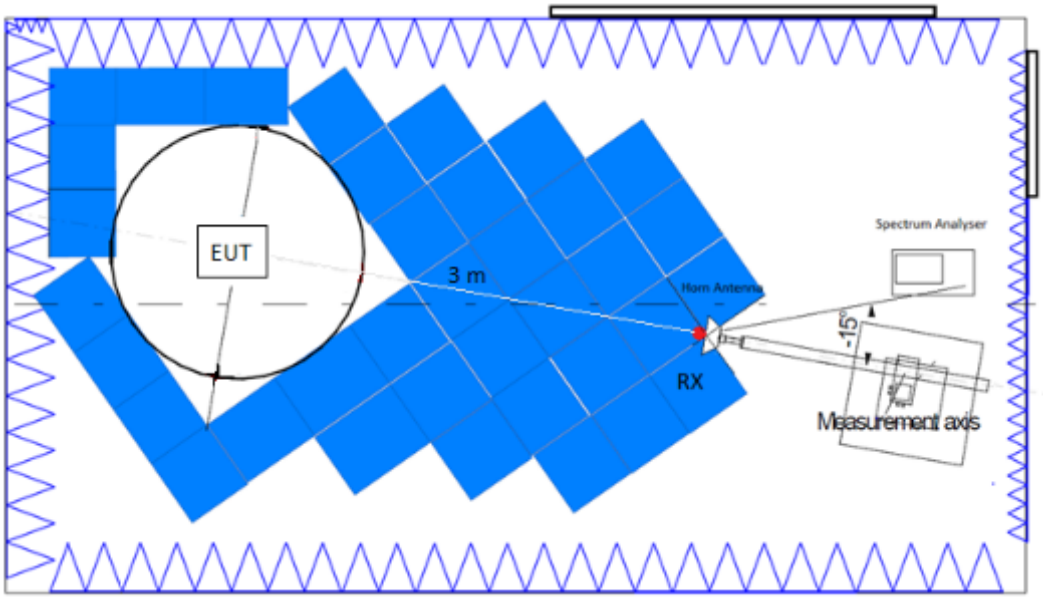
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find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

Measurements were made in both horizontal and vertical planes of polarization.
A resolution bandwidth/video bandwidth of 100 kHz / 300 kHz was used for frequencies below 1 GHz and 1 MHz / 3 MHz for frequencies above 1 GHz.

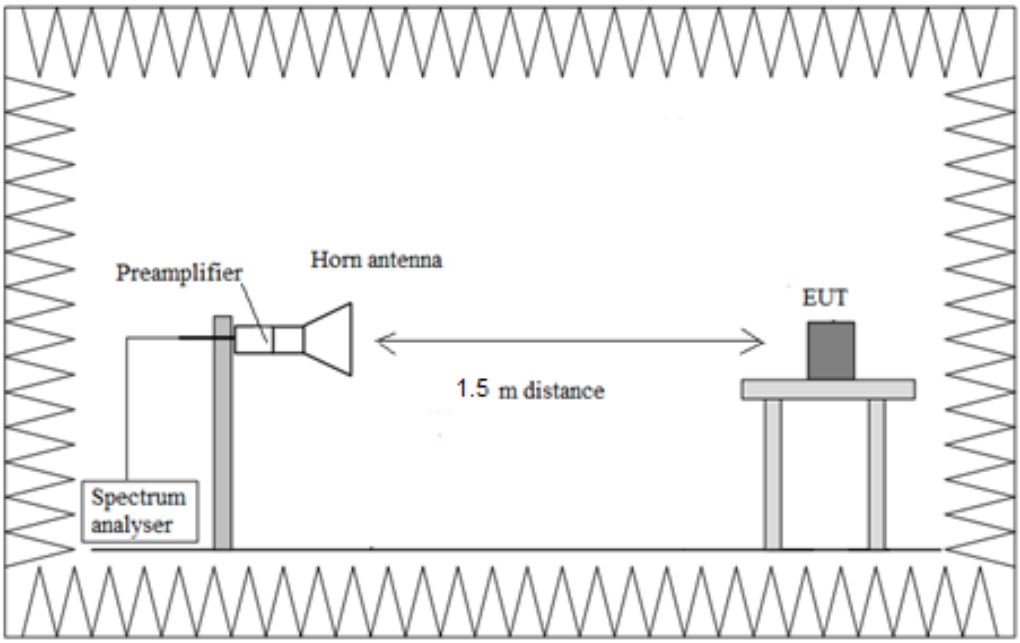
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup f > 17 GHz:



TEST CASES DETAILS

RSS-247 5.4 (b) / FCC 15.247 (b) (1) [Pkcp] 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).

The e.i.r.p. shall not exceed 4 W (36 dBm) (RSS-247).

Results

The maximum peak conducted output power level of the fundamental emission was measured according to clause 7.8.5 “Output power test procedure for frequency-hopping spread-spectrum (FHSS) devices” of ANSI C63.10-2013.

The EIRP power (dBm) is calculated by adding the maximum declared antenna gain to the measured conducted power.

Maximum Declared Antenna Gain: 1 dBi

Modulation: BT (GFSK 1-DH5)

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Port	Peak Power (dBm)	E.I.R.P. (dBm)
2441.000	Frequency Hopping Spread Spectrum systems (DSS)	1	1	1	8.87	9.87

Verdict

Pass

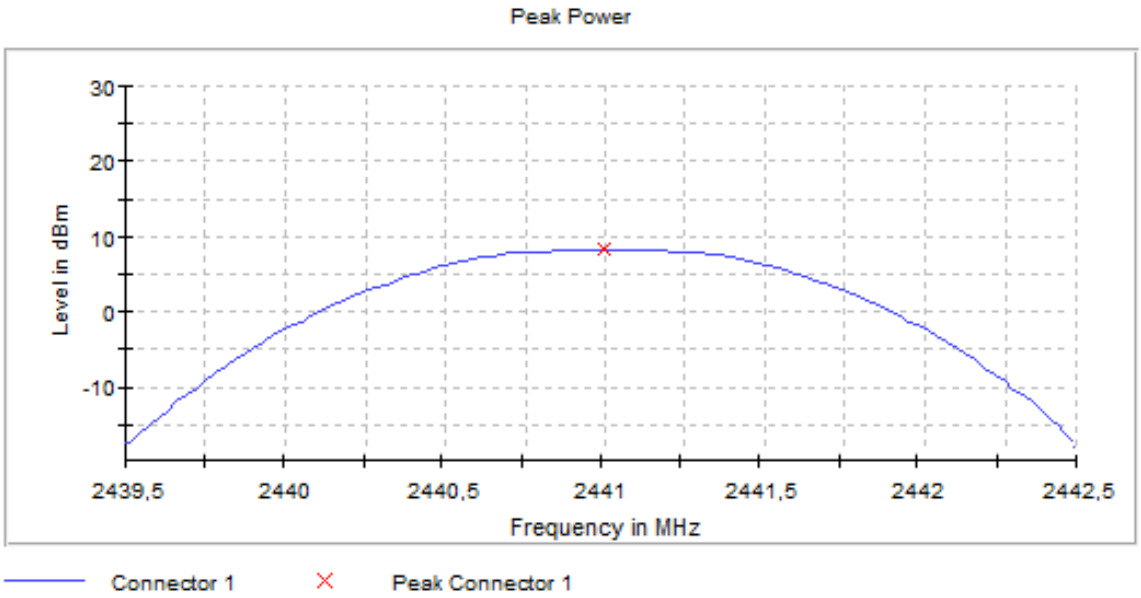
Attachments

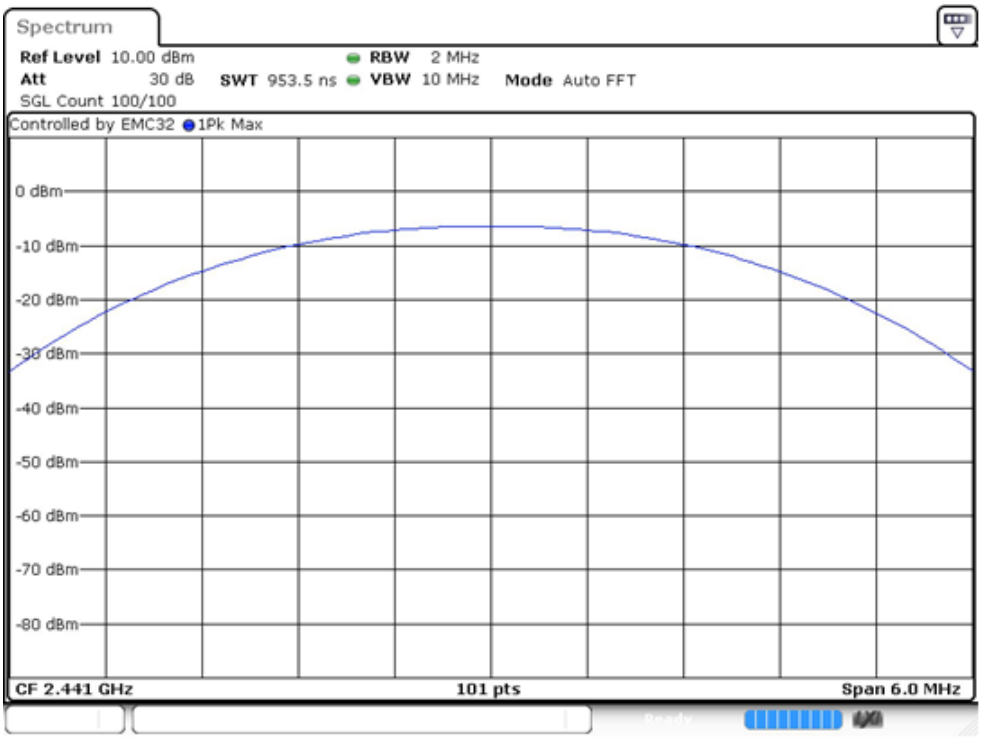
Frequency MHz = 2441.00000

Bandwidth MHz = 1 Modulation = BT (GFSK 1-DH5)

Number of Transmission Chains = 1 Active Port = 1

Images:





RSS-247 5.5 / FCC 15.247 (d) [RSE] Emission limitations radiated (Transmitter)

Limits

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 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
Above 960	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.

Results

Equipment	Freq Rng (GHz)	# of Tx Chains	Port	Unwanted Freq (MHz)	Unwanted Lvl (dBµV/m)	Pol	Detector
Frequency Hopping Spread Spectrum systems (DSS)	[0.03, 1]	1	1	63.980	25.51	V	PK
					24.33	V	QP

Modulation: BT (GFSK 1-DH5)

No spurious frequencies detected at less than 20 dB below the limit.

Modulation: BT (Pi/4 DQPSK 2-DH5)

No spurious frequencies detected at less than 20 dB below the limit.

Modulation: BT (8DPSK 3-DH5)

No spurious frequencies detected at less than 20 dB below the limit.

Verdict

Pass

Attachments

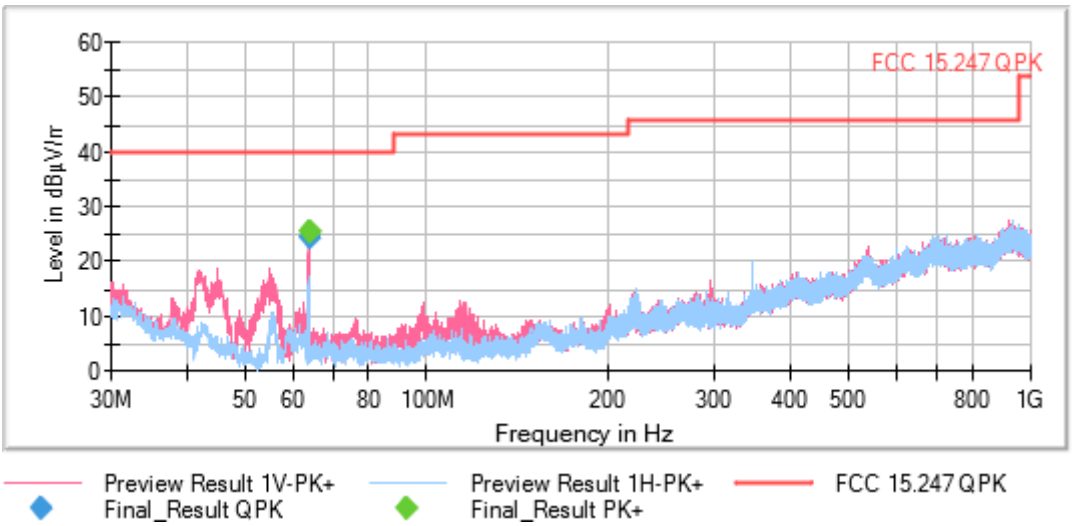
Frequency Range GHz = [0.03, 1]

The spurious frequencies detected do not depend neither on the operating channel nor the modulation mode.

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESR 7]					
	30 MHz - 1 GHz	30,312 kHz	PK+	100 kHz	1 s	0 dB

Modulation: BT (GFSK 1-DH5)

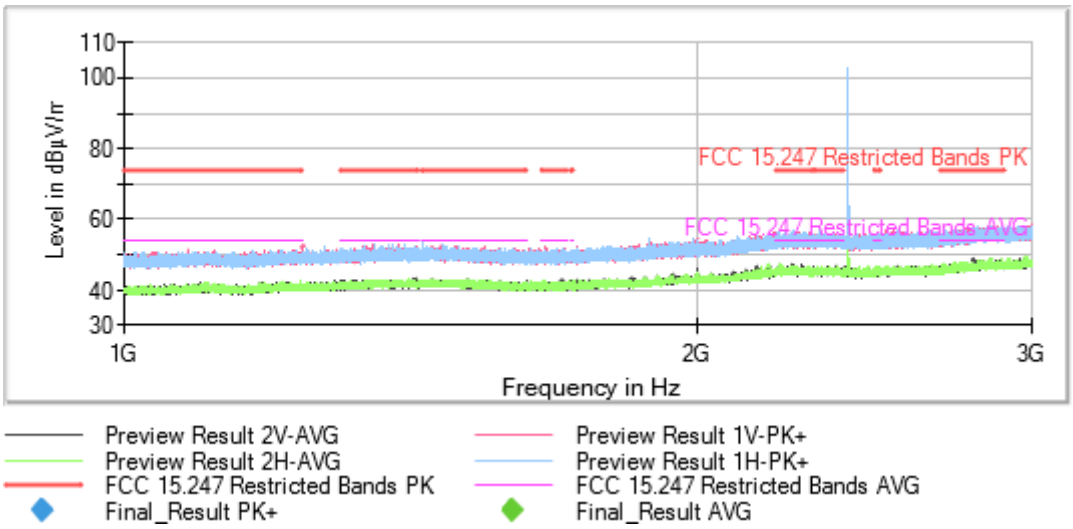
Frequency MHz = 2402.00000

Modulation = BT (GFSK 1-DH5) Frequency Range GHz = [1, 3]

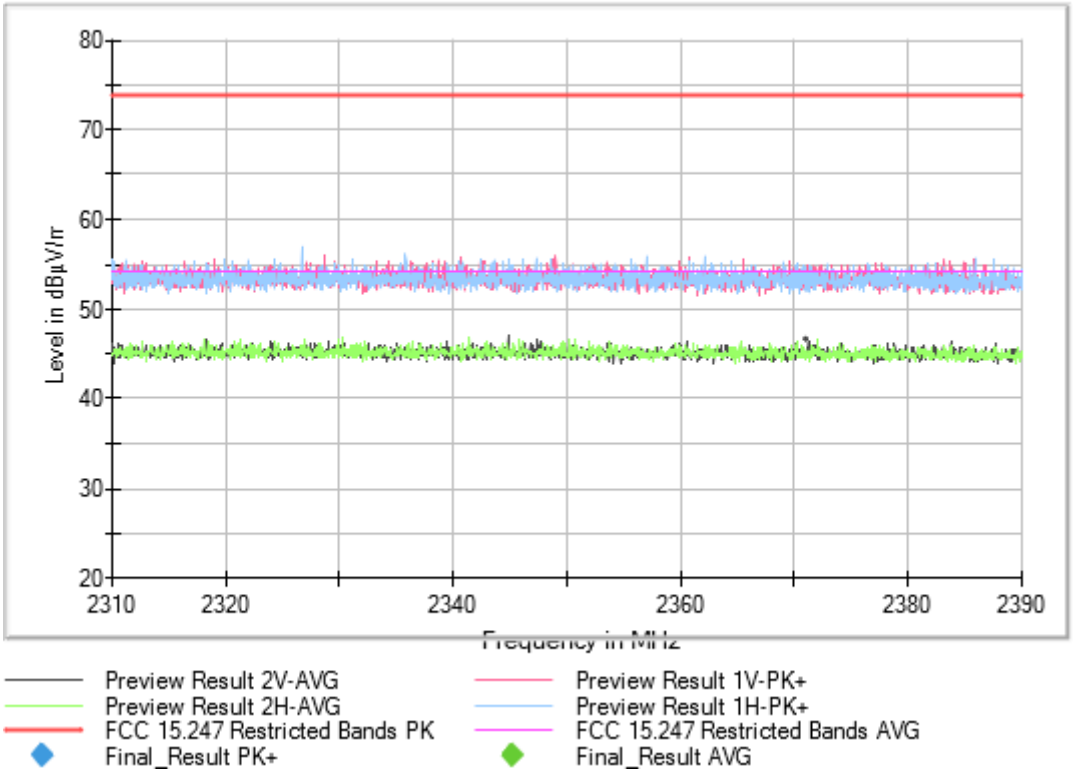
Number of Transmission Chains = 1 Measurement Point = 1

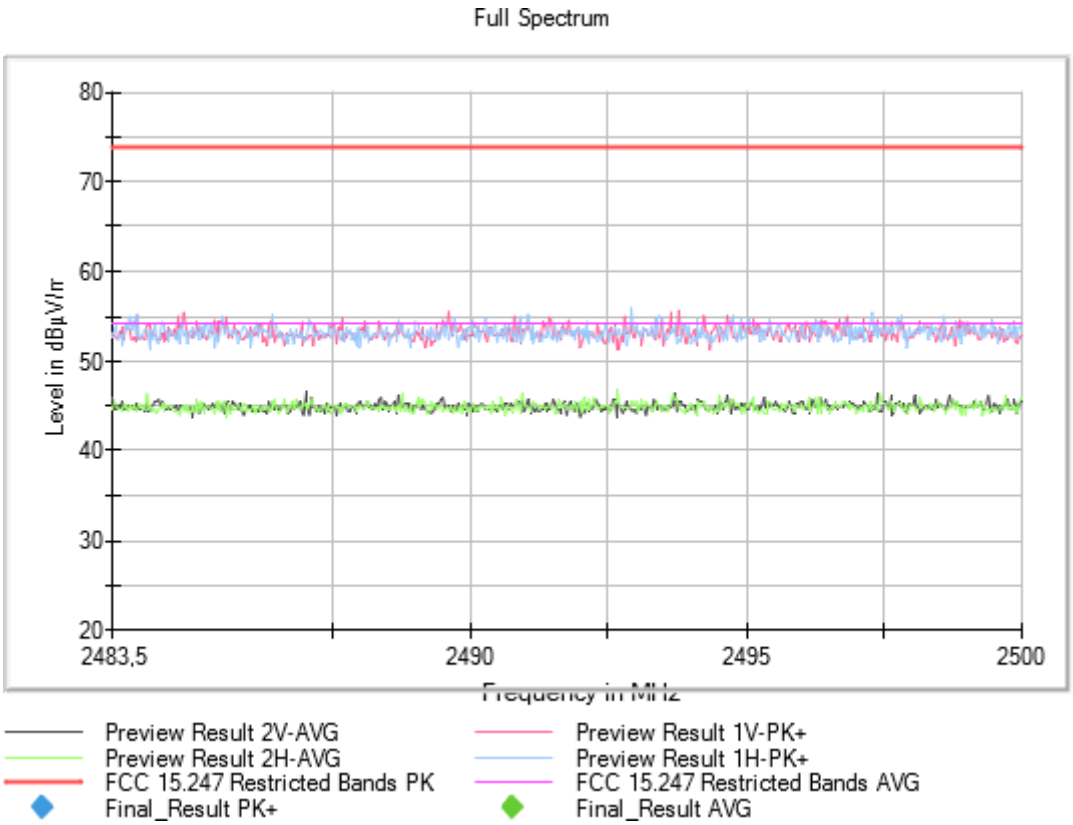
Active Port = 1

Images:



Full Spectrum




Full Spectrum
Level in dBµV/m
80
70
60
50
40
30
20
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 Restricted Bands PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

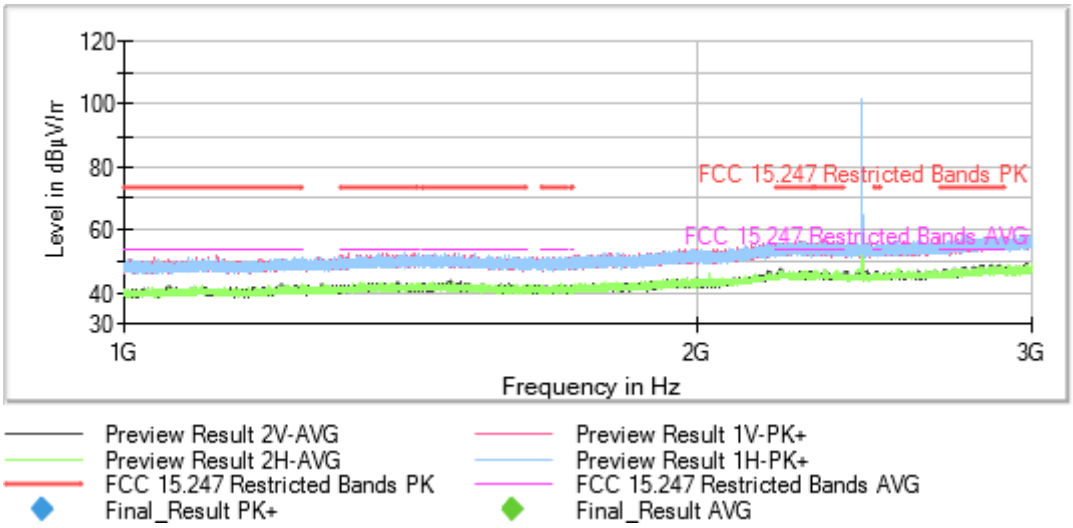
Frequency MHz = 2442.00000

Modulation = BT (GFSK 1-DH5) Frequency Range GHz = [1, 3]

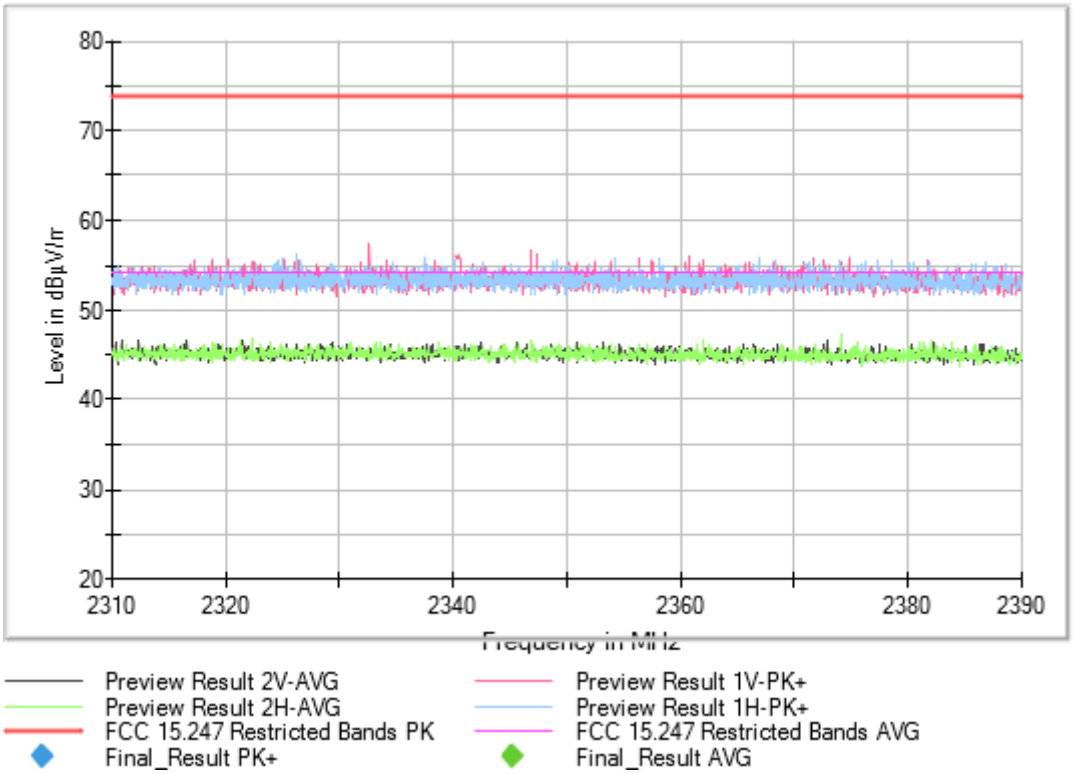
Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Full Spectrum



Full Spectrum
Level in dBµV/m
80
70
60
50
40
30
20
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 Restricted Bands PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

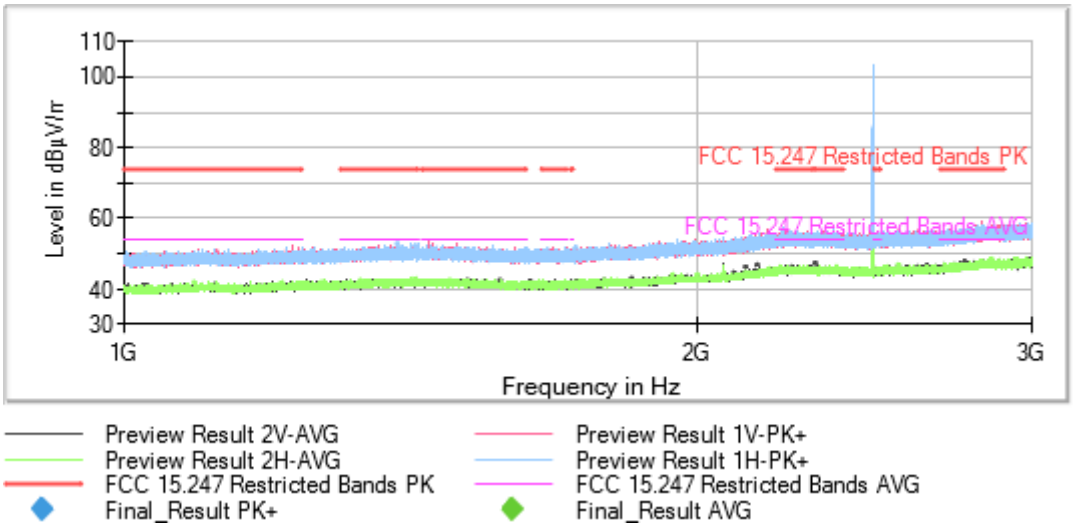
Frequency MHz = 2480.00000

Modulation = BT (GFSK 1-DH5) Frequency Range GHz = [1, 3]

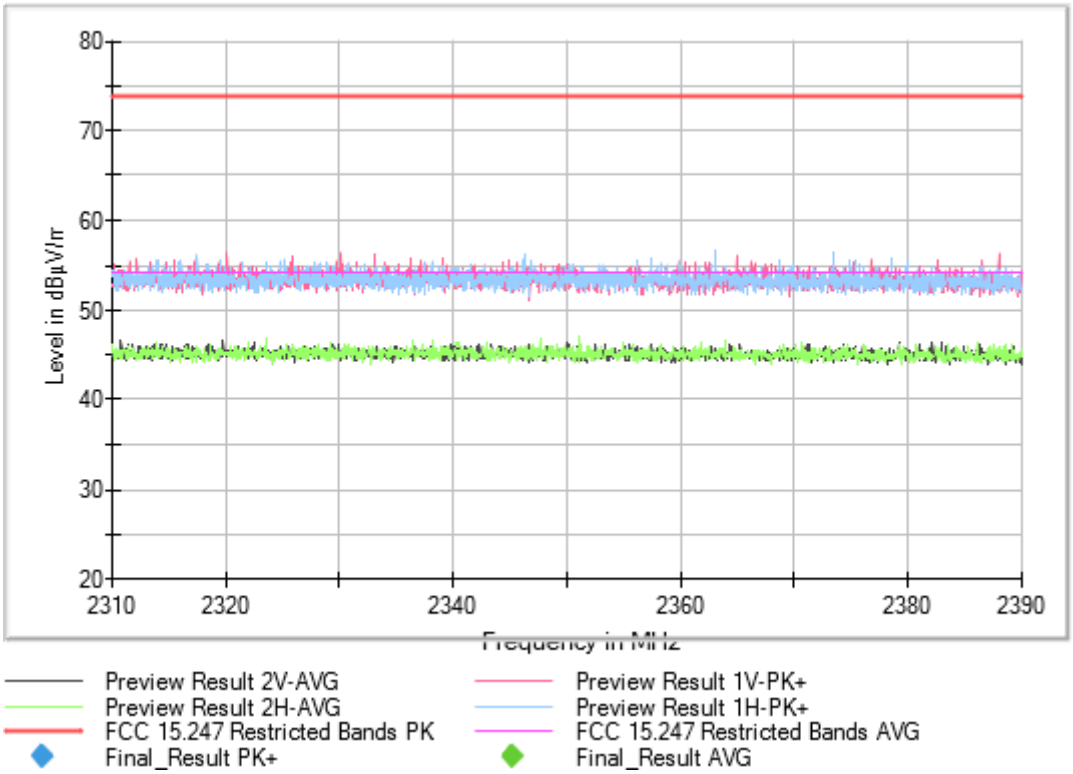
Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Full Spectrum



Full Spectrum
80
70
60
50
40
30
20
Level in dBµV/m
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 Restricted Bands PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

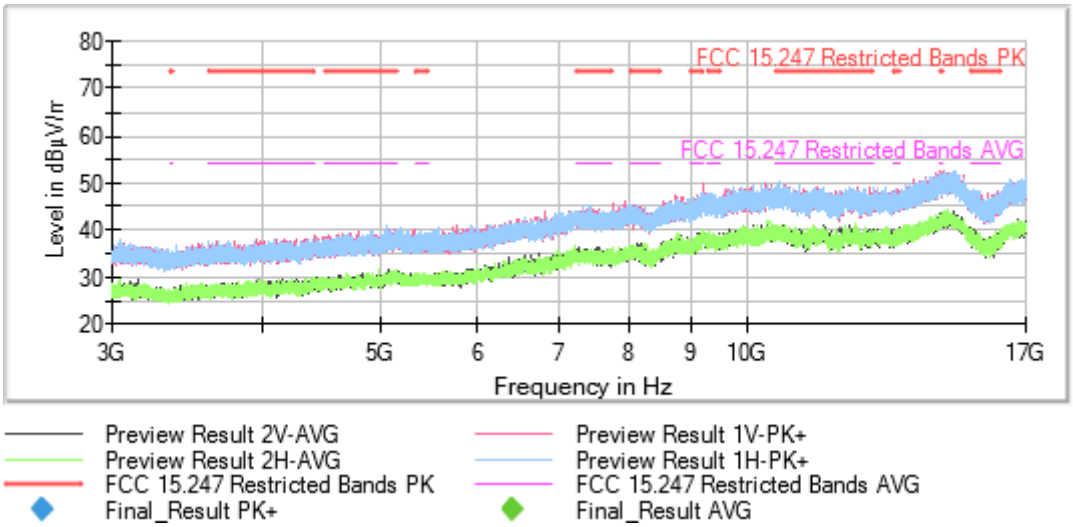
Frequency MHz = 2402.00000

Modulation = BT (GFSK 1-DH5) Frequency Range GHz = [3, 17]

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [FSW 50]					
	3 GHz - 17 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

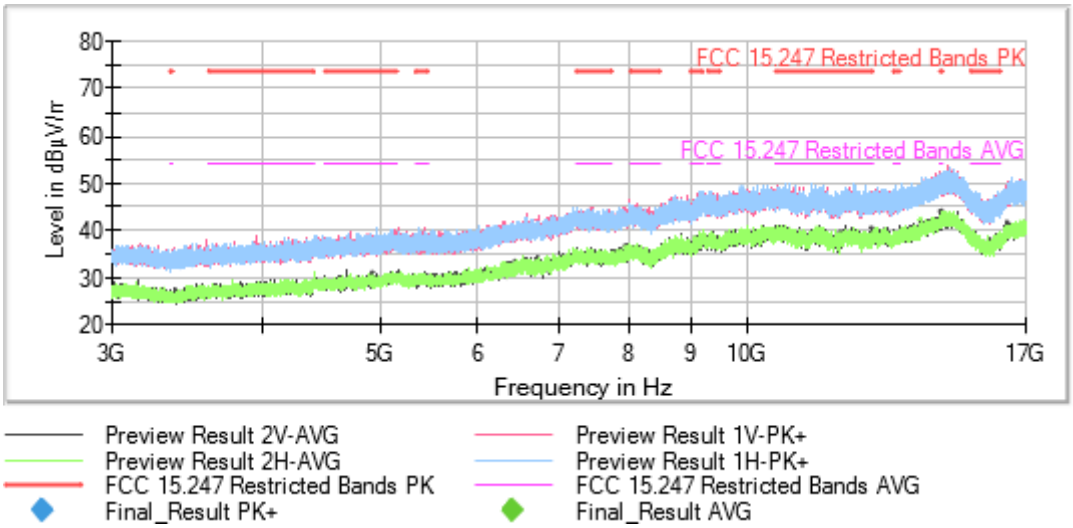
Frequency MHz = 2442.00000

Modulation = BT (GFSK 1-DH5) Frequency Range GHz = [3, 17]

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [FSW 50]					
	3 GHz - 17 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

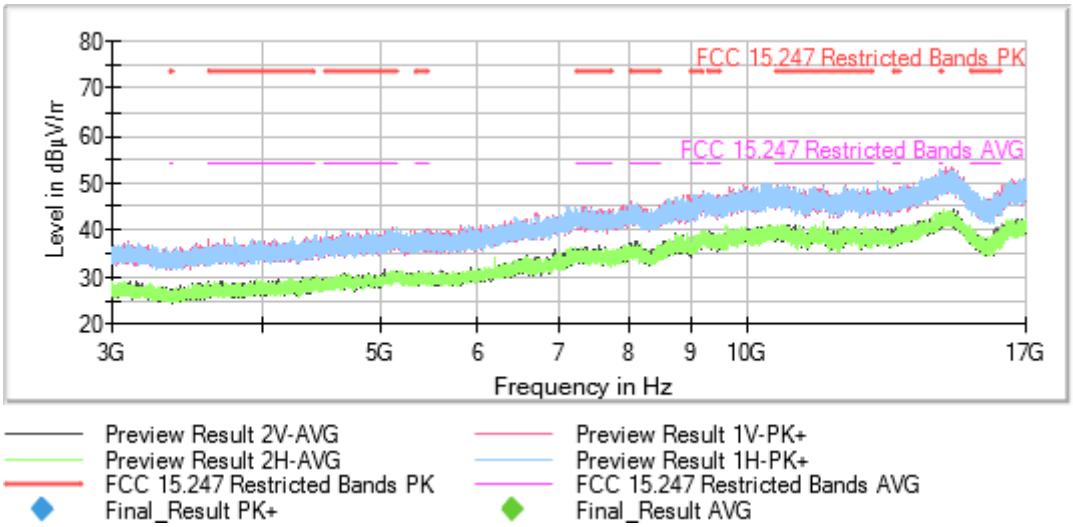
Frequency MHz = 2480.00000

Modulation = BT (GFSK 1-DH5) Frequency Range GHz = [3, 17]

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [FSW 50]					
	3 GHz - 17 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

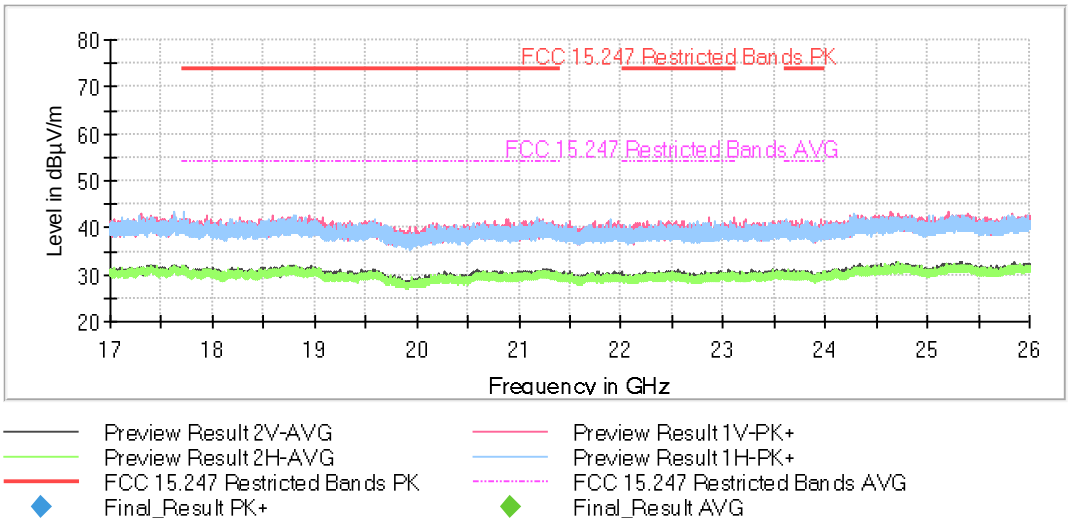
Frequency MHz = The spurious frequencies detected do not depend on the operating channel

Modulation = BT (GFSK 1-DH5) Frequency Range GHz = [17, 26]

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [FSW 50]					
	17 GHz - 26 GHz	300 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

Modulation: BT (Pi/4 DQPSK 2-DH5)

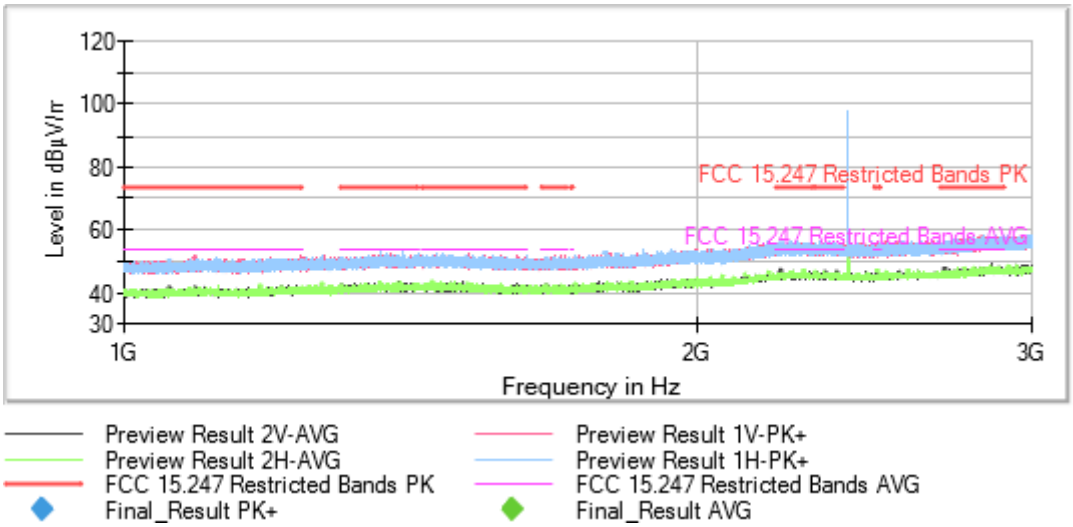
Frequency MHz = 2402.00000

Modulation = BT (Pi/4 DQPSK 2-DH5) Frequency Range GHz = [1, 3]

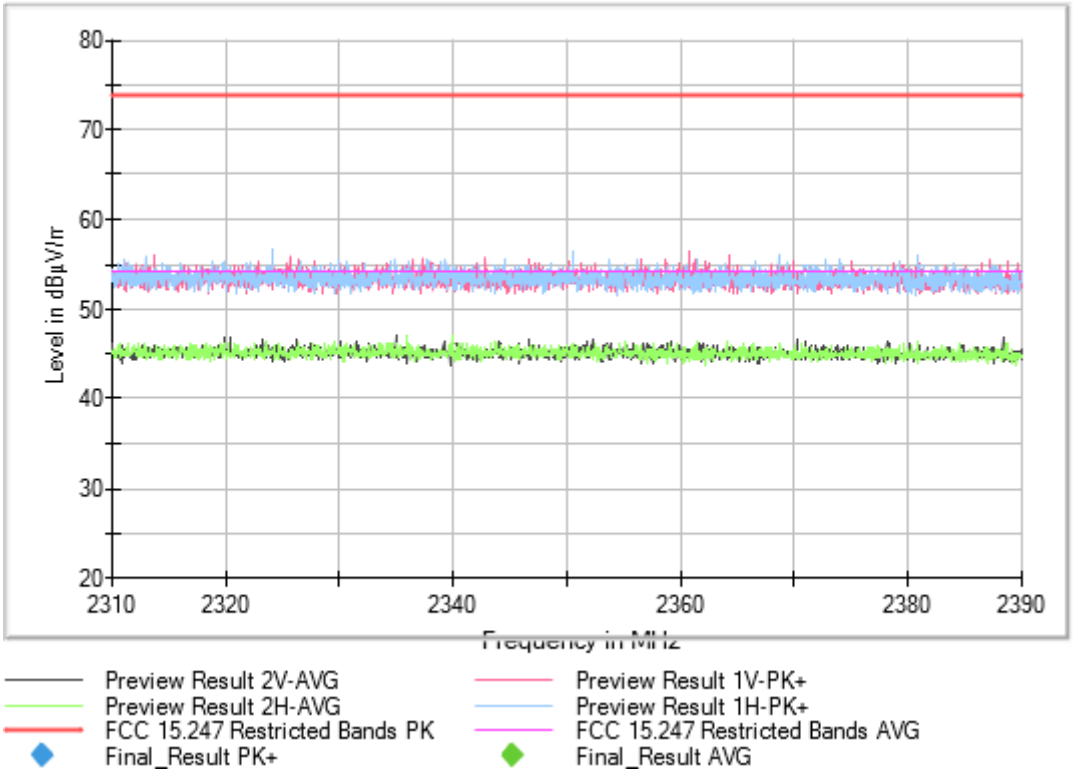
Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Full Spectrum



Full Spectrum
Level in dBµV/m
80
70
60
50
40
30
20
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 Restricted Bands PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

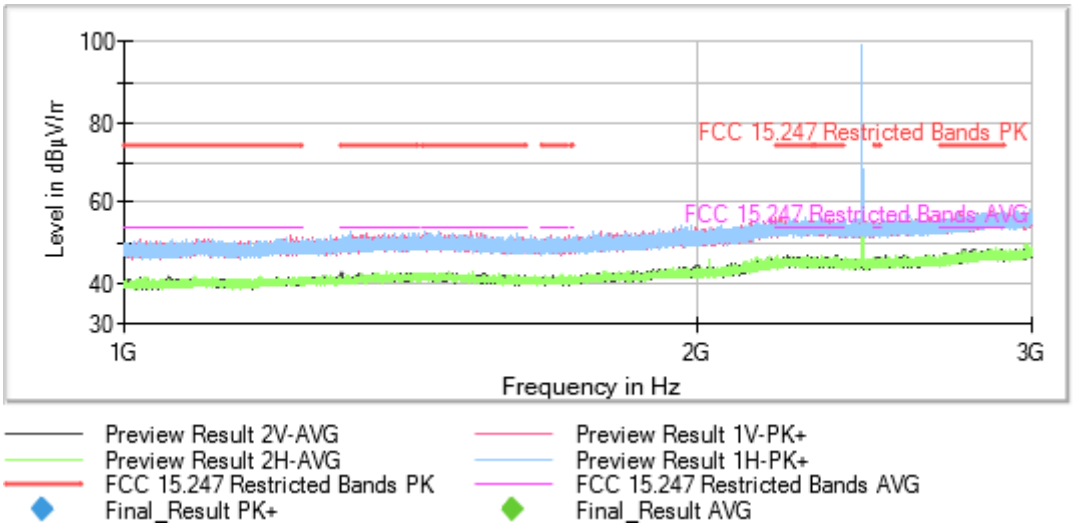
Frequency MHz = 2442.00000

Modulation = BT (Pi/4 DQPSK 2-DH5) Frequency Range GHz = [1, 3]

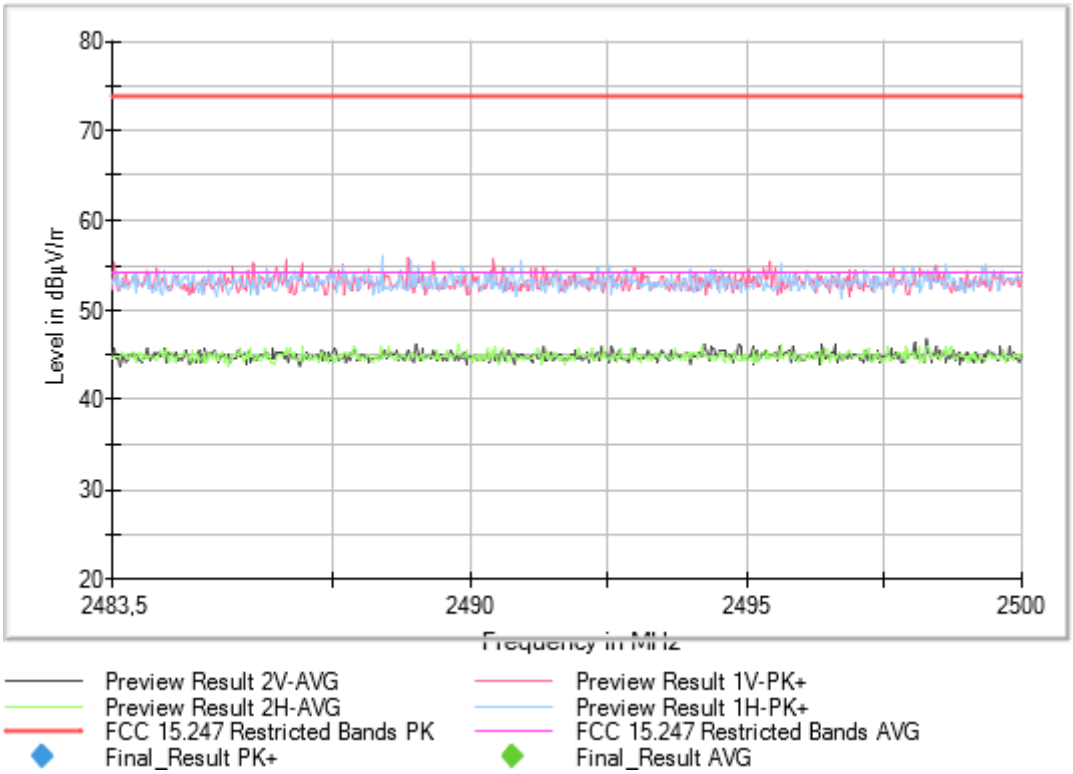
Number of Transmission Chains = 1 Measurement Point = 1

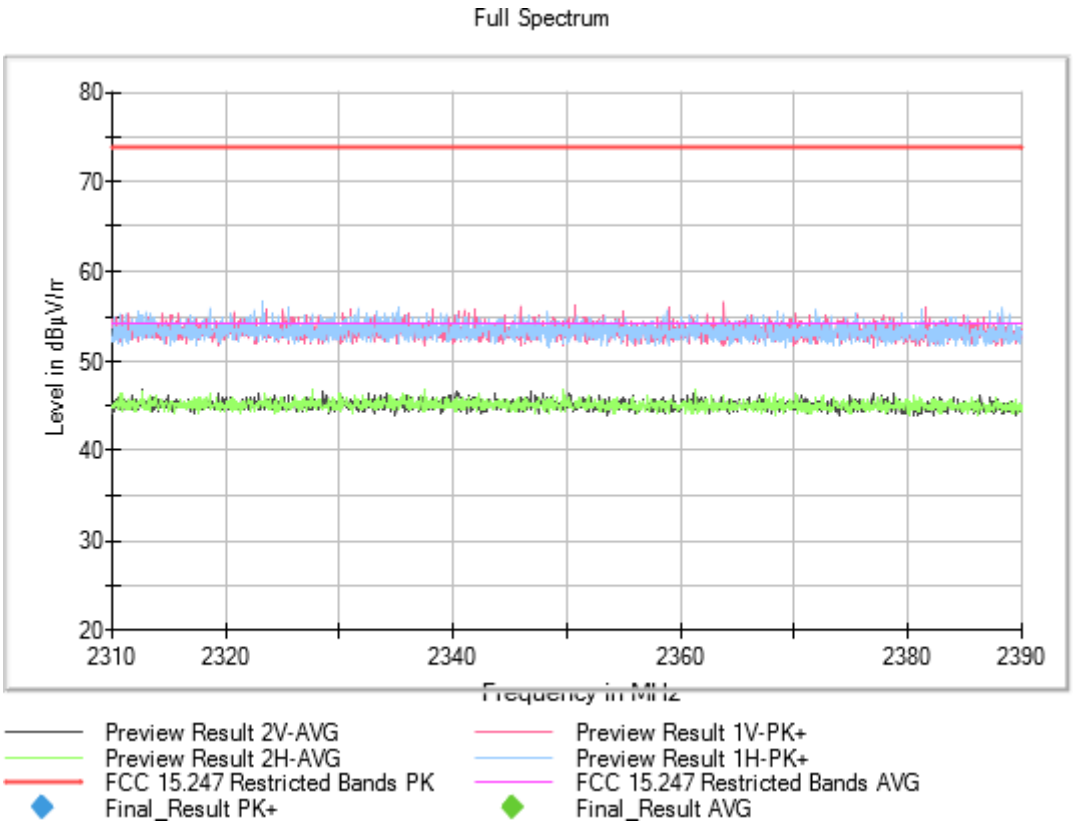
Active Port = 1

Images:



Full Spectrum




Full Spectrum
Level in dBµV/m
80
70
60
50
40
30
20
2310
2320
2340
2360
2380
2390
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 Restricted Bands PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

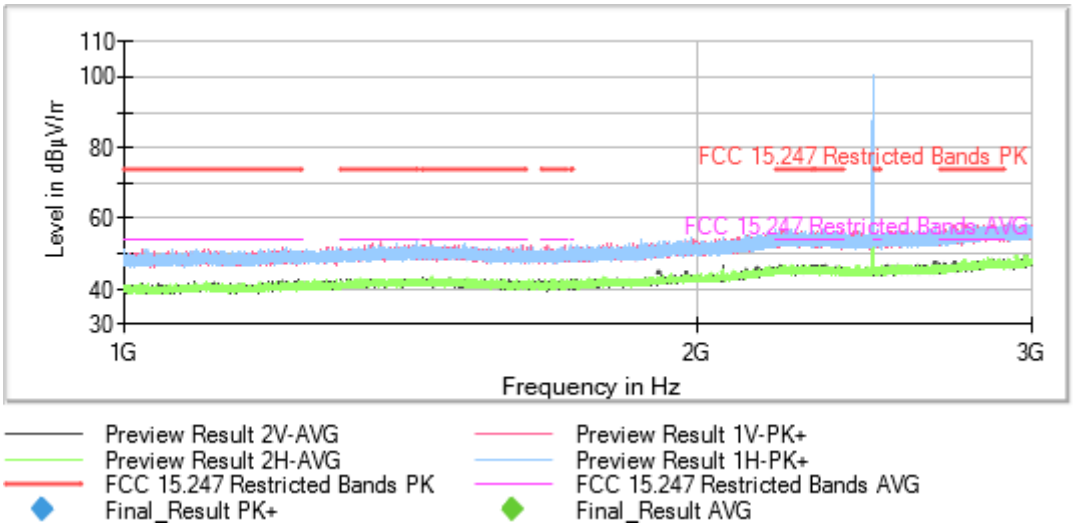
Frequency MHz = 2480.00000

Modulation = BT (Pi/4 DQPSK 2-DH5) Frequency Range GHz = [1, 3]

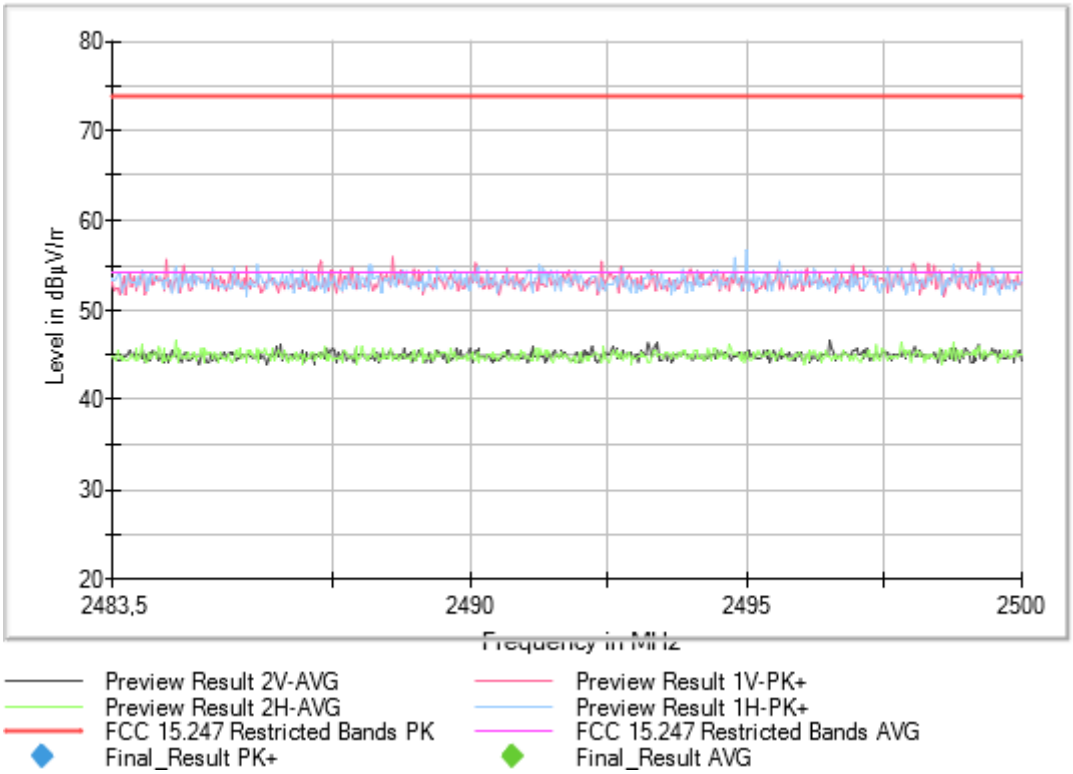
Number of Transmission Chains = 1 Measurement Point = 1

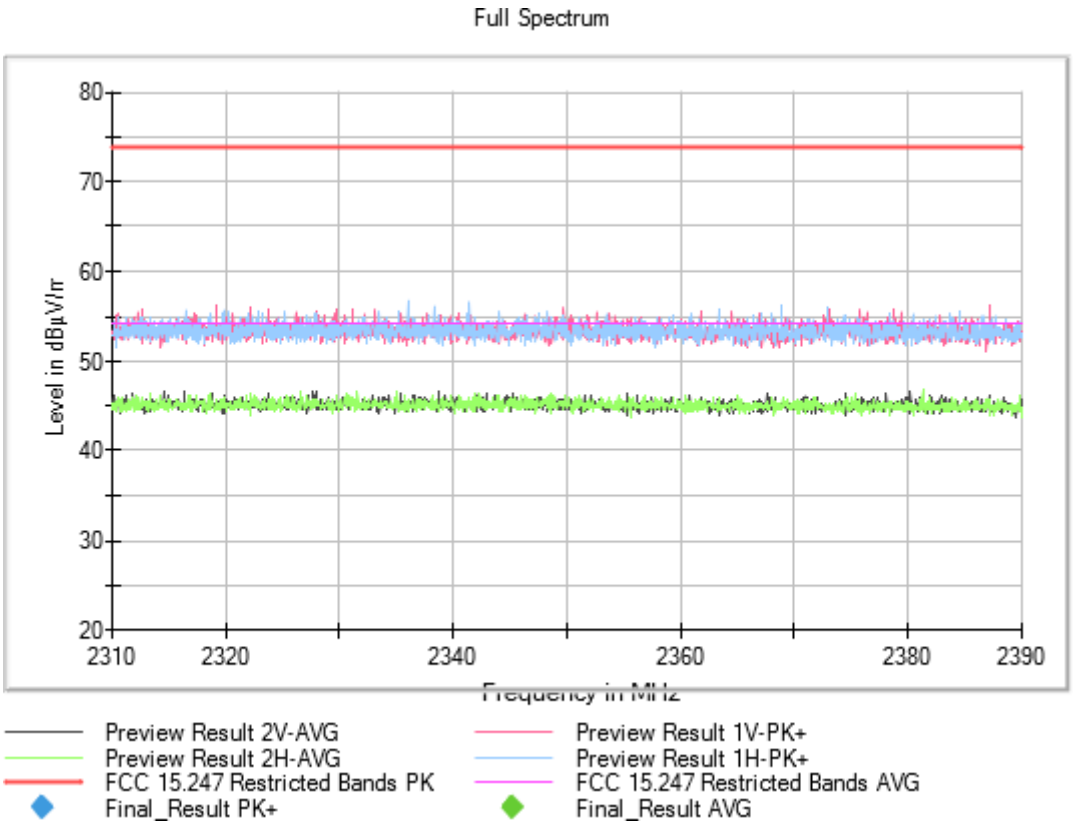
Active Port = 1

Images:



Full Spectrum




Full Spectrum
Level in dBµV/m
80
70
60
50
40
30
20
2310
2320
2340
2360
2380
2390
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 Restricted Bands PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

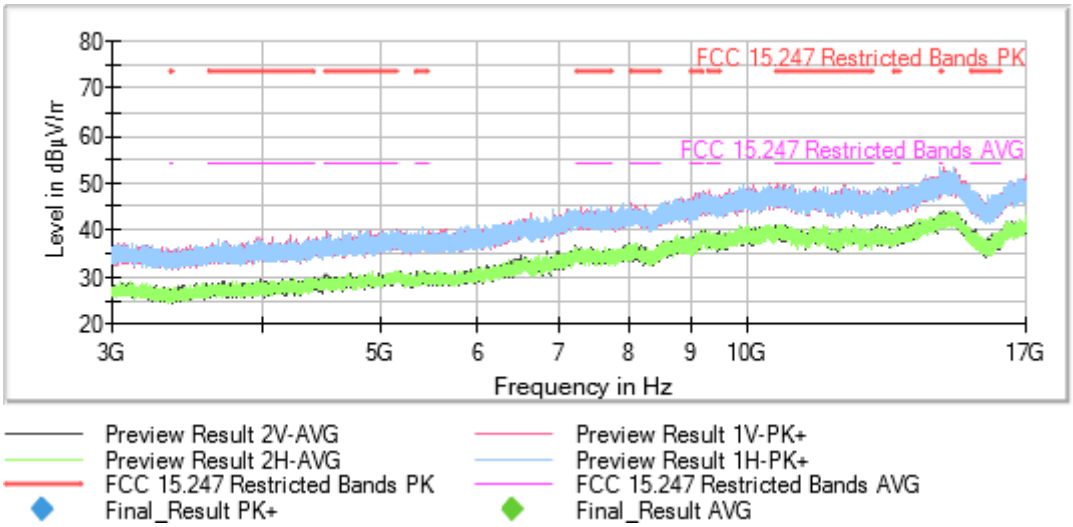
Frequency MHz = 2402.00000

Modulation = BT (Pi/4 DQPSK 2-DH5) Frequency Range GHz = [3, 17]

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [FSW 50]					
	3 GHz - 17 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

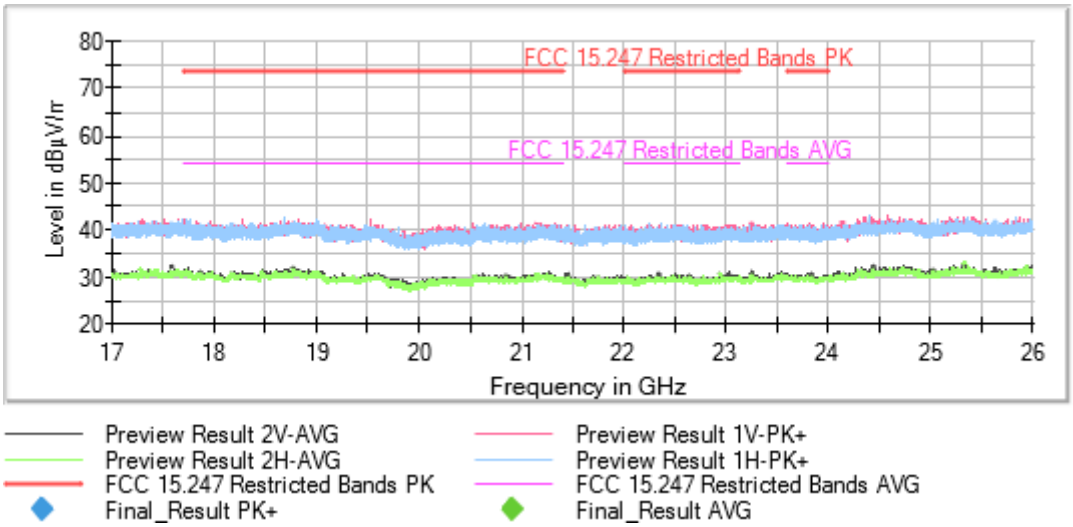
Frequency MHz = 2402.00000

Modulation = BT (Pi/4 DQPSK 2-DH5) Frequency Range GHz = [17, 26]

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [FSW 50]					
	17 GHz - 26 GHz	300 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

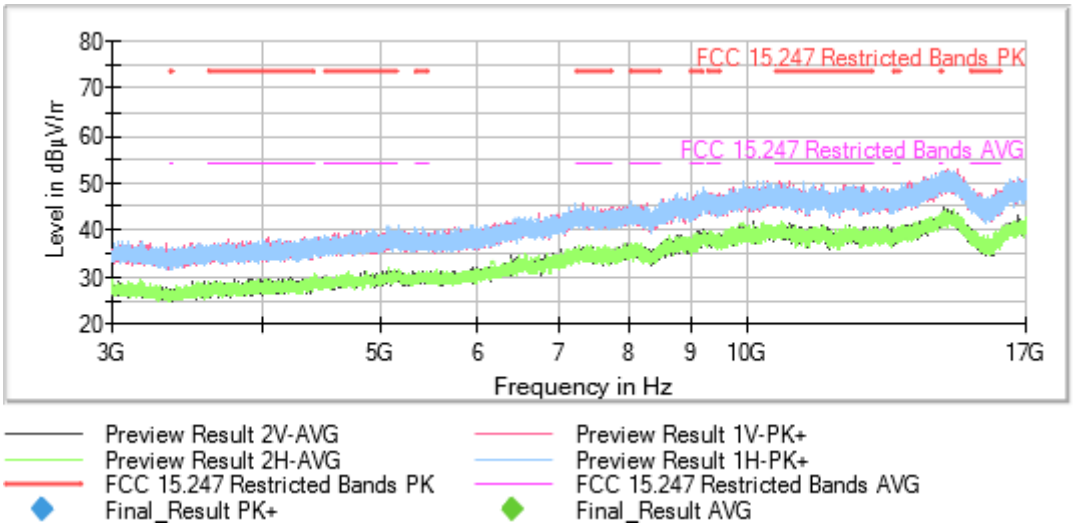
Frequency MHz = 2442.00000

Modulation = BT (Pi/4 DQPSK 2-DH5) Frequency Range GHz = [3, 17]

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [FSW 50]					
	3 GHz - 17 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

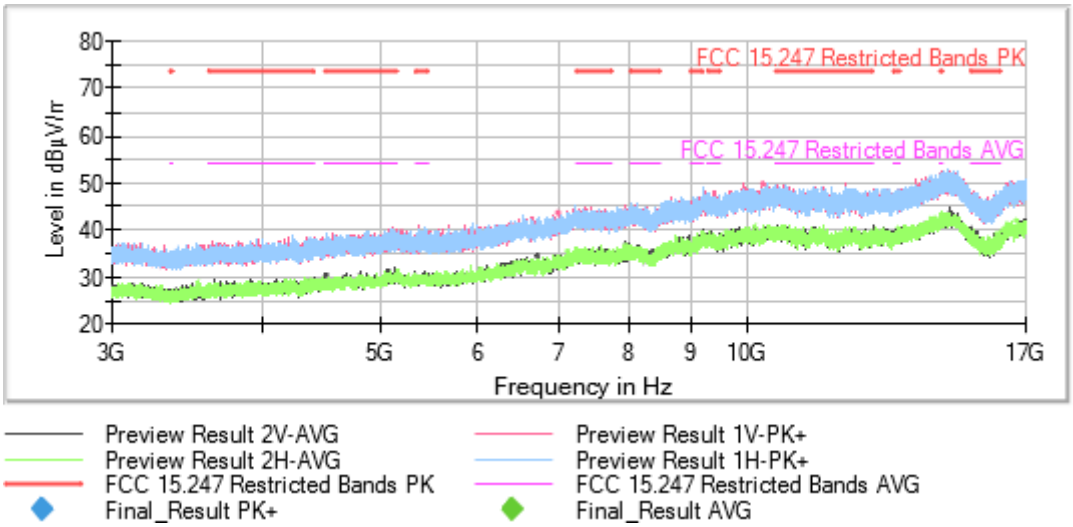
Frequency MHz = 2480.00000

Modulation = BT (Pi/4 DQPSK 2-DH5) Frequency Range GHz = [3, 17]

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [FSW 50]					
	3 GHz - 17 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

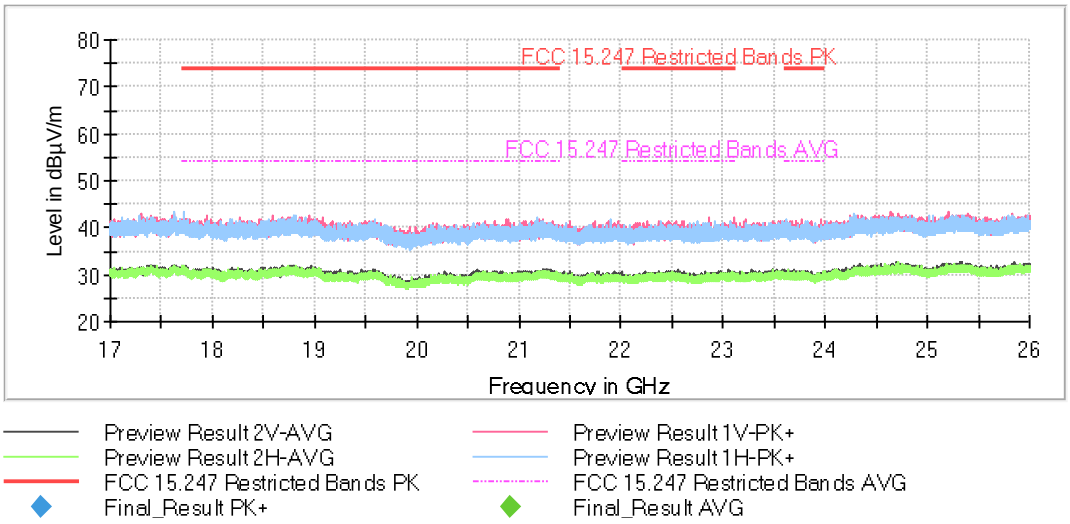
Frequency MHz = The spurious frequencies detected do not depend on the operating channel

Modulation = BT (Pi/4 DQPSK 2-DH5) Frequency Range GHz = [17, 26]

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [FSW 50]					
	17 GHz - 26 GHz	300 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

Modulation: BT (8DPSK 3-DH5)

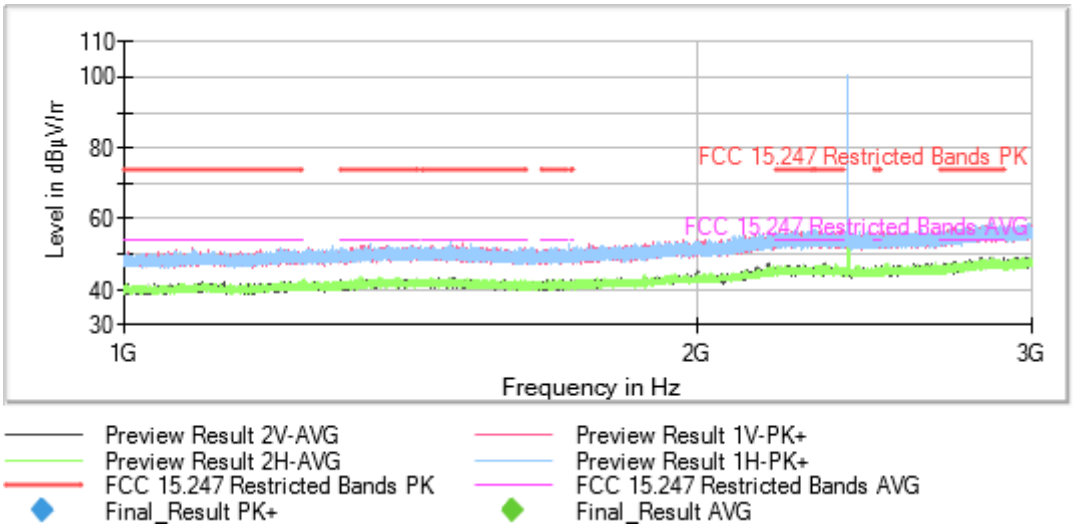
Frequency MHz = 2402.00000

Frequency Range GHz = [1, 3]

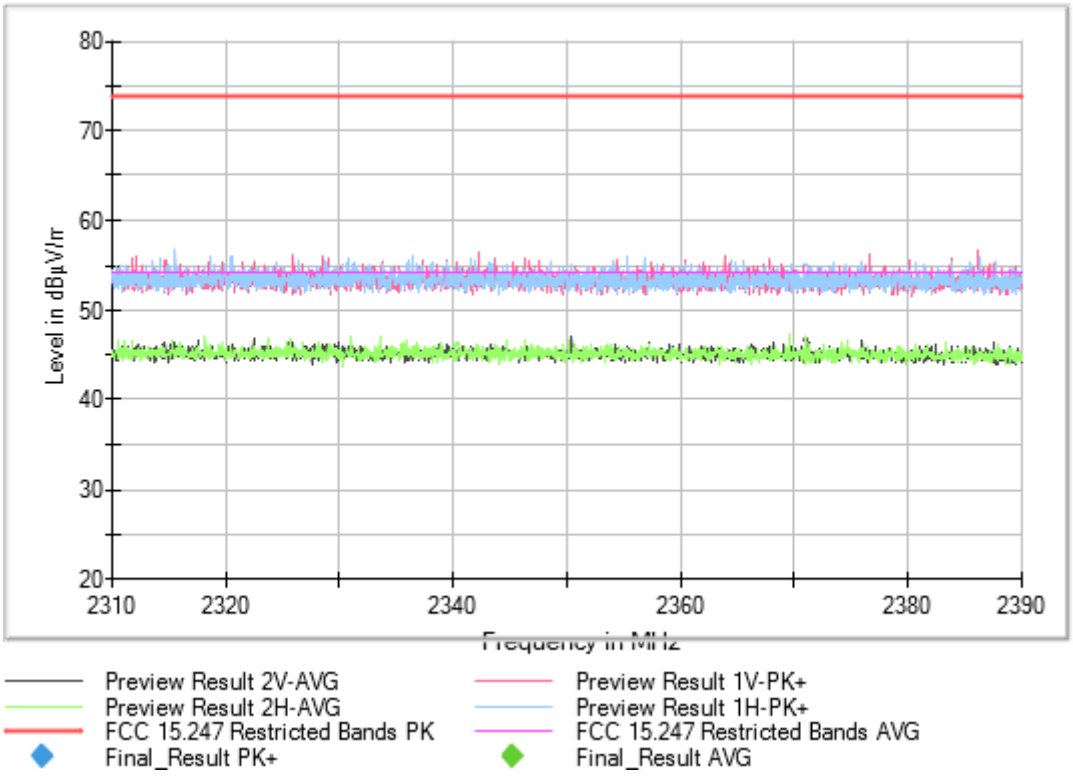
Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Full Spectrum



Full Spectrum
Level in dBµV/m
80
70
60
50
40
30
20
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 Restricted Bands PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

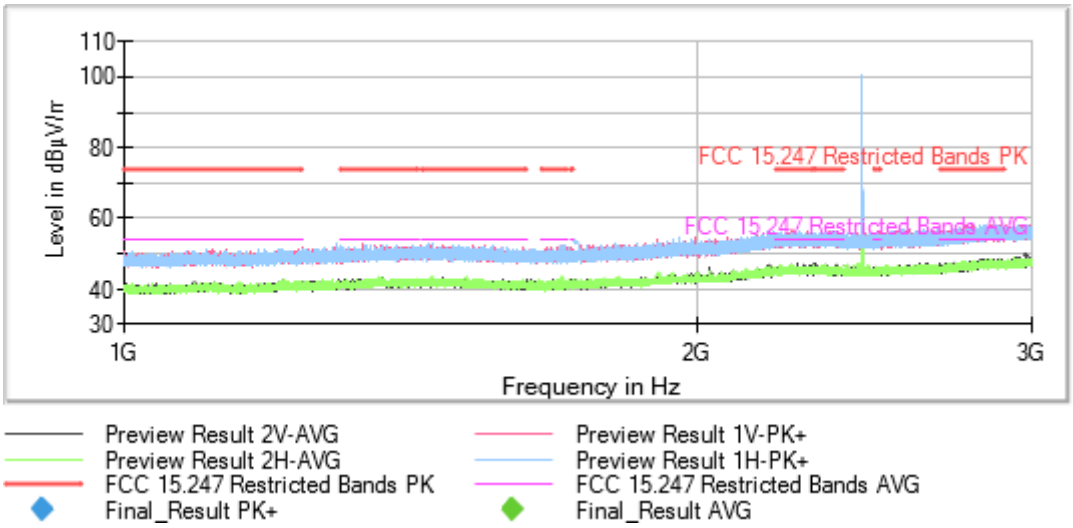
Frequency MHz = 2442.00000

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

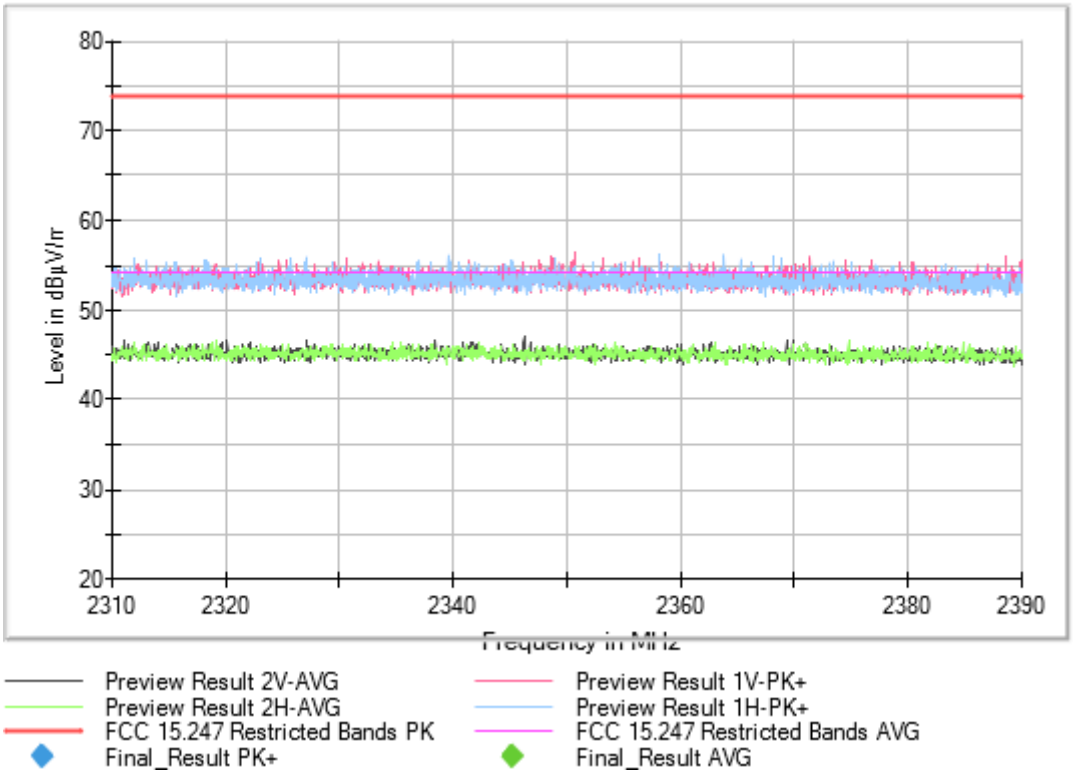
Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Full Spectrum



Full Spectrum
Level in dBµV/m
80
70
60
50
40
30
20
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 Restricted Bands PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

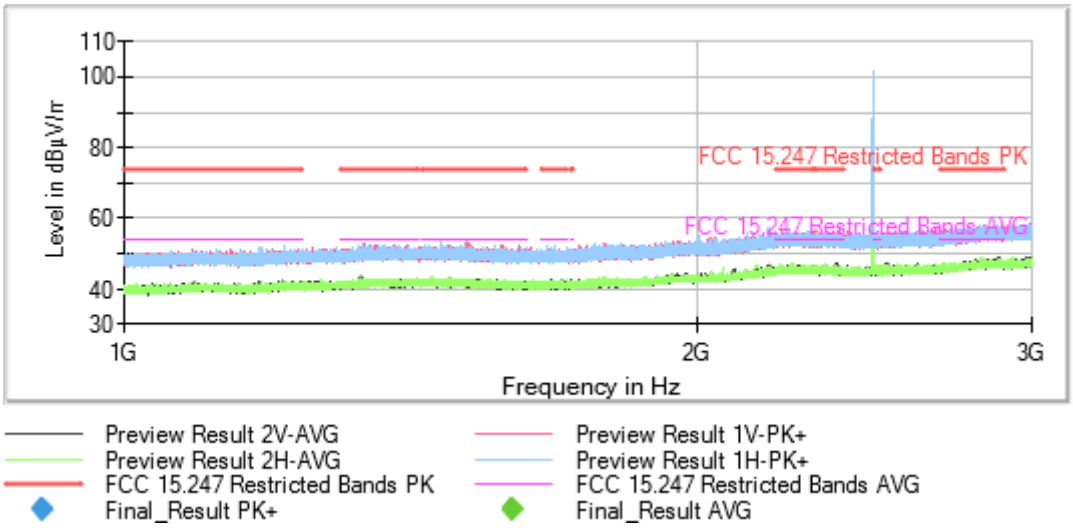
Frequency MHz = 2480.00000

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

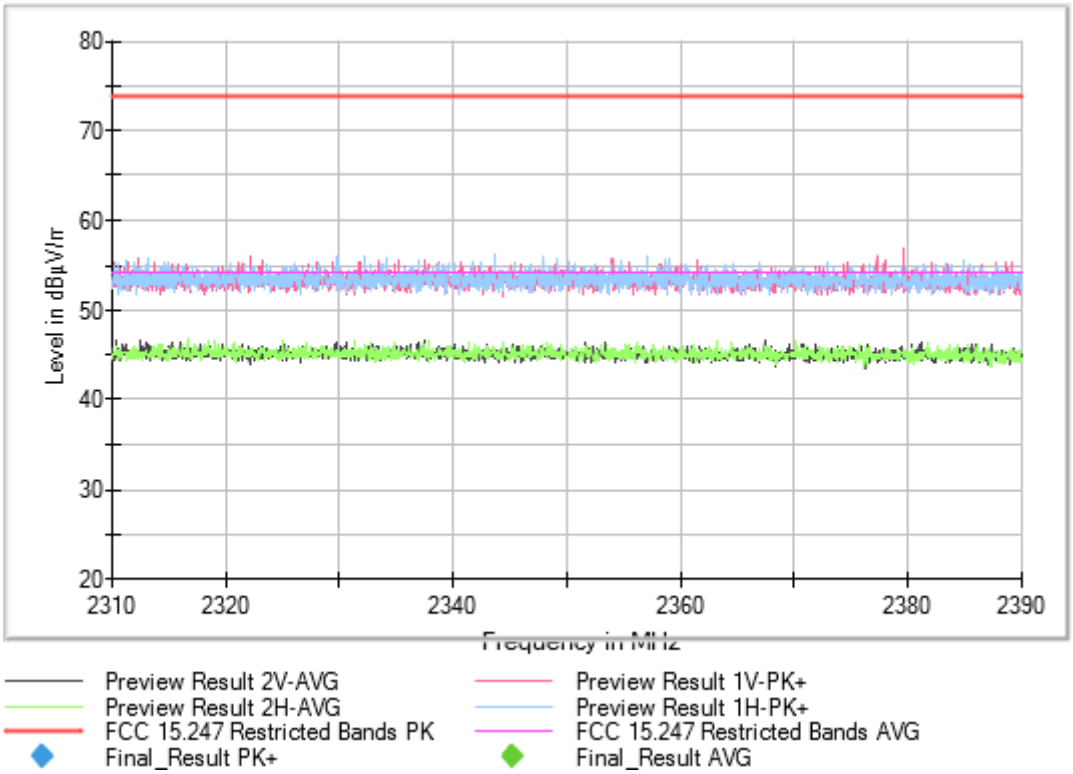
Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Full Spectrum



Full Spectrum
Level in dBµV/m
80
70
60
50
40
30
20
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 Restricted Bands PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

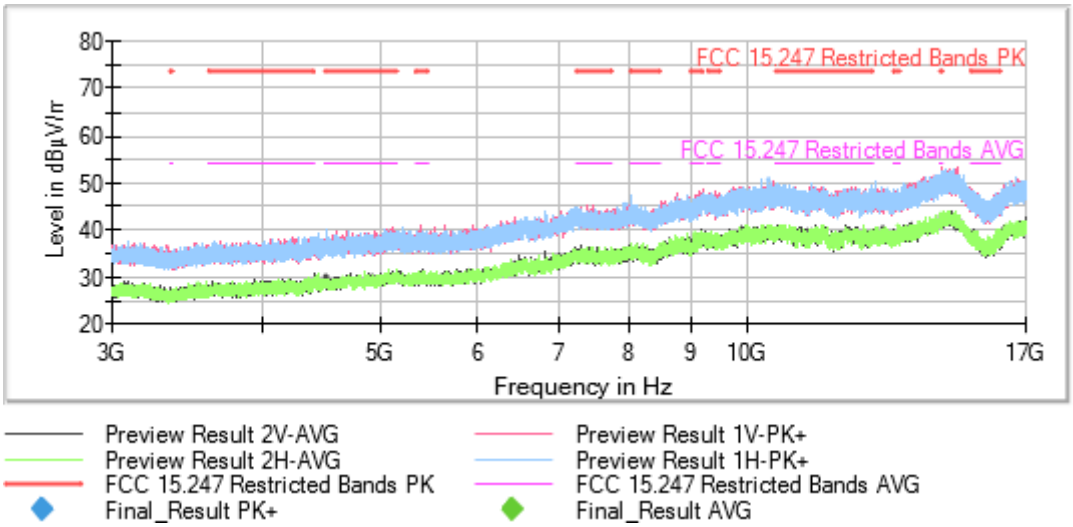
Frequency MHz = 2402.00000

Modulation = BT (8DPSK 3-DH5) Frequency Range GHz = [3, 17]

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [FSW 50]					
	3 GHz - 17 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

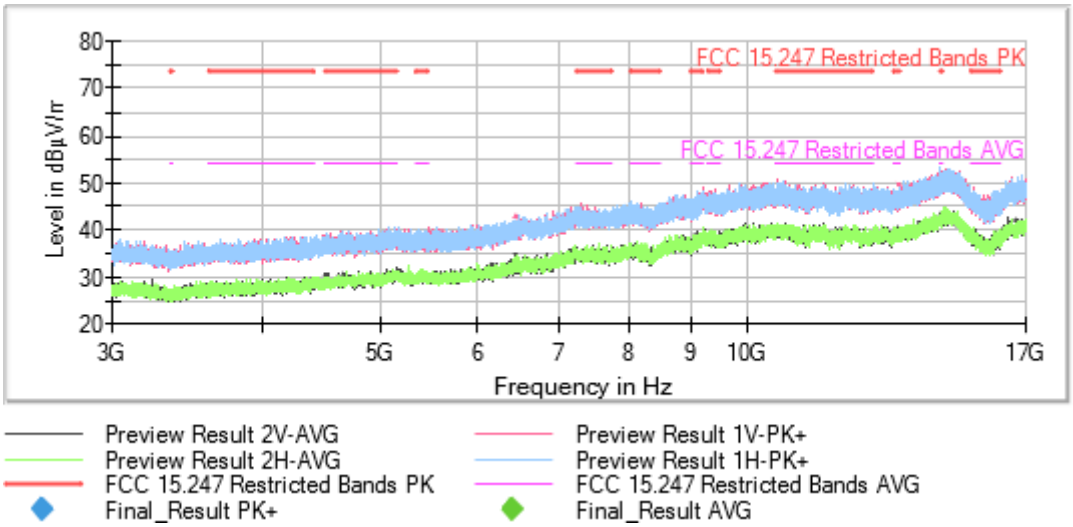
Frequency MHz = 2442.00000

Modulation = BT (8DPSK 3-DH5) Frequency Range GHz = [3, 17]

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [FSW 50]					
	3 GHz - 17 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

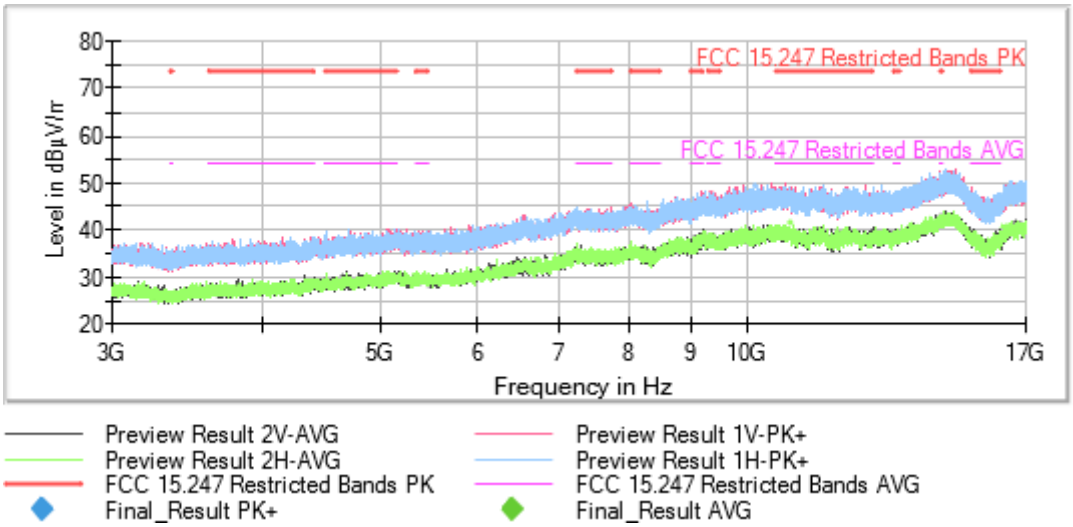
Frequency MHz = 2480.00000

Modulation = BT (8DPSK 3-DH5) Frequency Range GHz = [3, 17]

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [FSW 50]					
	3 GHz - 17 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

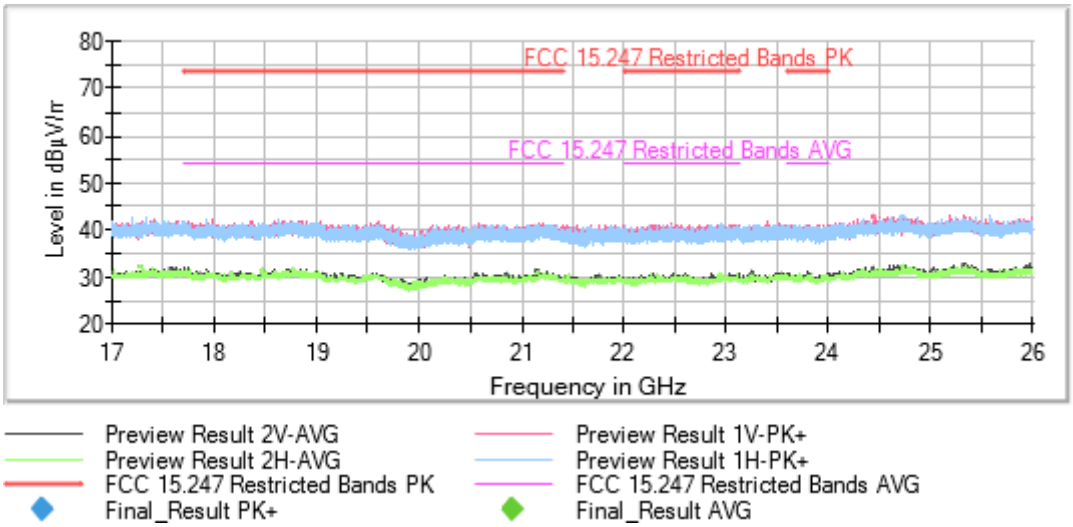
Frequency Range GHz = [17, 26]

Frequency = The spurious frequencies detected do not depend on the operating channel

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [FSW 50]					
	17 GHz - 26 GHz	300 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

Appendix B: Test results. Bluetooth Low Energy 5.0 (1M)

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TEST CONDITIONS

(*): Data provided by the client.

POWER SUPPLY (*):

Vnominal:	10.8-15.6 V
Type of Power Supply:	External DC (Vehicle Battery).

ANTENNA (*):

Type of Antenna:	Ixxat 1.04.0085.00001 BT/WiFi Antenna with SMA Connector (226-2765 RS Components)(Not sold by Sepura)
Maximum Declared Antenna Gain:	+1 dBi

TEST FREQUENCIES (*):

Low Channel:	2402 MHz
Middle Channel:	2442 MHz
High Channel:	2480 MHz

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and it is connected to the TS8997 using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.

RADIATED MEASUREMENTS:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz and 1 GHz-17 GHz Double ridge horn antenna) is situated at a distance of 3 m and at a distance of 1.5 m for the frequency range 17 GHz-26 GHz (17 GHz-40 GHz horn antenna).

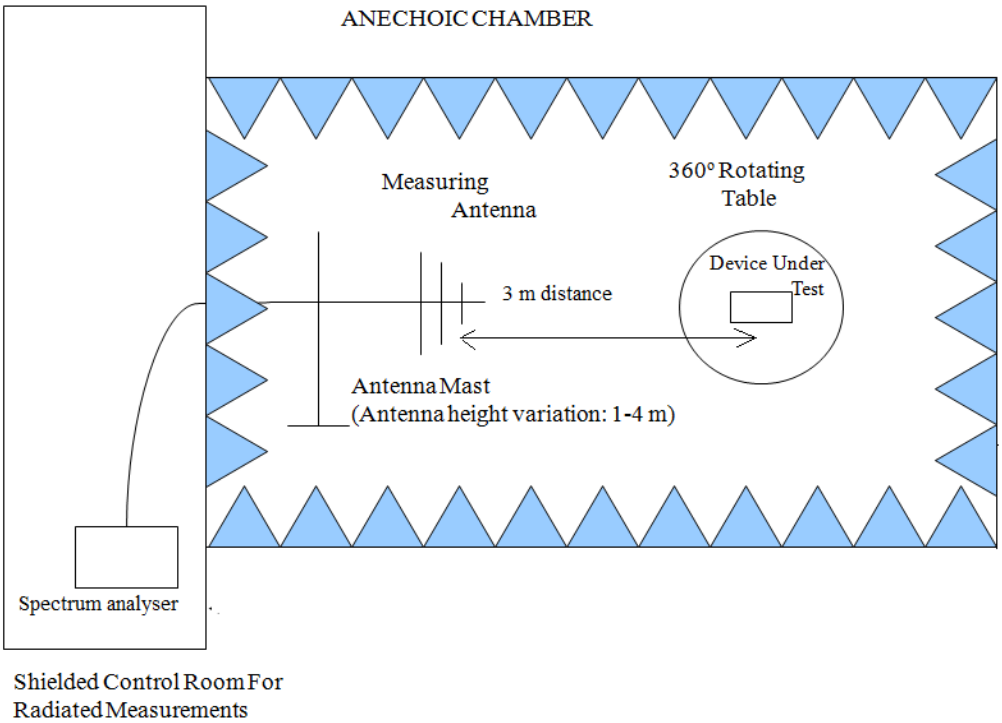
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

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 360º and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

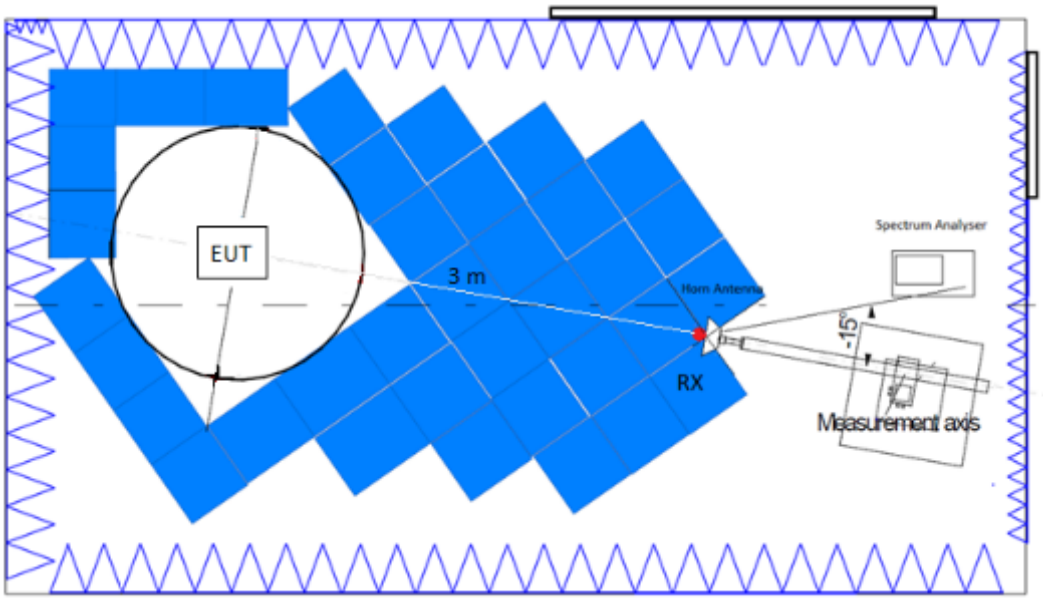
Measurements were made in both horizontal and vertical planes of polarization.

A resolution bandwidth/video bandwidth of 100 kHz / 300 kHz was used for frequencies below 1 GHz and 1 MHz / 3 MHz for frequencies above 1 GHz.

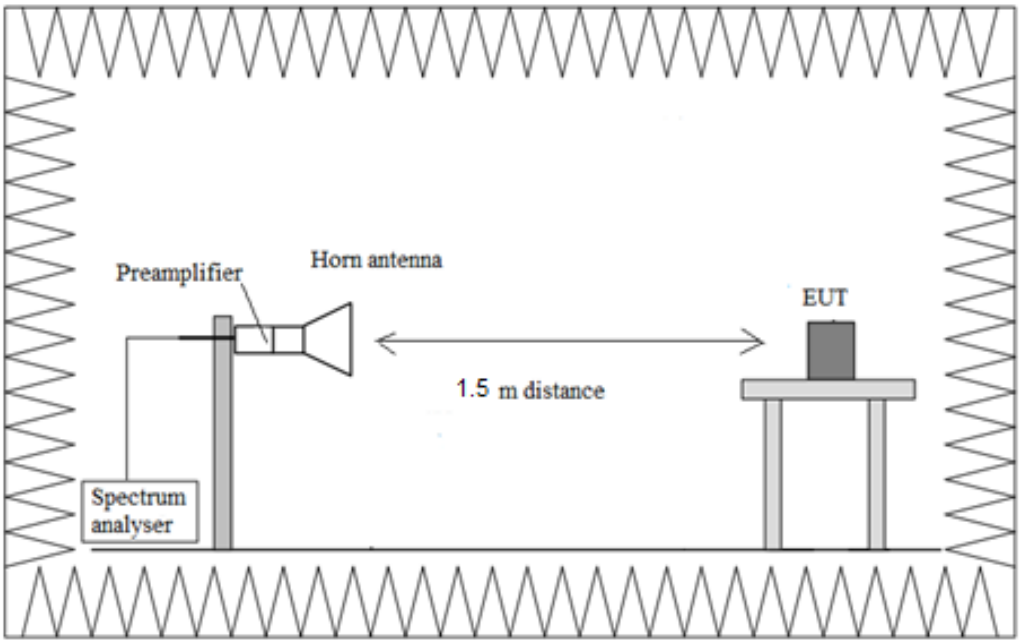
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup f > 17 GHz:



TEST CASES DETAILS

FCC 47 CFR Part 15.247 / RSS-247

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

Modulation: BLE 5.0 (GFSK 1 Mbit/s)

Results

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

The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.
Maximum Declared Antenna Gain: 1 dBi

Freq (MHz)	Equipment	BW (MHz)	# of Tx Chains	Port	RF Output power (dBm)	E.I.R.P. (dBm)
2480.00000	Digital Transmission System (DTS)	1	1	1	4.35	5.35

Verdict

Pass

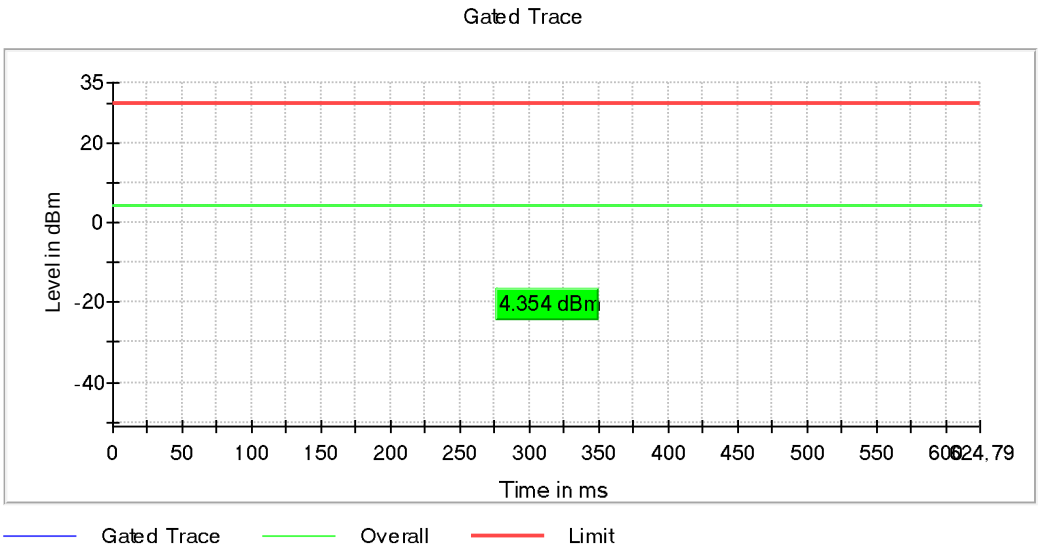
Attachments

Frequency MHz = 2480.00000

Bandwidth MHz = 1 Modulation = BLE 5.0 (GFSK 1 Mbit/s)

Number of Transmission Chains = 1 Active Port = 1

Images:



Tables:
Spectrum Analyzer Parameters

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

RSS-247 5.5 / FCC 15.247 (d) [RSE] Emission limitations radiated (Transmitter)

Limits

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 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
Above 960	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.

Modulation: BLE 5.0 (GFSK 1 Mbit/s)

Results

Freq (MHz)	Freq Rng (GHz)	# of Tx Chains	Port	Unwanted Freq (MHz)	Unwanted Lvl (dBµV/m)	Pol	Detector
2402.00000	[0.03, 1]	1	1	64.011	22.67	V	PK
2402.00000	[0.03, 1]	1	1	64.011	21.45	V	QP
2440.00000	[0.03, 1]	1	1	63.980	24.23	V	PK
2440.00000	[0.03, 1]	1	1	63.980	22.88	V	QP
2480.00000	[0.03, 1]	1	1	63.980	24.21	V	PK
2480.00000	[0.03, 1]	1	1	63.980	22.96	V	QP

Verdict

Pass

Attachments

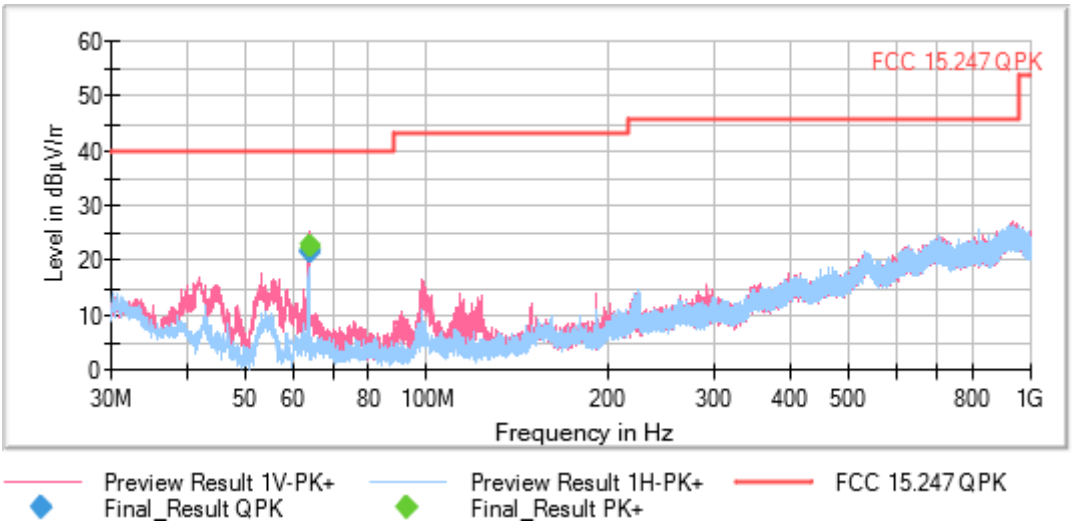
Frequency MHz = 2402.00000

Modulation = BLE 5.0 (GFSK 1 Mbit/s) Frequency Range GHz = [0.03, 1]

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESR 7]					
	30 MHz - 1 GHz	30,312 kHz	PK+	100 kHz	1 s	0 dB

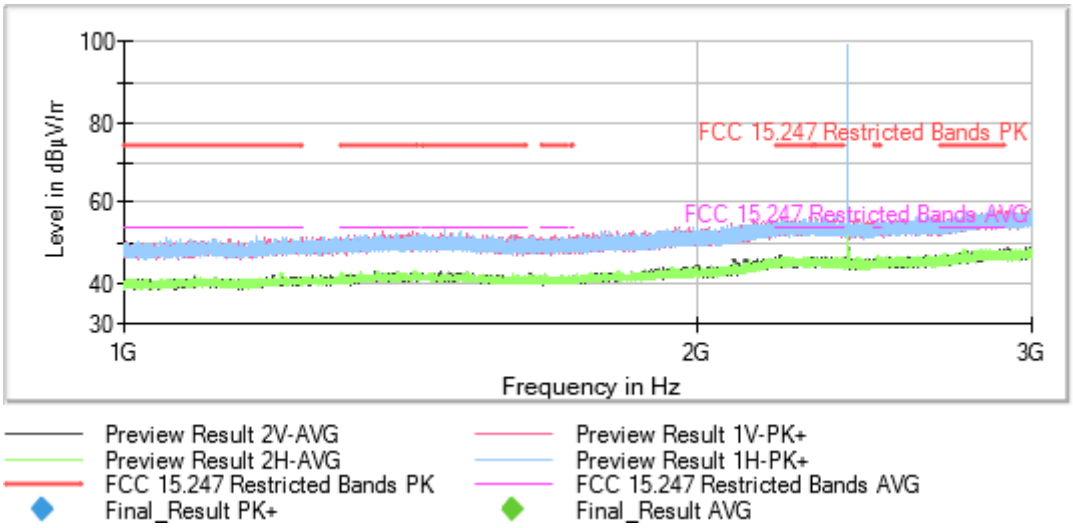
Frequency MHz = 2402.00000

Modulation = BLE 5.0 (GFSK 1 Mbit/s) Frequency Range GHz = [1, 3]

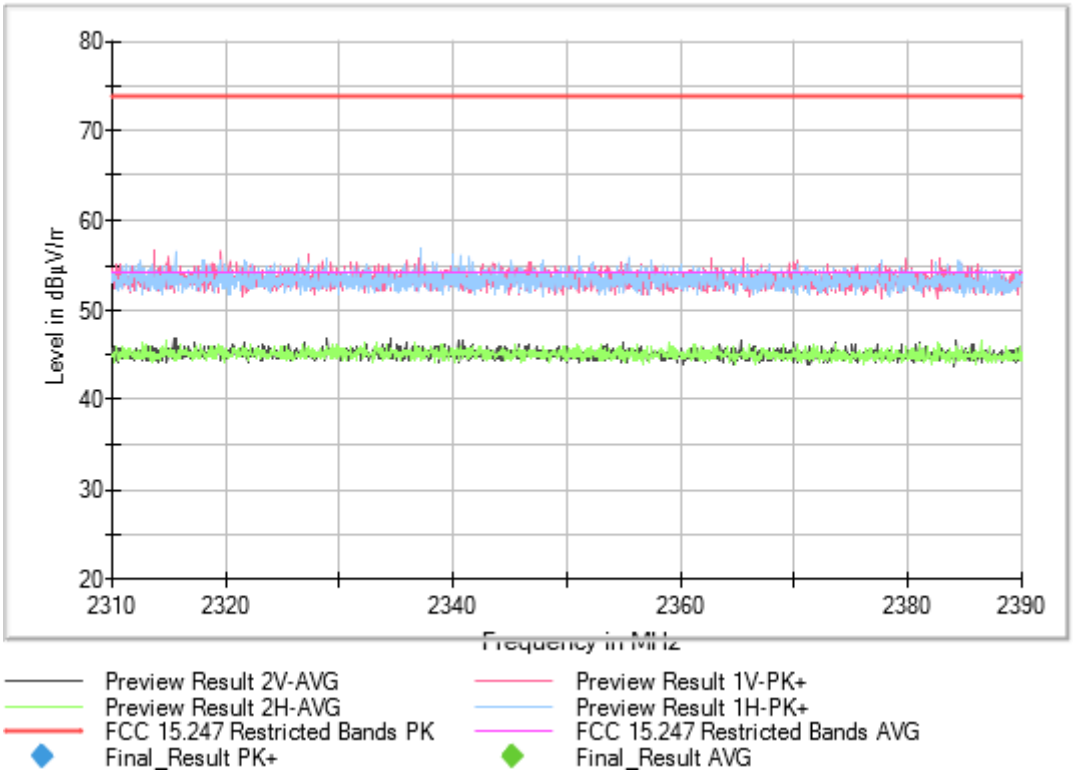
Number of Transmission Chains = 1 Measurement Point = 1

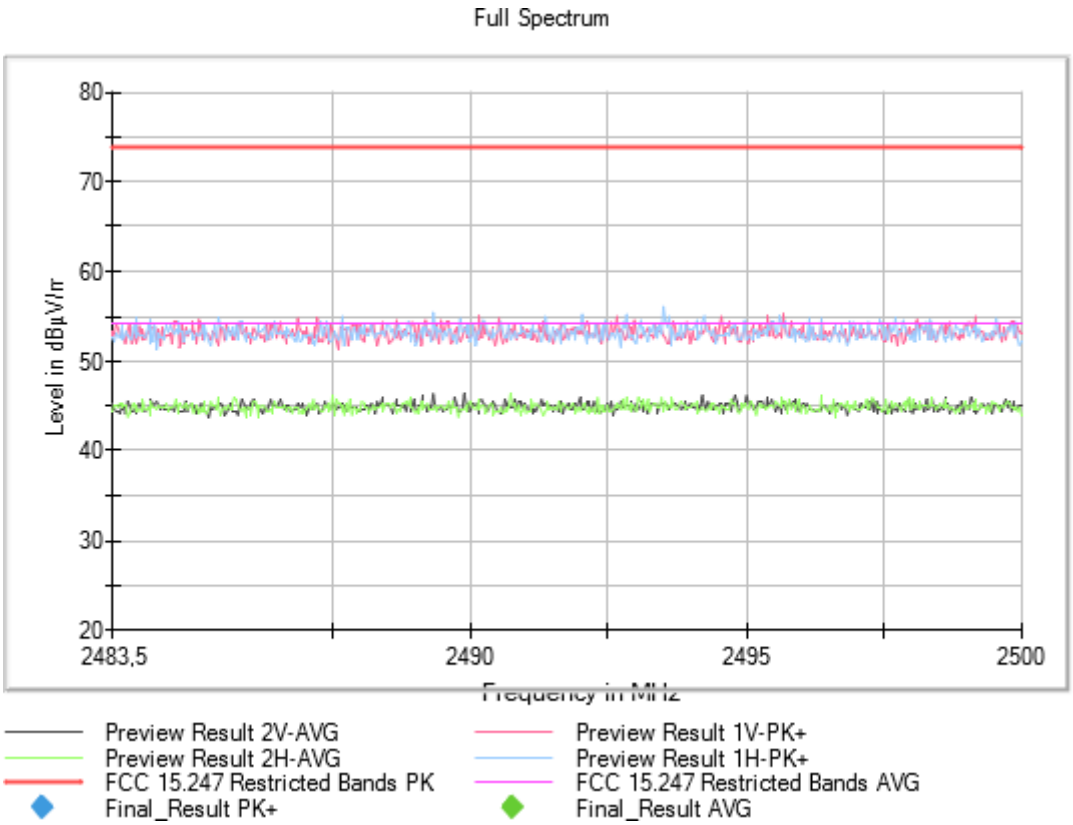
Active Port = 1

Images:



Full Spectrum




Full Spectrum
Level in dBµV/m
80
70
60
50
40
30
20
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 Restricted Bands PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

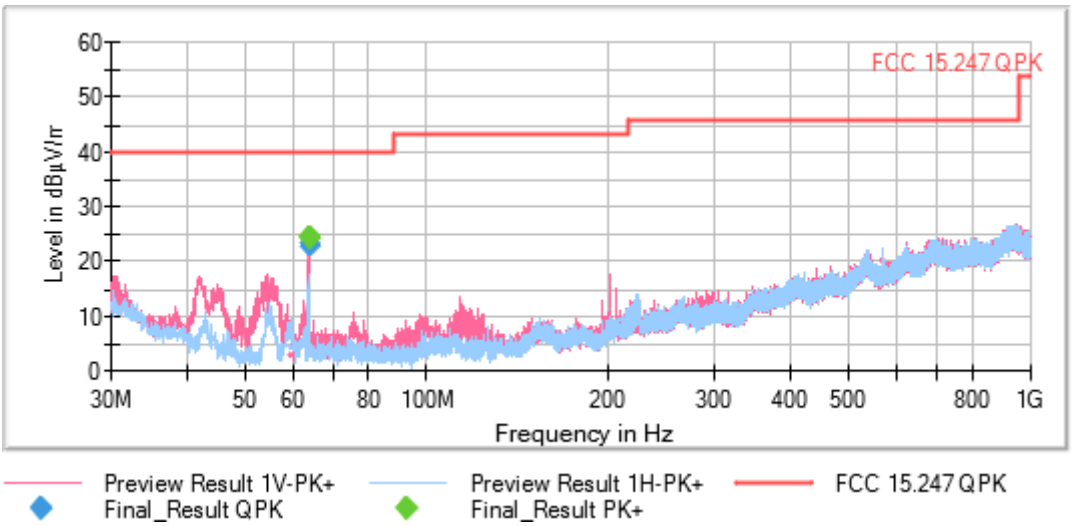
Frequency MHz = 2440.00000

Modulation = BLE 5.0 (GFSK 1 Mbit/s) Frequency Range GHz = [0.03, 1]

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESR 7]					
	30 MHz - 1 GHz	30,312 kHz	PK+	100 kHz	1 s	0 dB

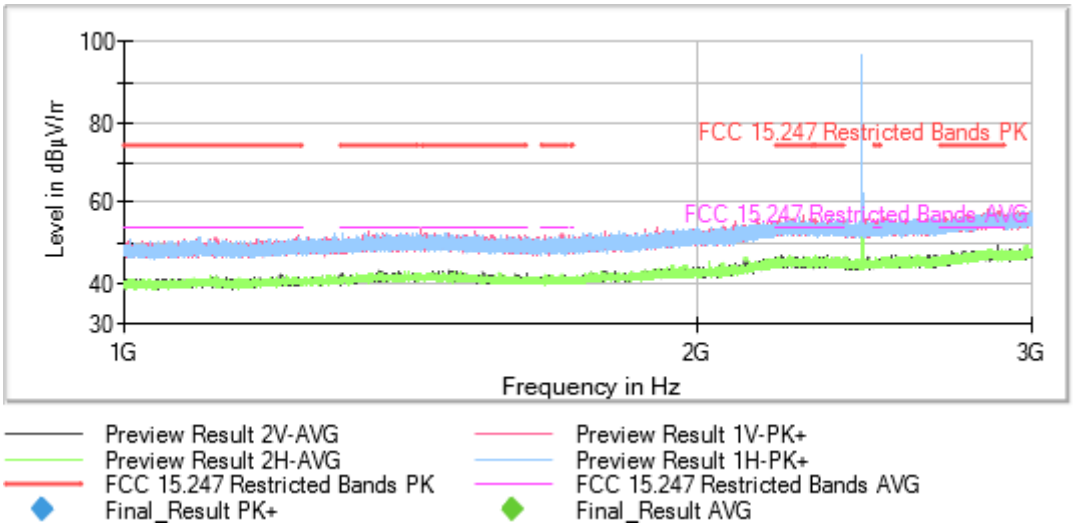
Frequency MHz = 2440.00000

Modulation = BLE 5.0 (GFSK 1 Mbit/s) Frequency Range GHz = [1, 3]

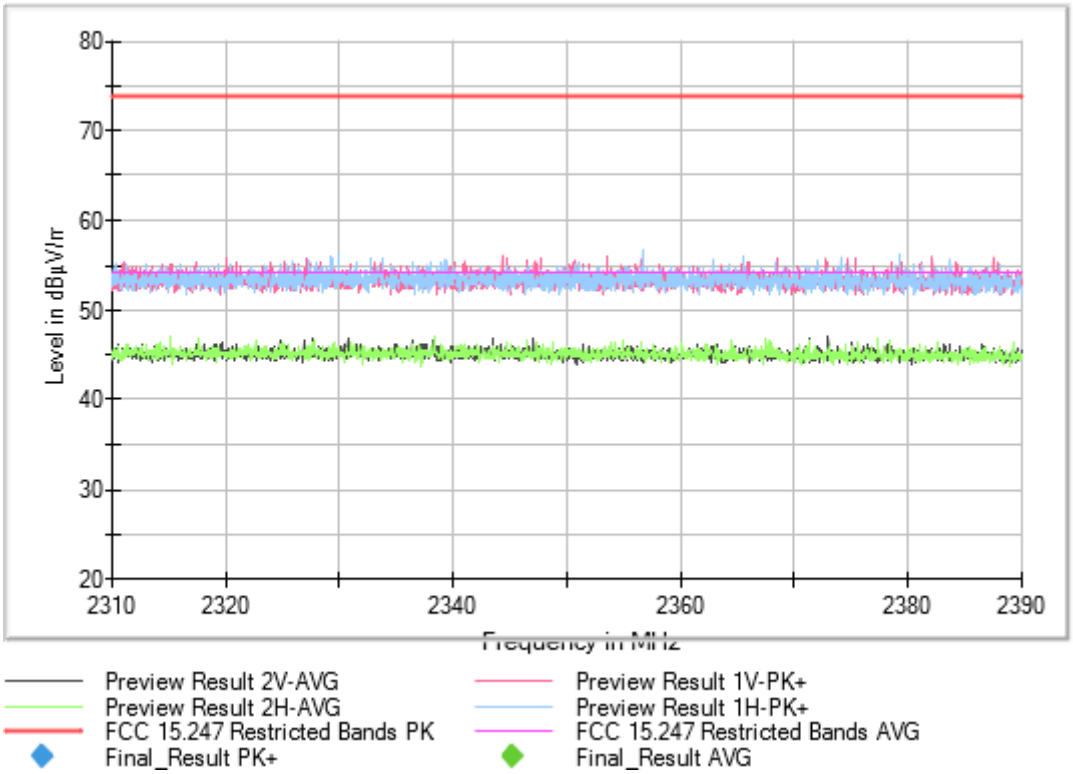
Number of Transmission Chains = 1 Measurement Point = 1

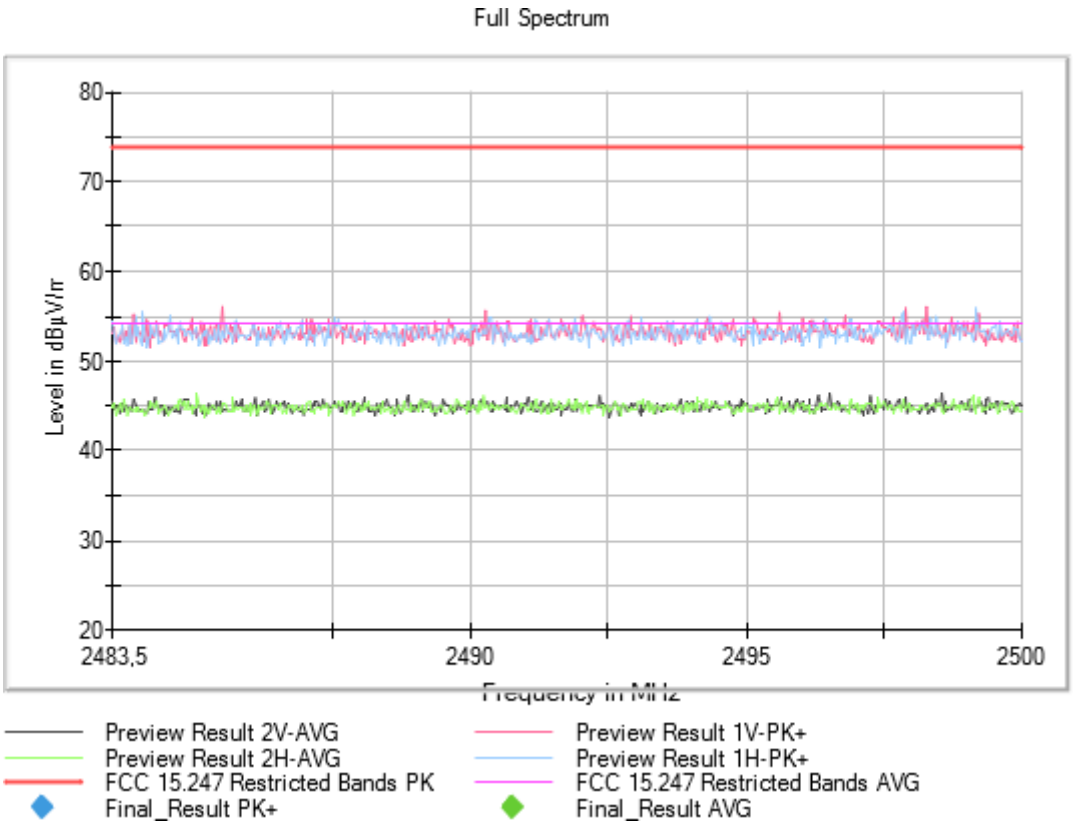
Active Port = 1

Images:



Full Spectrum




Full Spectrum
Level in dBµV/m
80
70
60
50
40
30
20
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 Restricted Bands PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

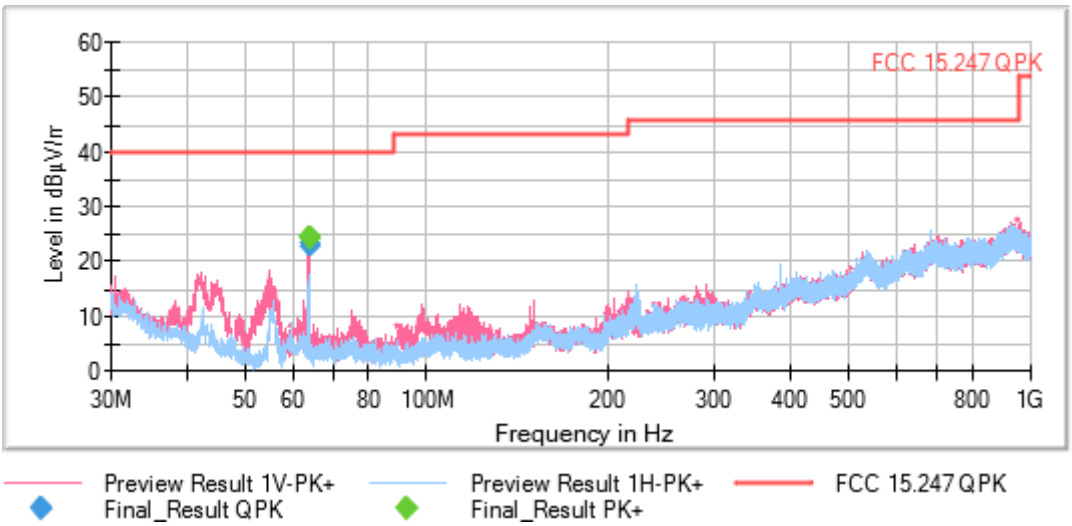
Frequency MHz = 2480.00000

Modulation = BLE 5.0 (GFSK 1 Mbit/s) Frequency Range GHz = [0.03, 1]

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [ESR 7]					
	30 MHz - 1 GHz	30,312 kHz	PK+	100 kHz	1 s	0 dB

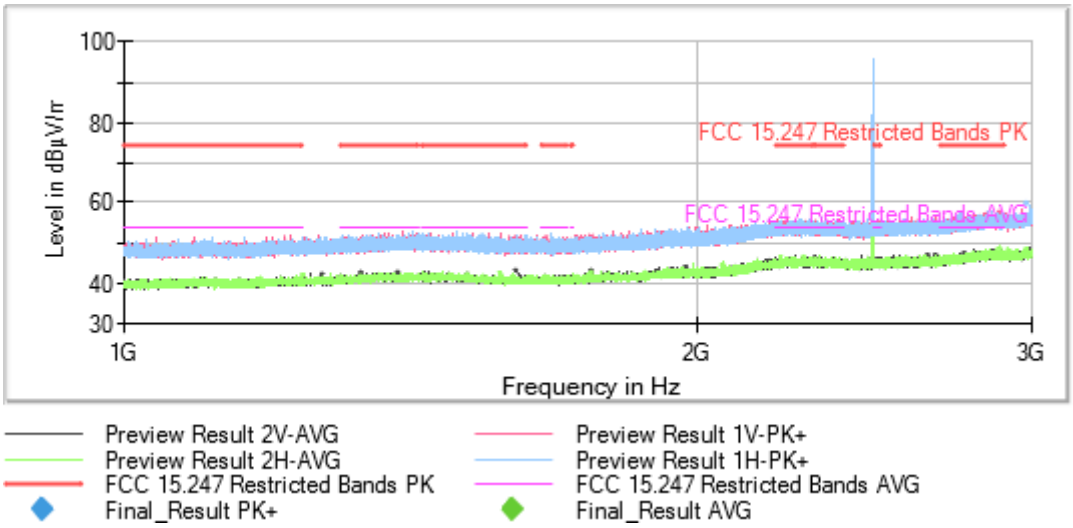
Frequency MHz = 2480.00000

Modulation = BLE 5.0 (GFSK 1 Mbit/s) Frequency Range GHz = [1, 3]

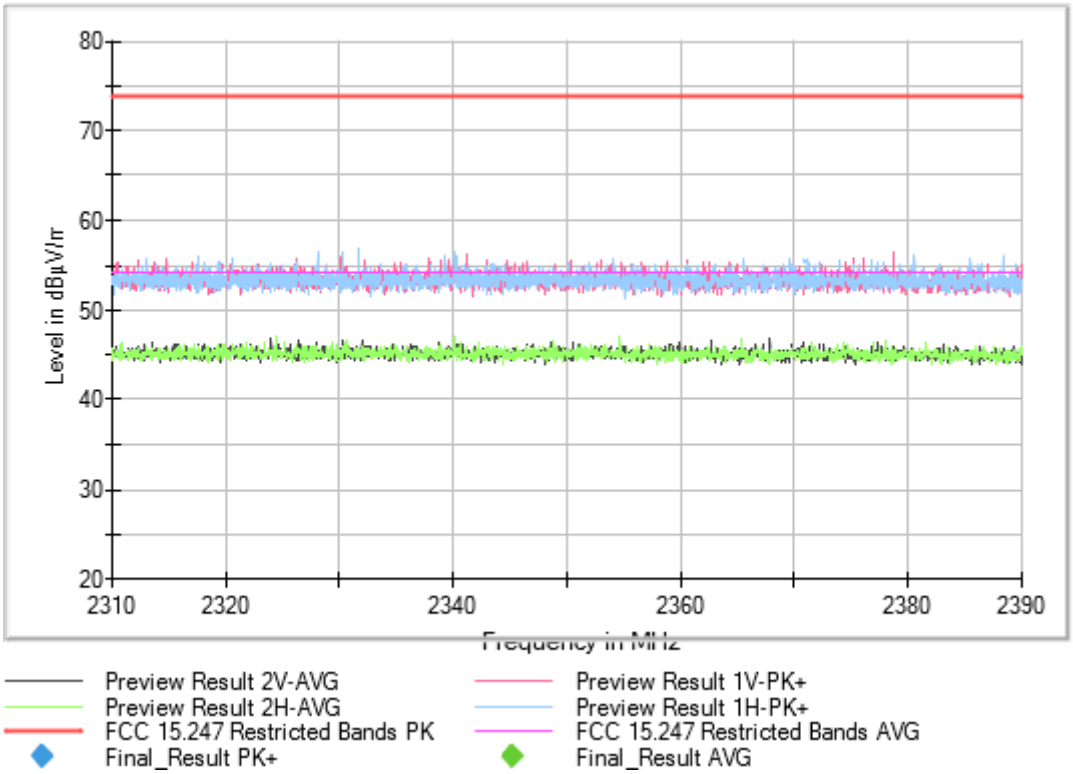
Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Full Spectrum



Full Spectrum
Level in dBµV/m
80
70
60
50
40
30
20
2483,5
2490
2495
2500
Frequency in MHz
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 Restricted Bands PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

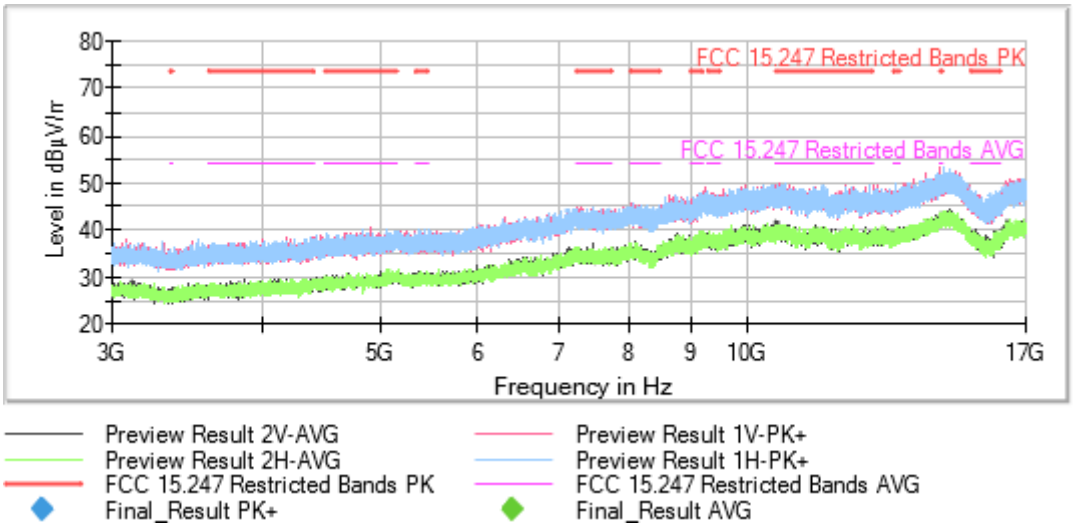
Frequency MHz = 2402.00000

Modulation = BLE 5.0 (GFSK 1 Mbit/s) Frequency Range GHz = [3, 17]

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [FSW 50]					
	3 GHz - 17 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

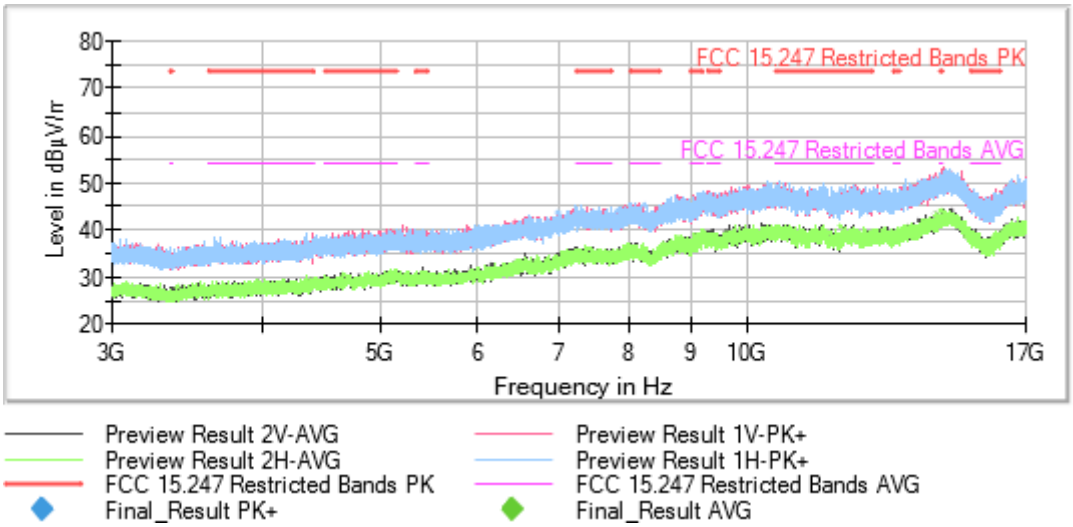
Frequency MHz = 2440.00000

Modulation = BLE 5.0 (GFSK 1 Mbit/s) Frequency Range GHz = [3, 17]

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [FSW 50]					
	3 GHz - 17 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

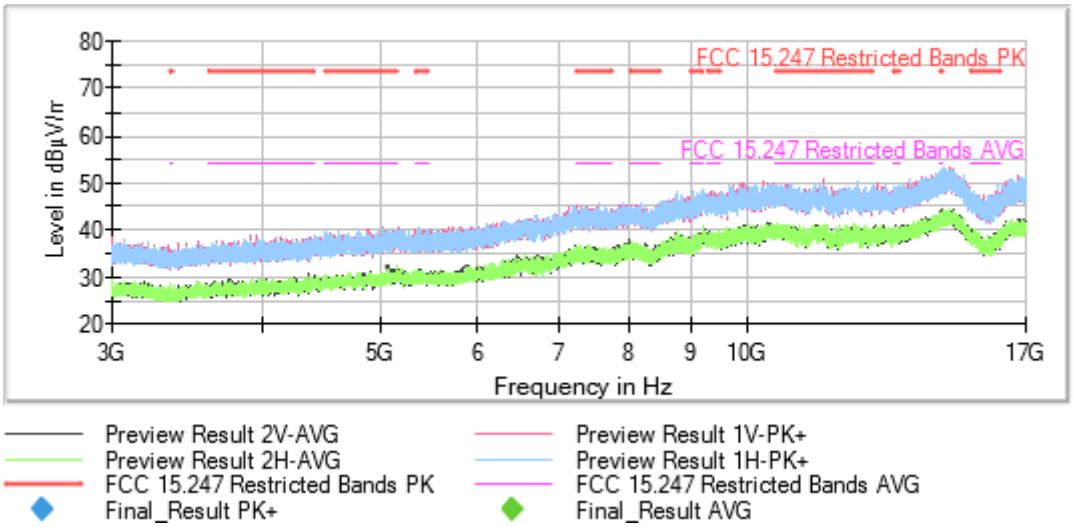
Frequency MHz = 2480.00000

Modulation = BLE 5.0 (GFSK 1 Mbit/s) Frequency Range GHz = [3, 17]

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [FSW 50]					
	3 GHz - 17 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

Frequency Range GHz = [17, 26]

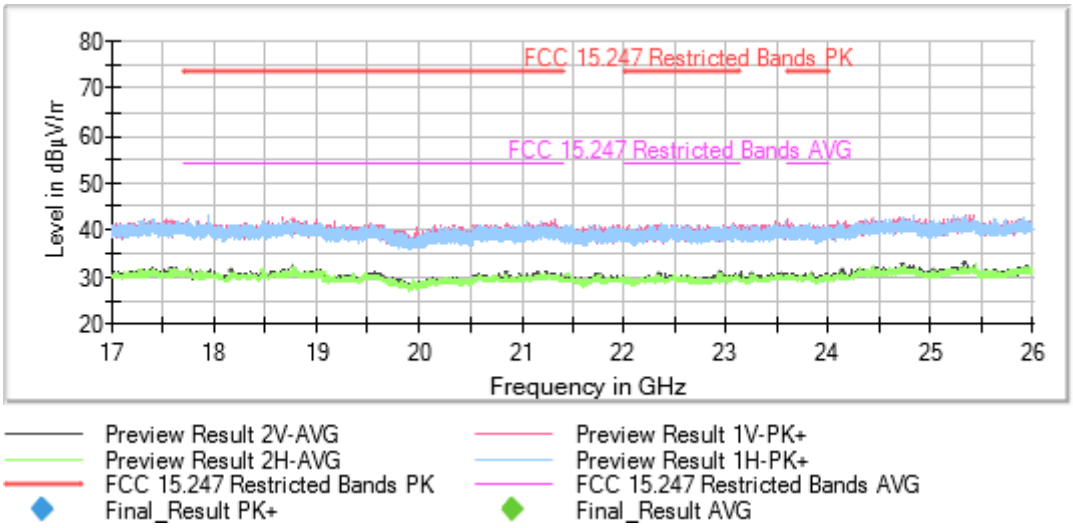
The spurious frequencies detected do not depend neither on the operating channel.

Modulation = BLE 5.0 (GFSK 1 Mbit/s)

Number of Transmission Chains = 1 Measurement Point = 1

Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

	Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
	Receiver: [FSW 50]					
	17 GHz - 26 GHz	300 kHz	PK+ ; AVG	1 MHz	1 s	0 dB