

ISED CABid: ES1909

Lab. Company Number: 4621A

Test Report No:

84820RRF.001A1

Partial Test Report

USA FCC Part 15.247, 15.209

CANADA RSS-247, RSS-Gen

(*) Identification of item tested	Bluetooth Module
(*) Trademark	u-Blox
(*) Model and /or type reference	NINA-B400
Other identification of the product	FCC ID: XPYNINAB4 IC: 8595A-NINAB4
(*) Features	BLE Module HW version: 1004 SW version: 91.02
Applicant	u-Blox AG Zuercherstrasse 68, CH-8800 Thalwil, Switzerland
Test method requested, standard	USA FCC Part 15.247 (10-1-24 Edition): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (10-1-24 Edition): Radiated emission limits; general requirements. CANADA RSS-247 Issue 4 (July 2025). CANADA RSS-Gen Issue 5 amendment 2 (February 2021). 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 C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024: American National Standard for Testing Unlicensed Wireless Devices.
Approved by (name / position & signature)	José Manuel Gómez Galván EMC Consumer & RF Lab. Manager 
Date of issue	2026-04-23
Report template No	FDT08_26 (*) "Data provided by the client"

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Acronyms

Acronym ID	Acronym Description
	Raw Rec
	Trd Corr.
	Sig Path
	Preamp
Detector	Detector used
Equipment	Equipment Type
Freq	Frequency
Freq Rng	Frequency Range
MP	Measurement Point
Mod	Modulation
Operation Band	Operation Band
Pol	Polarization
Port	Active Port
RU	Resource Unit
Unwanted Freq	Unwanted Emissions Frequency
Unwanted Lvl	Unwanted Emissions Level

Competences and guarantees

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

DEKRA Testing and Certification S.A.U. 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.

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

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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.
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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 $\leq \pm 5,35$ 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 $\leq \pm 4,32$ 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 $\leq \pm 5,51$ dB with factor ($k = 2$).

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 Bluetooth Module.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results. The laboratory is not responsible for such information and it is not covered by accreditation.

Usage of samples

Samples undergoing test have been selected by: The client.

Id	Control Number	Description	Model	Serial N°	Date of Reception	Application
S/01	74191_40.1	Bluetooth Module	NINA-B400	--	2024-12-11	Element Under Test
	74191_43.1	Antenna	ANT-2.4-WRT-SMA	--	2024-12-11	Auxiliary Element
	74191_44.1	SMA Cable	--	--	2024-12-11	Auxiliary Element
	74191_33.1	USB Cable	--	--	2024-12-11	Auxiliary Element
S/02	74191_32.1	Bluetooth Module	NINA-B400	--	2024-12-11	Element Under Test
	74191_42.1	Antenna	FXP74.07.0100A	--	2024-12-11	Auxiliary Element
	74191_33.1	USB Cable	--	--	2024-12-11	Auxiliary Element
S/03	74191_24.1	Bluetooth Module	NINA-B400	--	2024-12-11	Element Under Test
	74191_23.1	Antenna	D-ANT01	--	2024-12-11	Auxiliary Element
	74191_27.1	SMA Cable	--	--	2024-12-11	Auxiliary Element
	74191_33.1	USB Cable	--	--	2024-12-11	Auxiliary Element

Notes referenced to samples during the project:

Id	Type
S/01	Samples used for radiated tests (LINX Antenna in Annex A)
S/02	Samples used for radiated tests (Taoglas Antenna in Annex B)
S/03	Samples used for radiated tests (D-ANT Antenna in Annex C)

Test sample description

Ports..... :	Port name and description	Cable					
		Specified max length [m]	Attached during test	Shielded			
			[]	[]			
Supplementary information to the ports..... :							
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	[]	AC:	[]	[]	[]	[]	[]
	[X]	DC: 3.3 Vdc					
Rated Power							
Clock frequencies..... :							
Other parameters							
Software version	91.02						
Hardware version	1004						
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: Module					
Modules/parts..... :	Module/parts of test item		Type		Manufacturer		
							
Accessories (not part of the test item)	Description		Type		Manufacturer		
							
Documents as provided by the applicant..... :	Description		File name		Issue date		
							

Identification of the client

HILTI ENTWICKLUNGSGESELLSCHAFT MBH
Hiltistrasse 6, 86916 Kaufering, Germany

Testing period and place

Test Location	Location B
Date (start)	2025-11-25
Date (finish)	2025-12-08

Document history

Report number	Date	Description
84820RRF.001	2025-12-15	First release.
84820RRF.001A1	2026-04-23	Second release. It is modified due to a typo. This modification test report cancels and replaces the test report 84820RRF.001

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 %

Remarks and comments

The tests have been performed by the technical personnel: José Manuel Jiménez González and Valentin Andarias Diaz.

Used instrumentation:

Control No.	Equipment	Model	Manufacturer	Next Calibration
06791	SEMIANECHOIC ABSORBER LINED CHAMBER IV	FACT 3 200 STP	ETS LINDGREN	N/A
06792	SHIELDED ROOM	S101	ETS LINDGREN	N/A
06609	ETHERNET TEMPERATURE AND HUMIDITY LOGGER	HWg-STE	HW GROUP	2026-04-21
06615	ETHERNET TEMPERATURE AND HUMIDITY LOGGER	HWg-STE	HW GROUP	2026-04-24
06143	HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	ETS LINDGREN	2027-01-22
06142	PRE-AMPLIFIER G>38dB 30MHz-6GHz	BLNA 0360-01N	BONN ELEKTRONIK	2026-07-30
06144	PRE-AMPLIFIER G>40dB 10MHz-6GHz	BLNA 0160-01N	BONN ELEKTRONIK	2026-09-05
06496	HORN ANTENNA 1-18GHz	BBHA 9120 D	SCHWARZBECK	2026-12-01
03783	PRE-AMPLIFIER G>30dB 1GHz-18GHz	BLMA 0118-3A	BONN ELEKTRONIK	2026-03-17
04657	HORN ANTENNA 18-40GHz	BBHA 9170	SCHWARZBECK	2026-06-12
10573	PRE-AMPLIFIER G>46dB 18GHz-40GHz	BLMA 1840-5G	BONN ELEKTRONIK	2026-03-07
07817	EMI TEST RECEIVER 2Hz-44GHz	ESW44	ROHDE AND SCHWARZ	2026-07-01
04848	SOFTWARE FOR EMC/RF TESTING	EMC32	ROHDE AND SCHWARZ	N/A
07445	DC POWER SUPPLY 30V/5A	U8002A	KEYSIGHT TECHNOLOGIES	N/A
07760	DIGITAL MULTIMETER	175	FLUKE	2026-11-07

Testing verdicts

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

Summary

Bluetooth Low Energy (1M)

FCC PART 15 PARAGRAPH/ RSS-247			
Requirement – Test case	Verdict	Remark	Location
FCC 15.247 (a)(2) / RSS-247 6.3.1. (a) 6 dB Bandwidth	N/A	(1)	--
FCC 15.247 (b) / RSS-247 6.3.2. Maximum output power and antenna gain	N/A	(1)	--
FCC 15.247 (d) / RSS-247 6.6 Band-edge emissions compliance (Transmitter)	N/A	(1)	--
FCC 15.247 (e) / RSS-247 6.3.1. (b) Power spectral density	N/A	(1)	--
FCC 15.247 (d) / RSS-247 6.6. Emission limitations radiated (Transmitter)	P		Location B
<u>Supplementary information and remarks:</u> (1) Test not requested by the client.			

Appendix A: Test results. Bluetooth Low Energy (1M). Linx antenna.

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TEST CONDITIONS

(*): Data provided by the client.

POWER SUPPLY (*):

Vnominal: 3.3 Vdc
Type of Power Supply: Internal DC

ANTENNA (*):

Type of Antenna: ANT-2.4-WRT-SMA
Maximum Declared Antenna Gain: 9.1 dBi (peak)

TEST FREQUENCIES (*):

Modulation	Data rates	Low Channel	Middle Channel	High Channel
BTLE GFSK	1M 1 Mbit/s	2402 MHz	2440 MHz	2480 MHz

During transmitter test the EUT was controlled by a SW tool provided by the client to operate in a continuous transmit mode on the modulation schemes and test channels as required.

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).

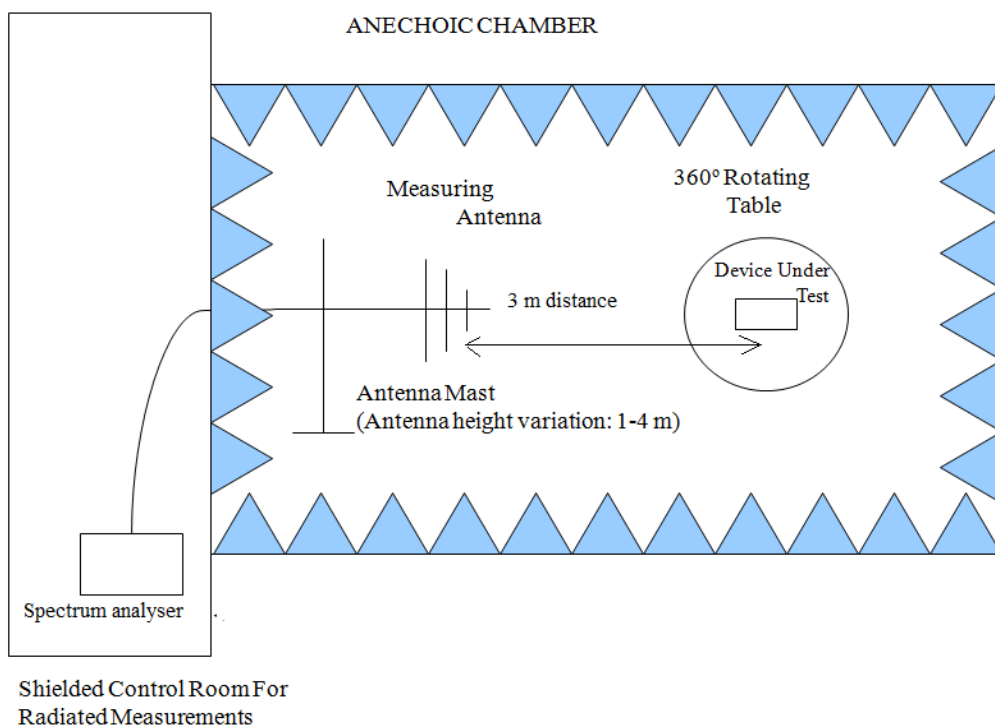
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

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

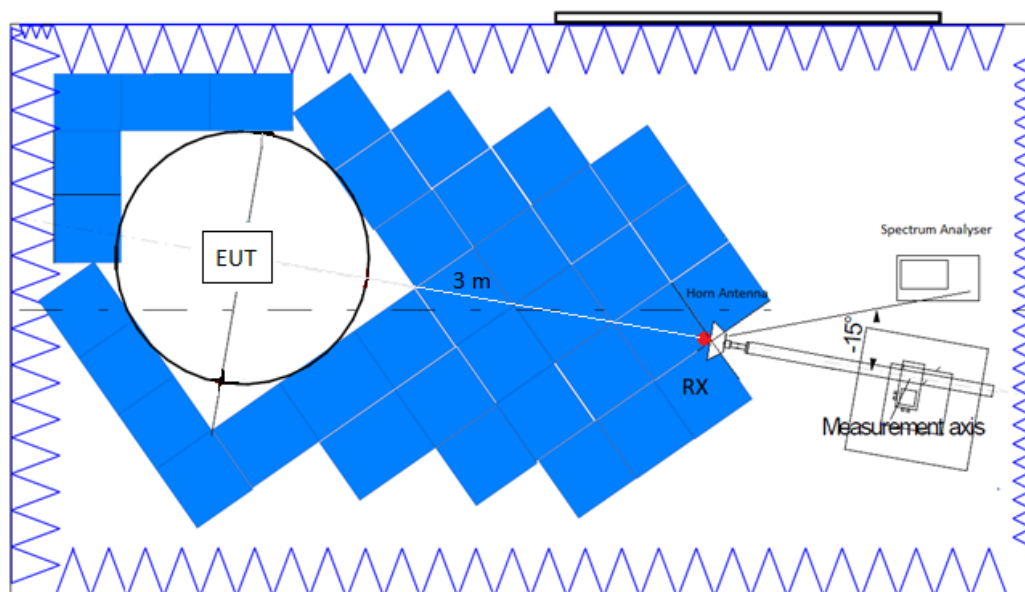
Measurements were made in both horizontal and vertical planes of polarization.

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.

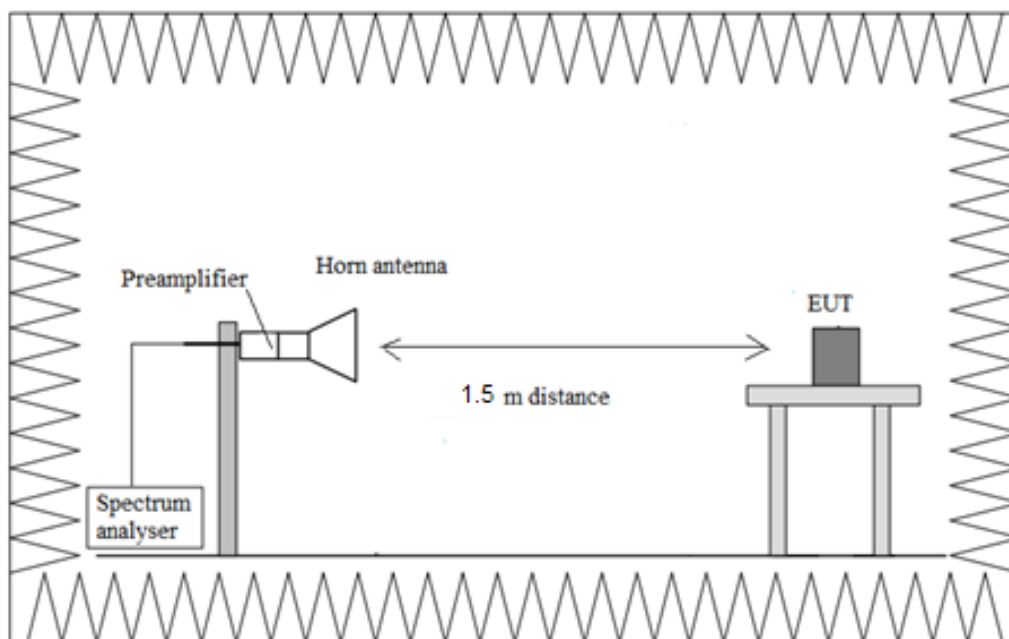
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup $f > 17$ GHz:



SAMPLE CALCULATION

For radiated measurements:

Values measures by the test receiver / analyzer are converted to field strength, in dBuV/m, at the regulatory distance using the following calculation:

$$\text{Unwanted Lvl (dBuV/m)} = \text{Raw Rec (dBuV)} + \text{Preamp (dB)} + \text{Trd Corre. (dB/m)} + \text{SigPath (dB)}$$

Where,

Raw Rec (dBuV): Measured voltage in the receiver / spectrum analyzer in dBuV

Preamp (dB): Path loses due to preamplifier

Trd Corr. (dB/m): Antenna factor in dB/m

SigPath (dB) = Cable loss (dB) – External Gain amplifier (dB) – Distance factor (dB)

Cable loss (dB): Cable loss

External Gain amplifier (dB): Gain from external amplifier (when used)

Distance factor (dB): Distance factor in dB. When measurement distance is different to limit distance

The field strength, calculated by this way is compared with the regulatory limit.

TEST CASES DETAILS

FCC 47 CFR Part 15.247 / RSS-247

RSS-247 6.6 / FCC 15.247 (d) 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 ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	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.

Frequency range tested for Radiated emissions:

Start frequency: no radiofrequency signal generated in the device found below 10th sub-harmonic, no further investigation required.

Stop frequency: it has been performed the radiated spurious emissions until 10th harmonic.

Modulation: BTLE (GFSK 1 Mbit/s)

Results

Operation Band (MHz)	Freq Rng (GHz)	Equipment	Unwanted Freq (MHz)	Unwanted Lvl (dBμV/m)	Pol	Detector	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBμV)
[2400, 2483.5]	[0.03, 1]	Digital Transmission System (DTS)	47.800	36.33	V	PK	-35.6	3.0	7.4	61.6
			47.800	30.63	V	QP	-35.6	3.0	7.4	55.9
			66.278	28.27	V	PK	-35.5	3.0	6.9	53.8
			66.278	21.58	V	QP	-35.5	3.0	6.9	47.1
			108.812	25.51	V	PK	-35.1	3.0	8.0	49.6
			108.812	21.36	V	QP	-35.1	3.0	8.0	45.4
			143.248	26.45	V	PK	-34.5	3.0	8.3	49.7
			143.248	19.71	V	QP	-34.5	3.0	8.3	42.9
			165.994	32.92	V	PK	-34.3	3.0	9.3	54.8
			165.994	22.46	V	QP	-34.3	3.0	9.3	44.4
			332.688	32.21	V	PK	-33.1	3.0	14.1	48.2
			332.688	21.21	V	QP	-33.1	3.0	14.1	37.2
	[1, 17]	9606.600	43.62 (*)	V	PK	-17.4	0.0	38.5	22.5	

(*) This frequency is outside the restricted band according to FCC 15.205. Both the carrier and the harmonic signal have been measured using an RBW=100kHz, and the difference between them is greater than 20dB. The carrier level is 103.37 dBuV/m and the harmonic level is 43.62 dBuV/m.

Verdict

Pass

Attachments

Operation Band MHz = [2400, 2483.5]

Equipment Type = Digital Transmission System (DTS)

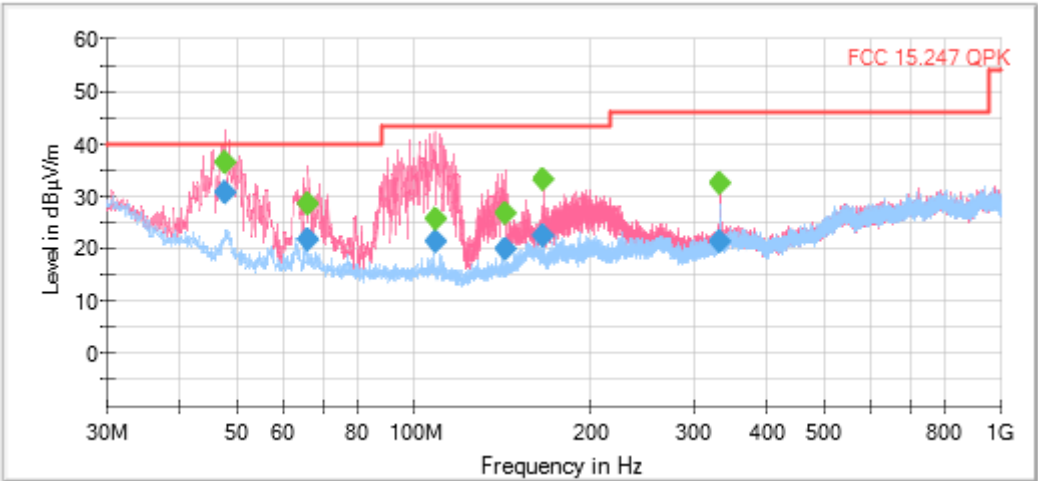
Active Port = 1

Frequency Range GHz = [0.03, 1]

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

Modulation = The spurious frequencies detected do not depend on the modulation.

Images:



Tables:
Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	48,5 kHz	PK+	100 kHz	1 s	0 dB

Operation Band MHz = [2400, 2483.5]

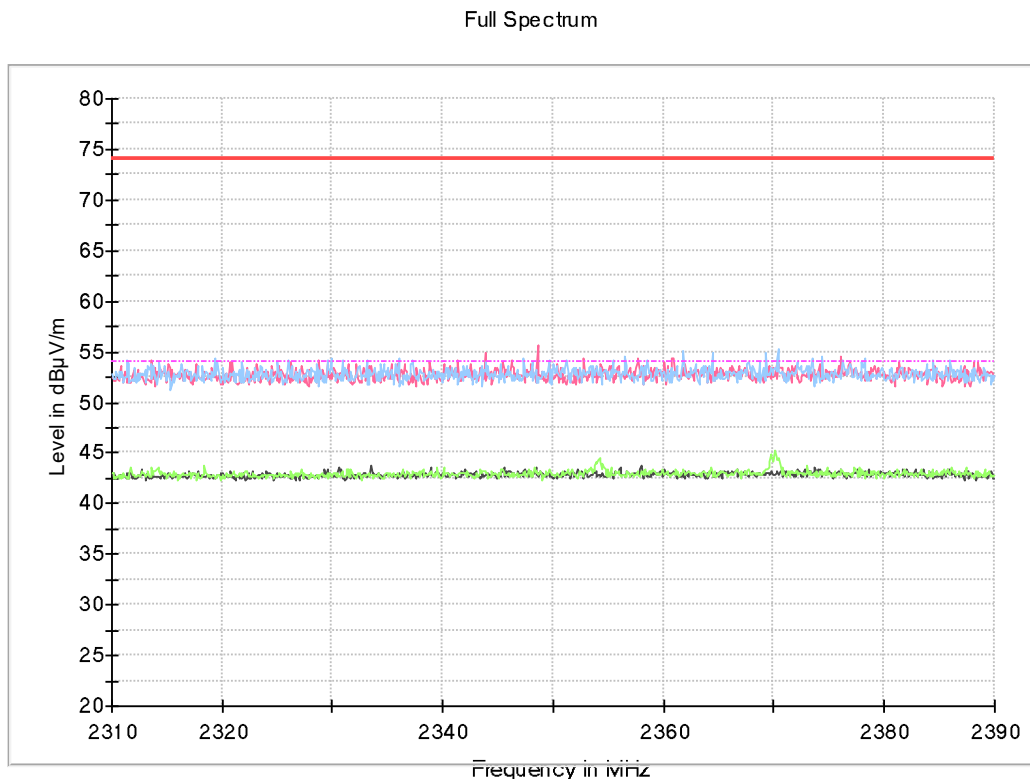
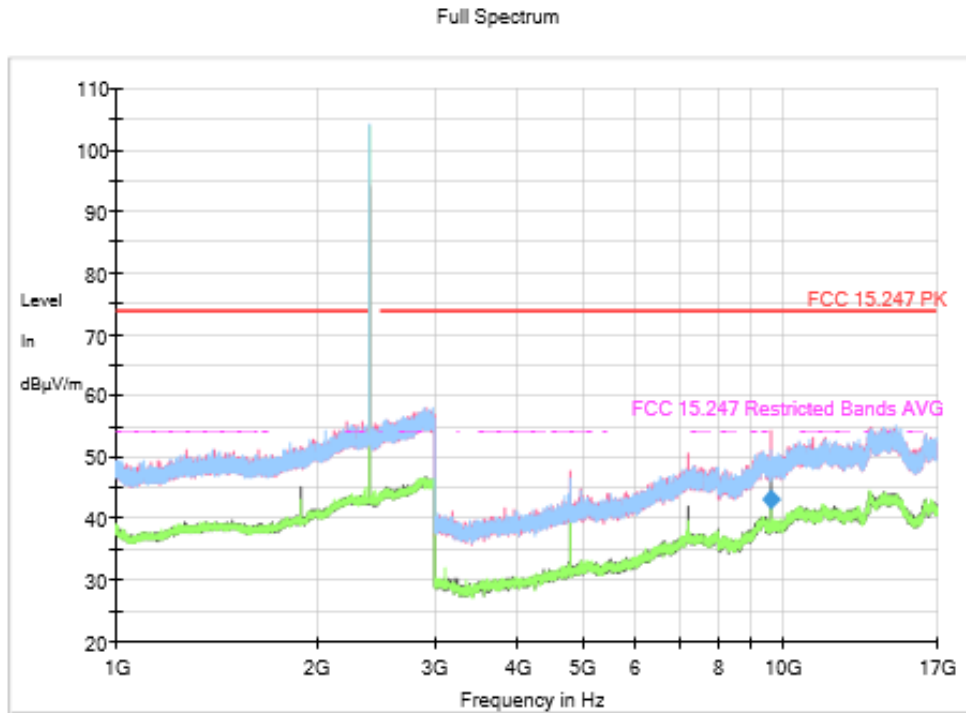
Frequency Range GHz = [1, 17]

Equipment Type = Digital Transmission System (DTS) Frequency MHz = 2402.00000

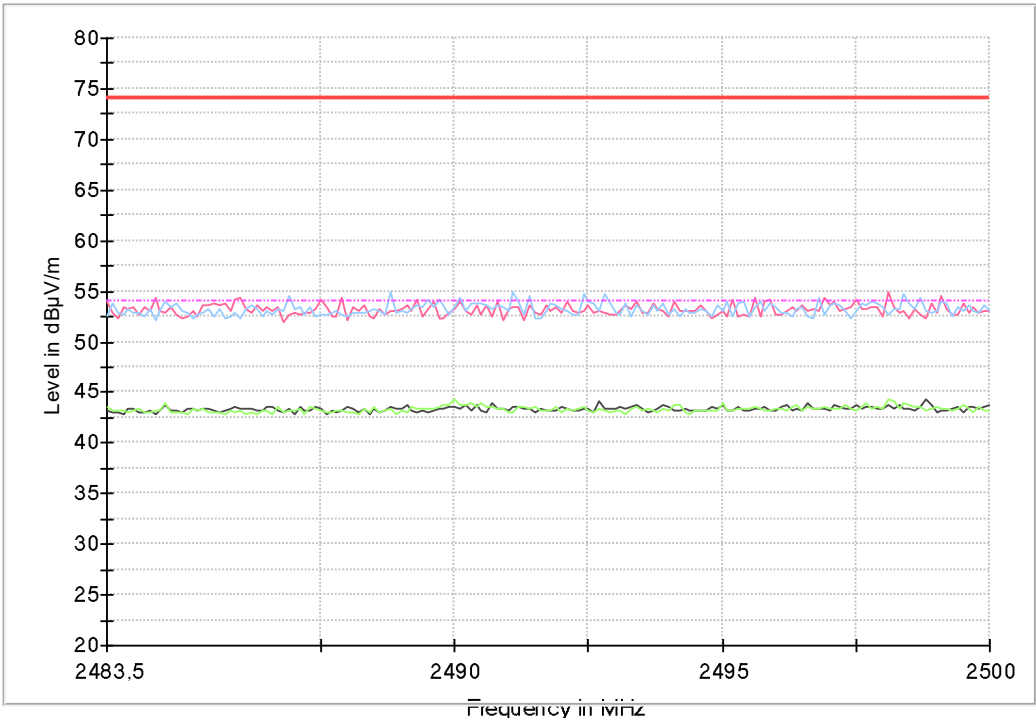
Active Port = 1

Modulation = BTLE (GFSK 1 Mbit/s)

Images:



Full Spectrum



Operation Band MHz = [2400, 2483.5]

Frequency Range GHz = [1, 17]

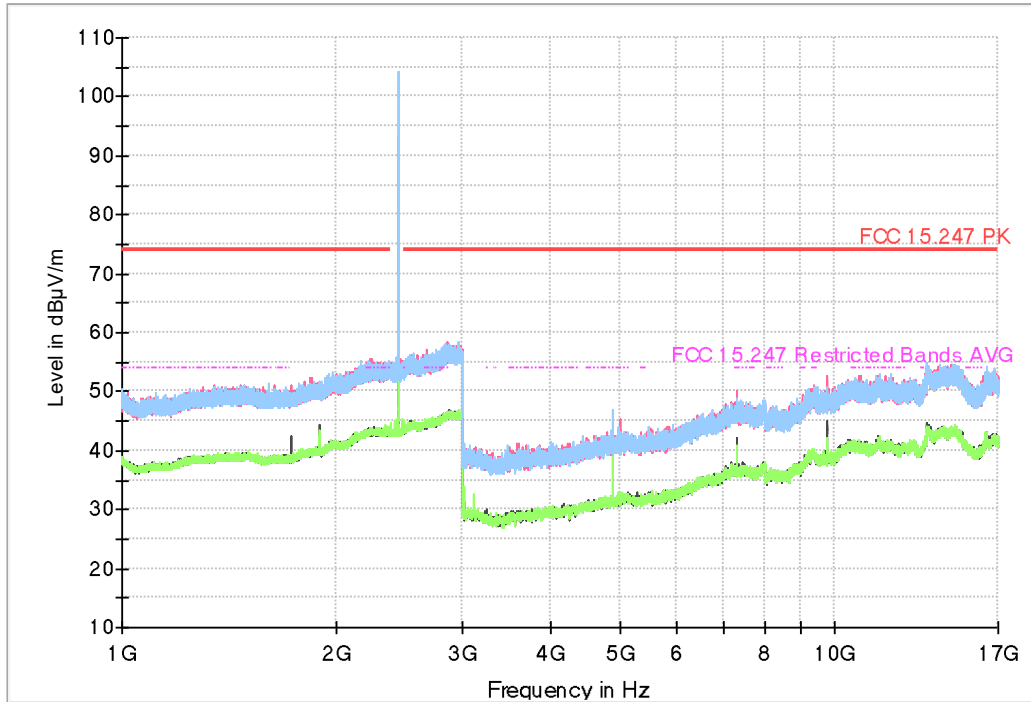
Equipment Type = Digital Transmission System (DTS) Frequency MHz = 2440.00000

Active Port = 1

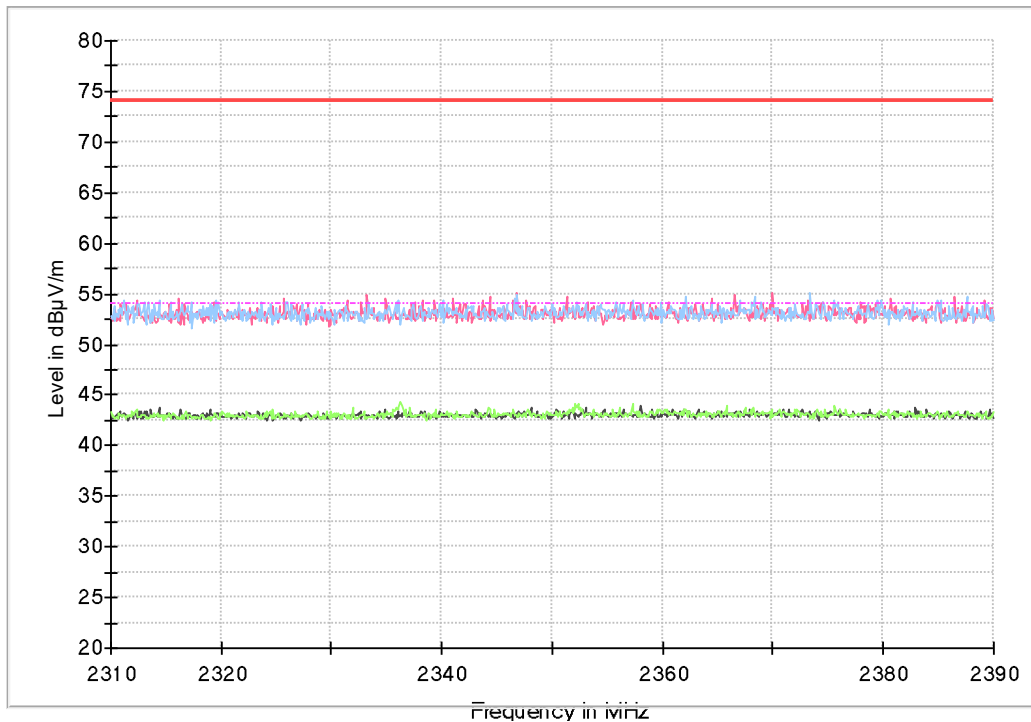
Modulation = BTLE (GFSK 1 Mbit/s)

Images:

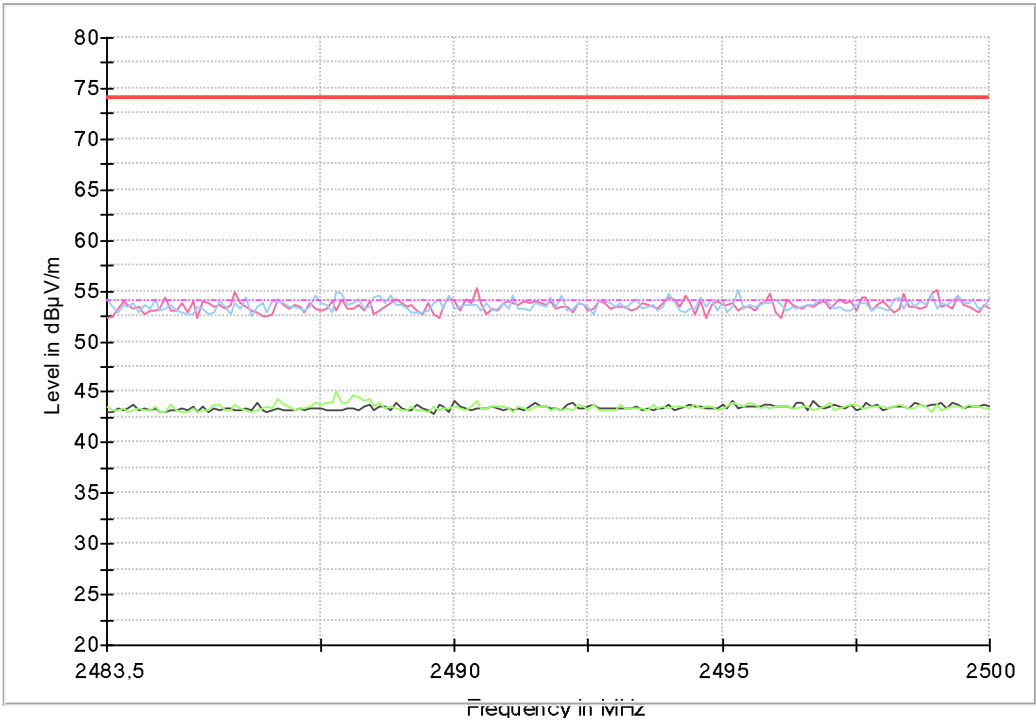
Full Spectrum



Full Spectrum



Full Spectrum



Operation Band MHz = [2400, 2483.5]

Frequency Range GHz = [1, 17]

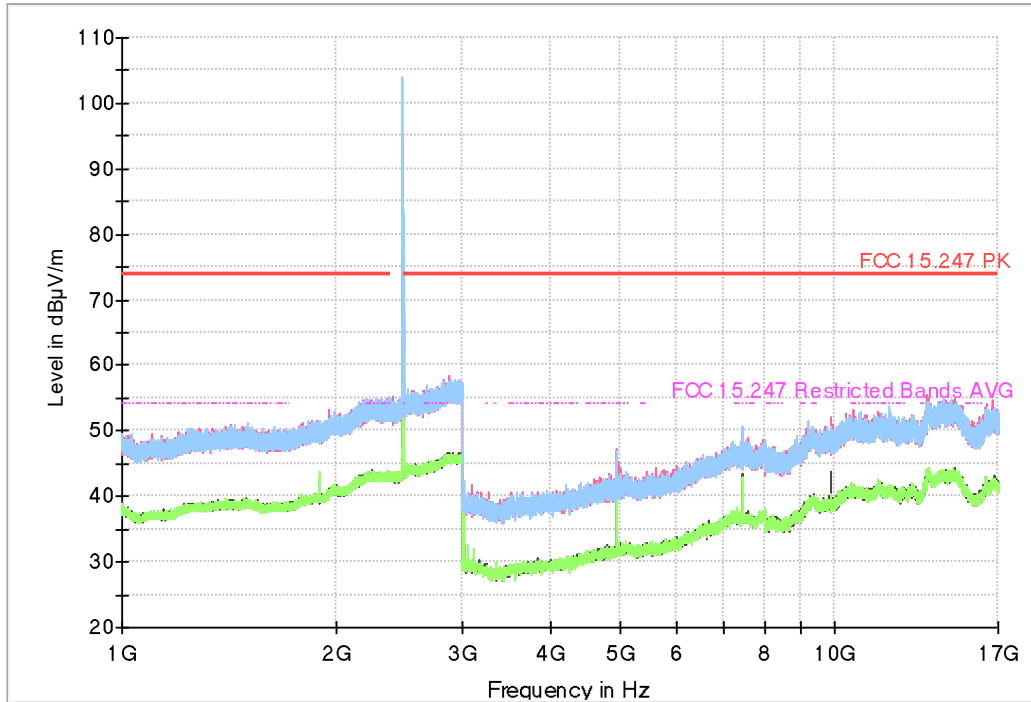
Equipment Type = Digital Transmission System (DTS) Frequency MHz = 2480.00000

Active Port = 1

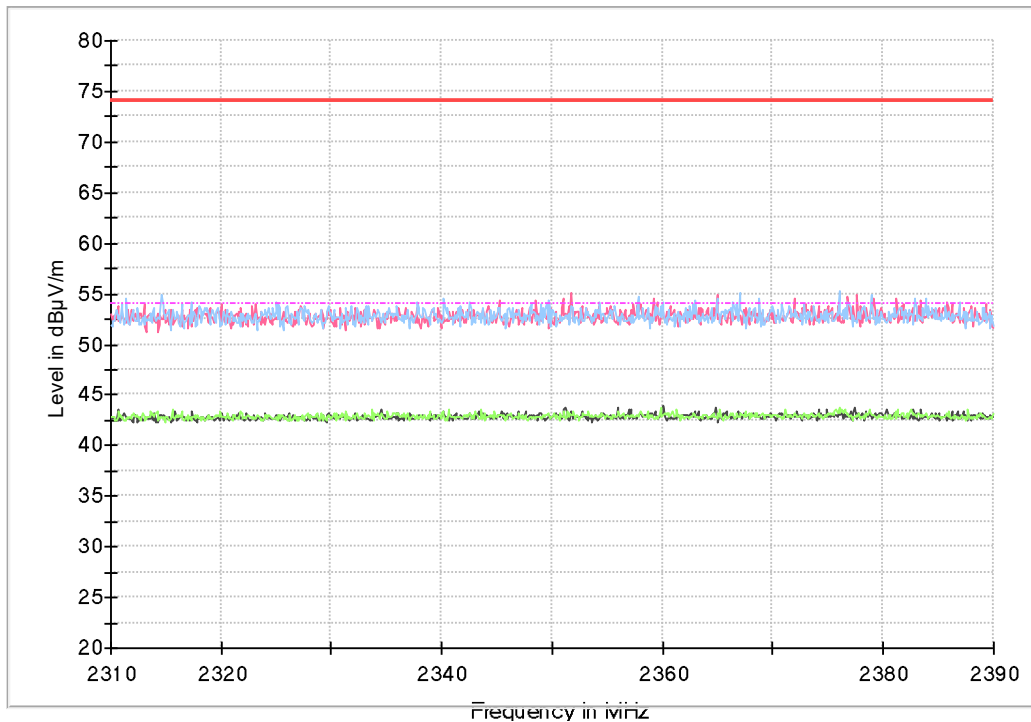
Modulation = BTLE (GFSK 1 Mbit/s)

Images:

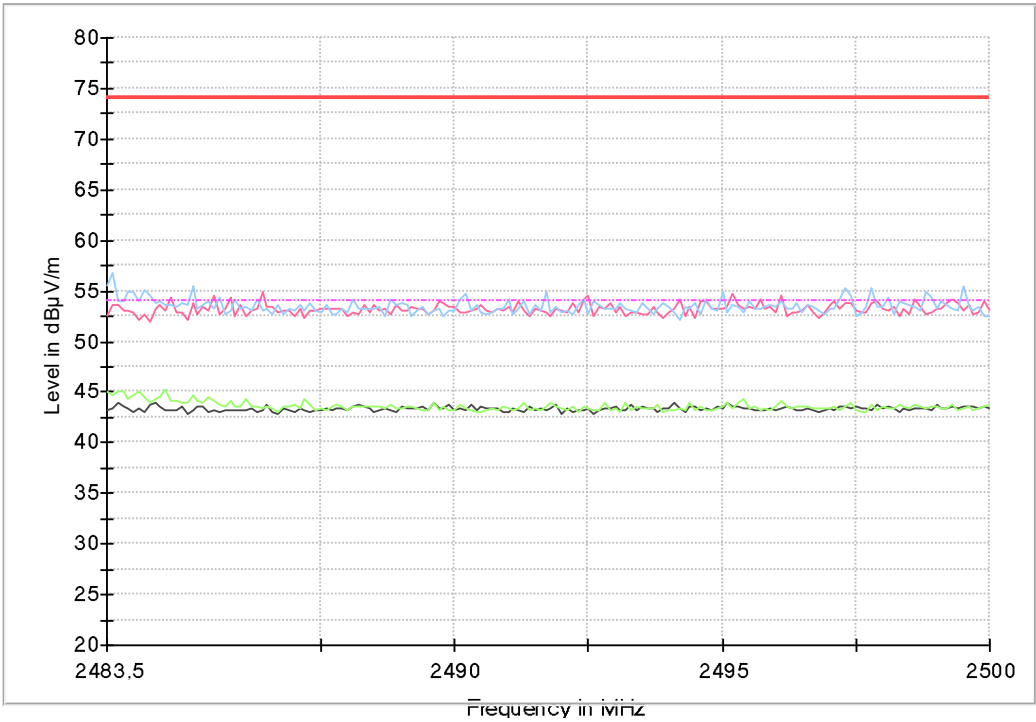
Full Spectrum



Full Spectrum



Full Spectrum



Tables:
Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
1 GHz - 2,39 GHz	400 kHz	PK+	1 MHz	0,01 s	0 dB
2,39 GHz - 2,484 GHz	40 kHz	PK+	100 kHz	0,01 s	0 dB
2,484 GHz - 3 GHz	400 kHz	PK+	1 MHz	0,01 s	0 dB
3 GHz - 17 GHz	400 kHz	PK+	1 MHz	0,01 s	0 dB

Operation Band MHz = [2400, 2483.5]

Frequency Range GHz = [17, 26]

Equipment Type = Digital Transmission
 System (DTS)

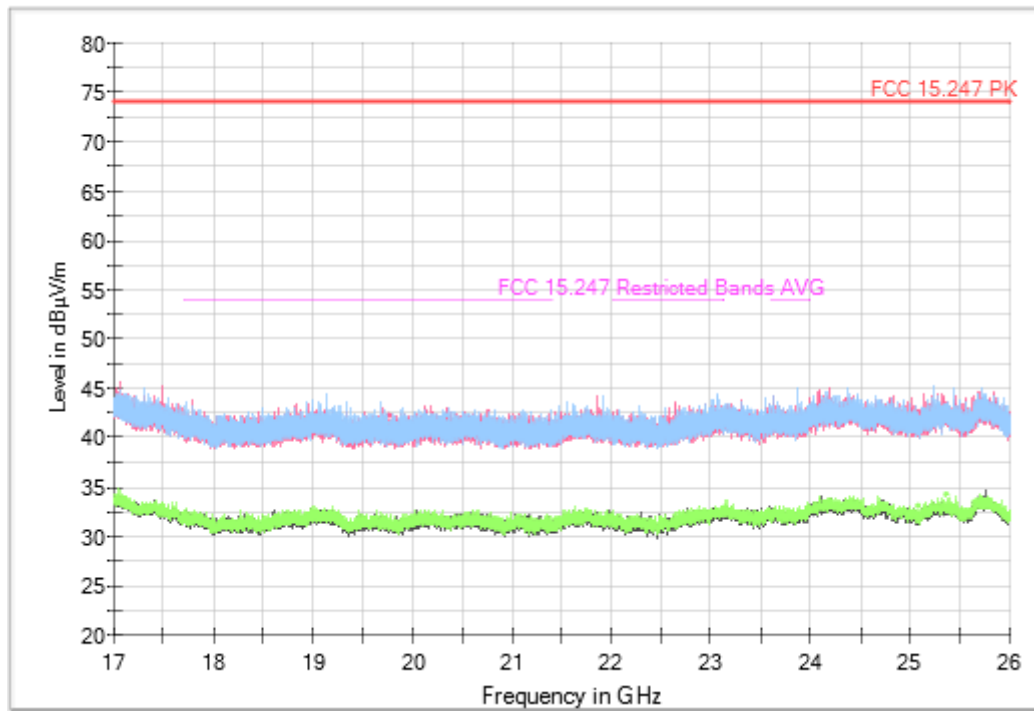
Frequency MHz = The spurious frequencies detected do not depend
 on the operating channel.

Active Port = 1

Modulation = The spurious frequencies detected do not depend on
 the modulation.

Images:

Full Spectrum



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

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TEST CONDITIONS

(*): Data provided by the client.

POWER SUPPLY (*):

Vnominal: 3.3 Vdc
Type of Power Supply: Internal DC

ANTENNA (*):

Type of Antenna: FXP74.07.0100A
Maximum Declared Antenna Gain: 4 dBi (peak)

TEST FREQUENCIES (*):

Modulation	Data rates	Low Channel	Middle Channel	High Channel
BTLE GFSK	1M 1 Mbit/s	2402 MHz	2440 MHz	2480 MHz

During transmitter test the EUT was controlled by a SW tool provided by the client to operate in a continuous transmit mode on the modulation schemes and test channels as required.

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).

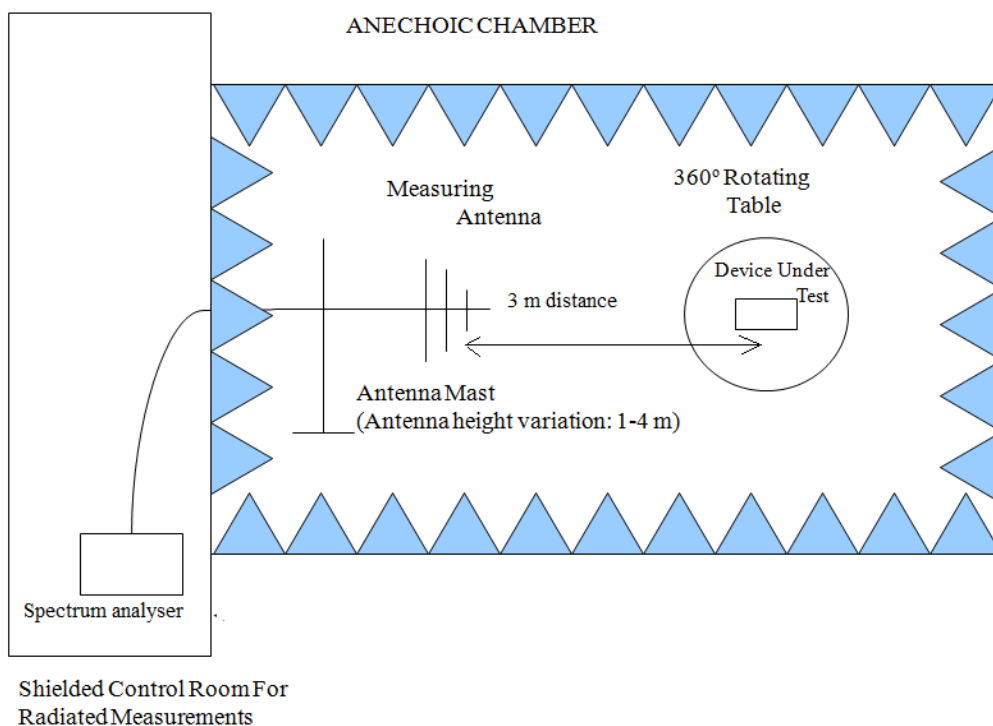
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

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

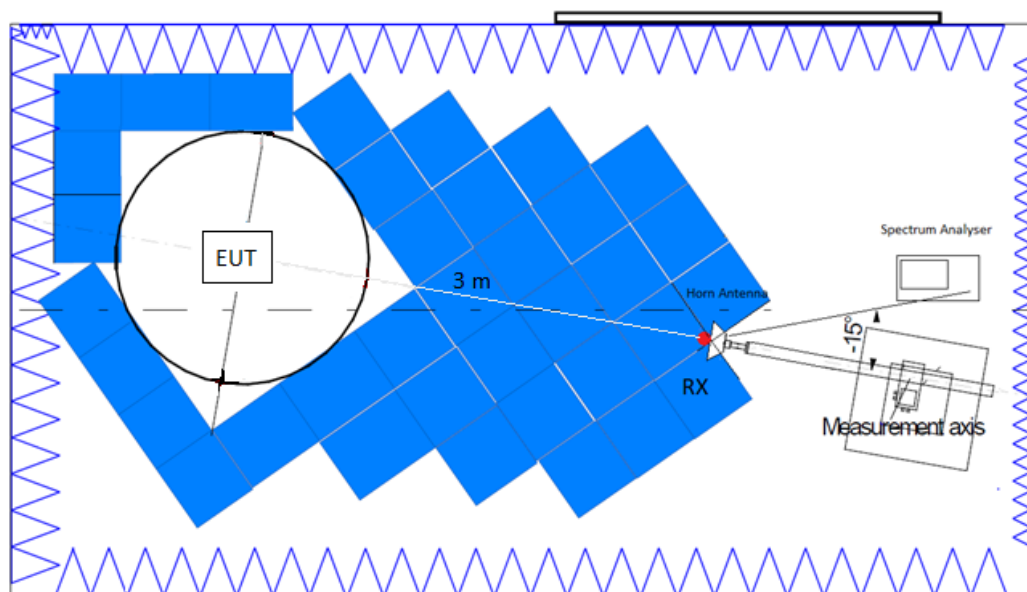
Measurements were made in both horizontal and vertical planes of polarization.

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.

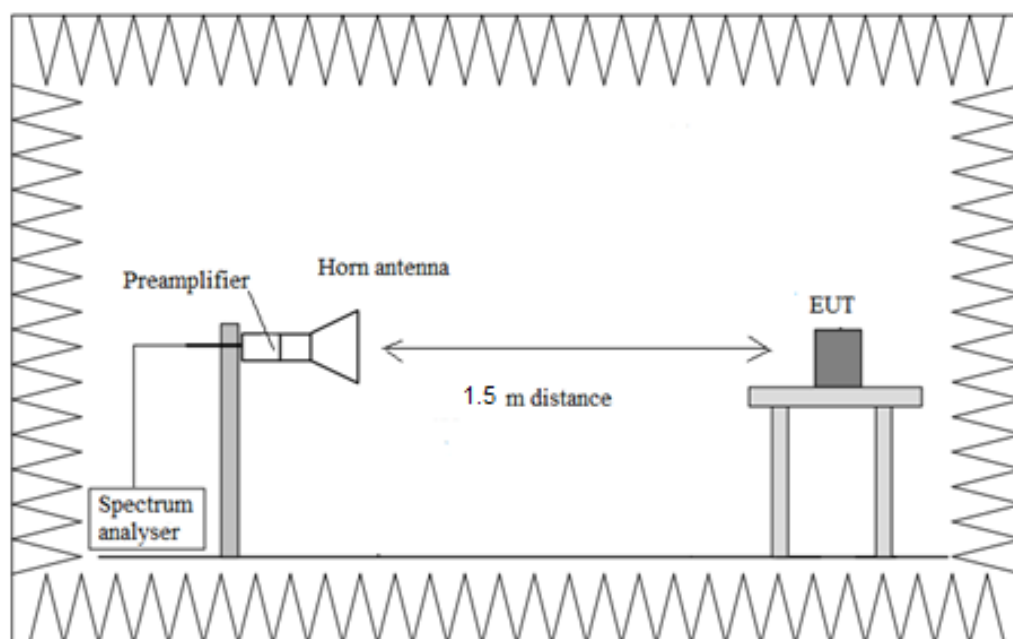
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup $f > 17$ GHz:



SAMPLE CALCULATION

For radiated measurements:

Values measures by the test receiver / analyzer are converted to field strength, in dBuV/m, at the regulatory distance using the following calculation:

$$\text{Unwanted Lvl (dBuV/m)} = \text{Raw Rec (dBuV)} + \text{Preamp (dB)} + \text{Trd Corre. (dB/m)} + \text{SigPath (dB)}$$

Where,

Raw Rec (dBuV): Measured voltage in the receiver / spectrum analyzer in dBuV

Preamp (dB): Path loses due to preamplifier

Trd Corr. (dB/m): Antenna factor in dB/m

SigPath (dB) = Cable loss (dB) – External Gain amplifier (dB) – Distance factor (dB)

Cable loss (dB): Cable loss

External Gain amplifier (dB): Gain from external amplifier (when used)

Distance factor (dB): Distance factor in dB. When measurement distance is different to limit distance

The field strength, calculated by this way is compared with the regulatory limit.

TEST CASES DETAILS

FCC 47 CFR Part 15.247 / RSS-247

RSS-247 6.6 / FCC 15.247 (d) 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 ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	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.

Frequency range tested for Radiated emissions:

Start frequency: no radiofrequency signal generated in the device found below 10th sub-harmonic, no further investigation required.

Stop frequency: it has been performed the radiated spurious emissions until 10th harmonic.

Modulation: BTLE (GFSK 1 Mbit/s)

Results

Operation Band (MHz)	Freq Rng (GHz)	Equipment	Unwanted Freq (MHz)	Unwanted Lvl (dBµV/m)	Pol	Detector	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
[2400, 2483.5]	[0.03, 1]	Digital Transmission System (DTS)	47.751	32.25	V	PK	-35.6	3.0	7.4	57.5
			47.751	27.23	V	QP	-35.6	3.0	7.4	52.5
			50.419	32.76	V	PK	-35.6	3.0	6.9	52.2
			50.419	26.50	V	QP	-35.6	3.0	6.9	58.4
			66.278	37.62	V	PK	-35.5	3.0	6.9	63.2
			66.278	31.05	V	QP	-35.5	3.0	6.9	56.6
			98.385	20.84	V	PK	-35.2	3.0	7.9	45.2
			98.385	14.86	V	QP	-35.2	3.0	7.9	39.2
			193.978	29.64	V	PK	-34.0	3.0	9.3	51.3
			193.978	22.05	V	QP	-34.0	3.0	9.3	43.7
			332.495	30.75	V	PK	-33.1	3.0	14.1	36.5
			332.495	20.46	V	QP	-33.1	3.0	14.1	46.8

Verdict

Pass

Attachments

Operation Band MHz = [2400, 2483.5]

Equipment Type = Digital Transmission System (DTS)

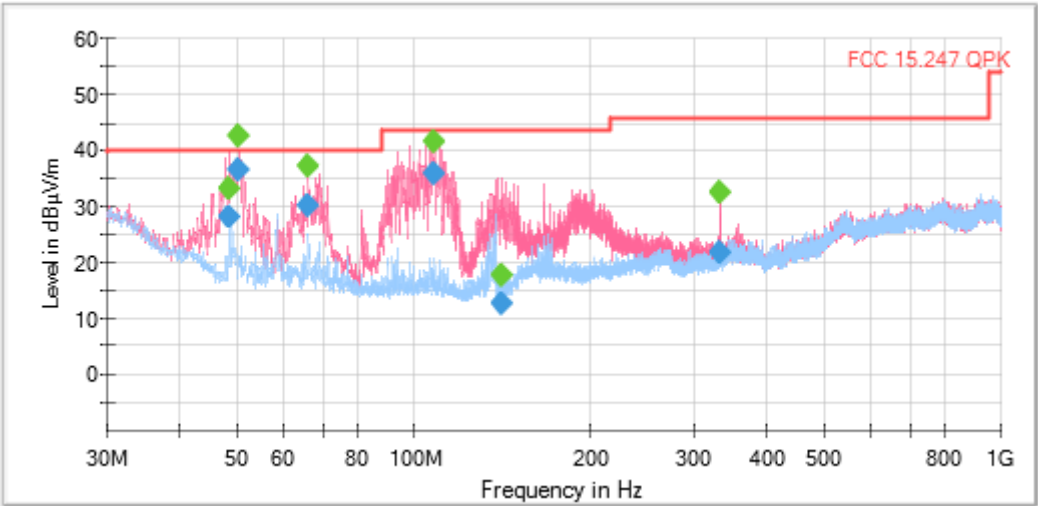
Active Port = 1

Frequency Range GHz = [0.03, 1]

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

Modulation = The spurious frequencies detected do not depend on the modulation.

Images:



Tables:
Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	48,5 kHz	PK+	100 kHz	1 s	0 dB

Operation Band MHz = [2400, 2483.5]

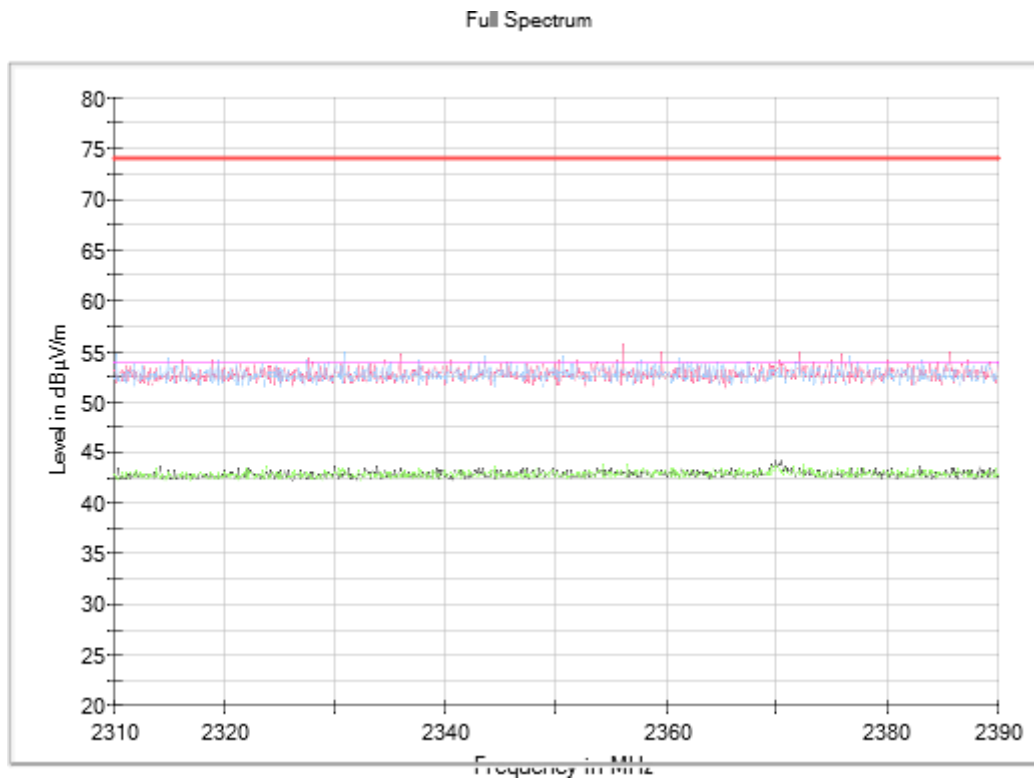
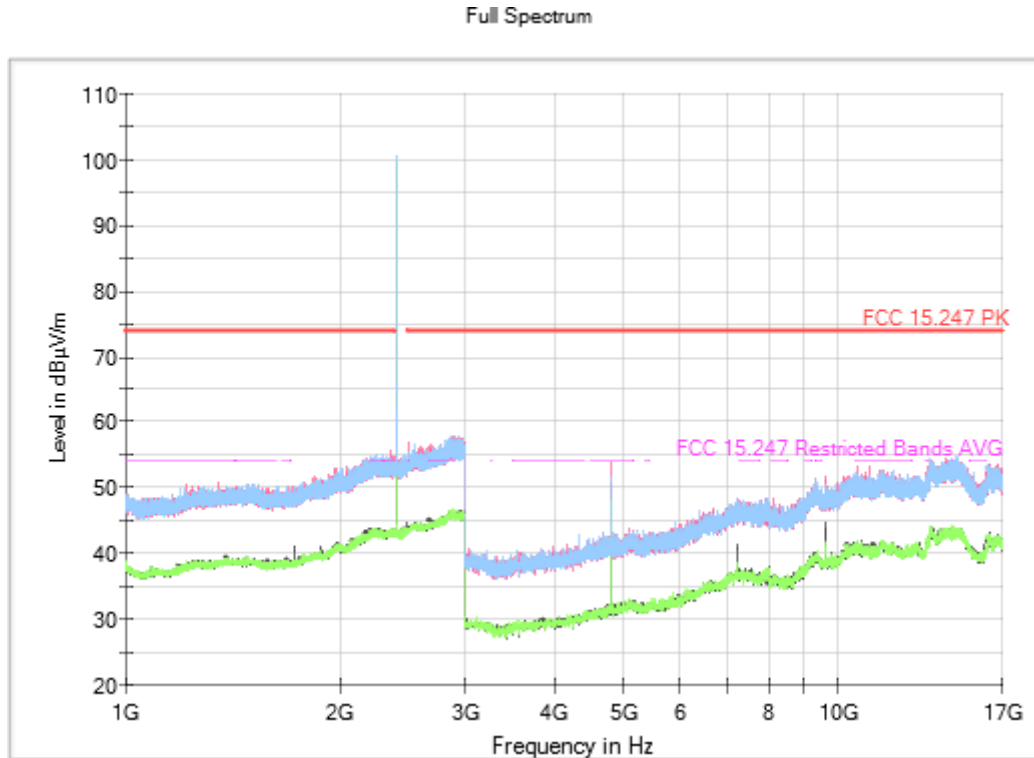
Frequency Range GHz = [1, 17]

Equipment Type = Digital Transmission System (DTS) Frequency MHz = 2402.00000

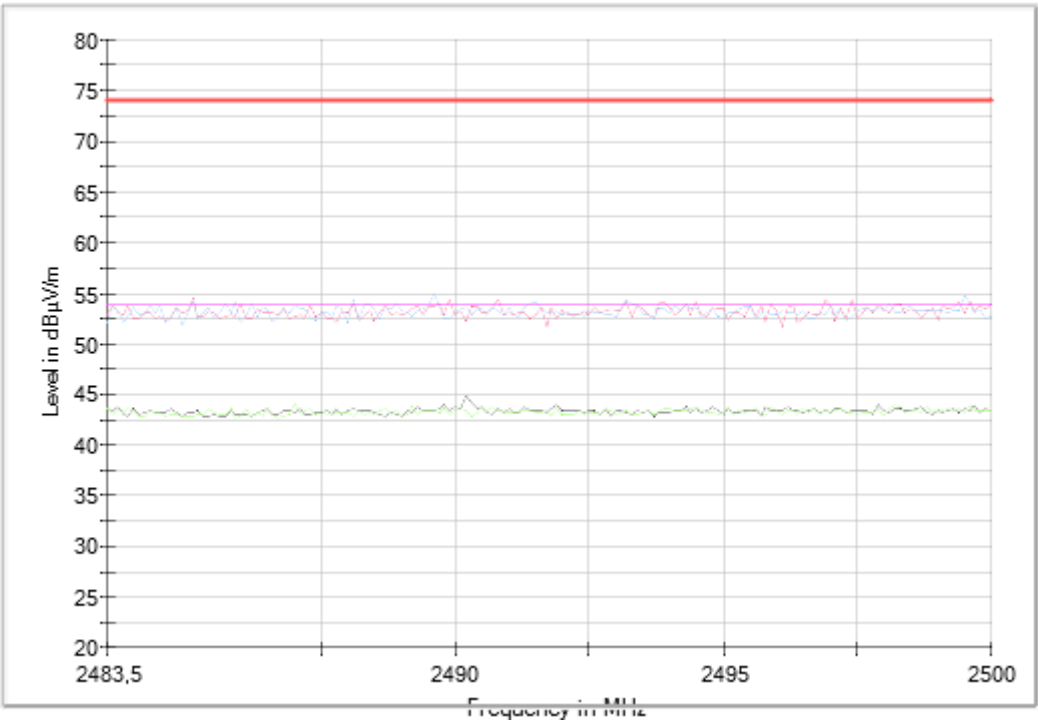
Active Port = 1

Modulation = BTLE (GFSK 1 Mbit/s)

Images:



Full Spectrum



Operation Band MHz = [2400, 2483.5]

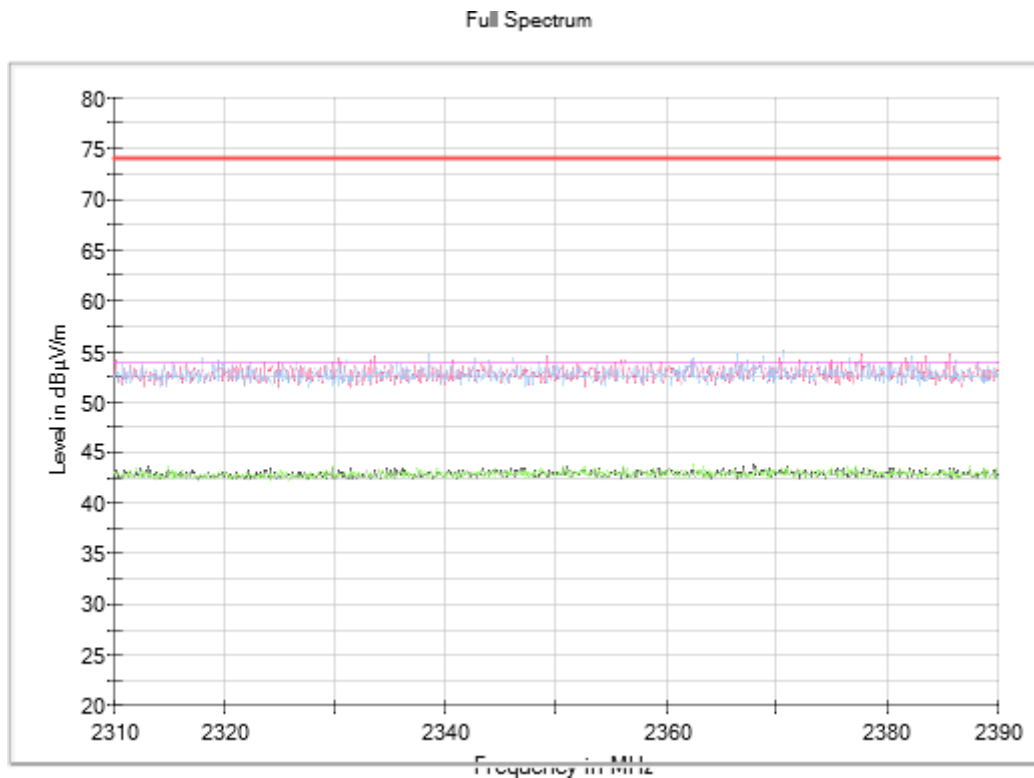
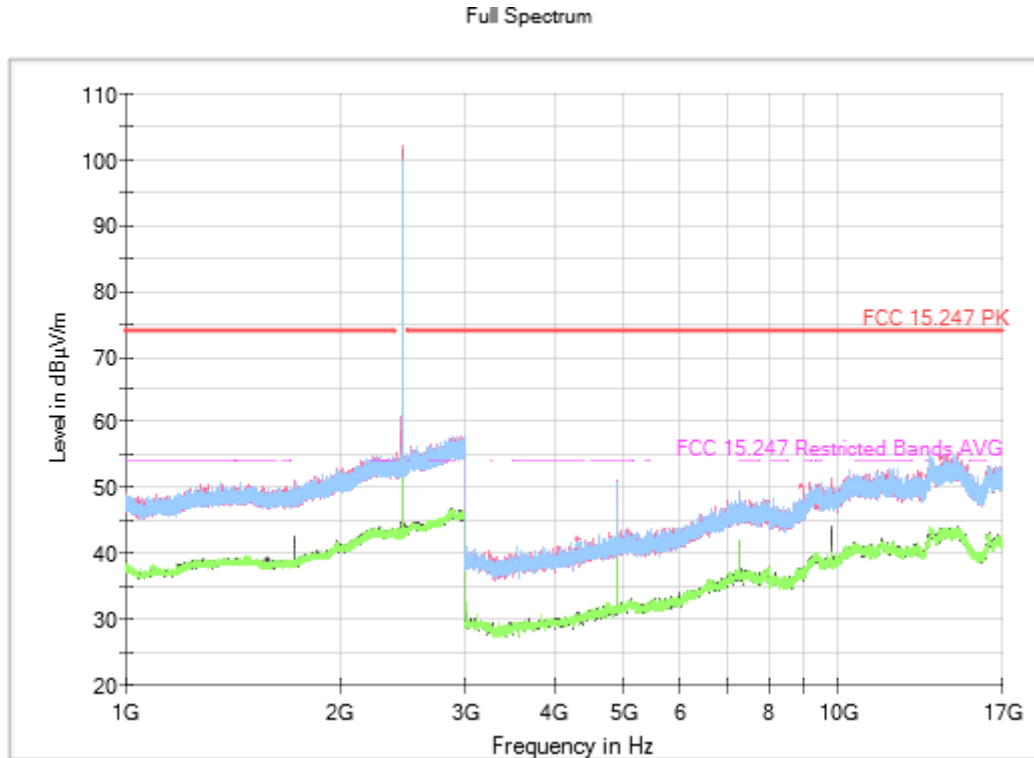
Frequency Range GHz = [1, 17]

Equipment Type = Digital Transmission System (DTS) Frequency MHz = 2440.00000

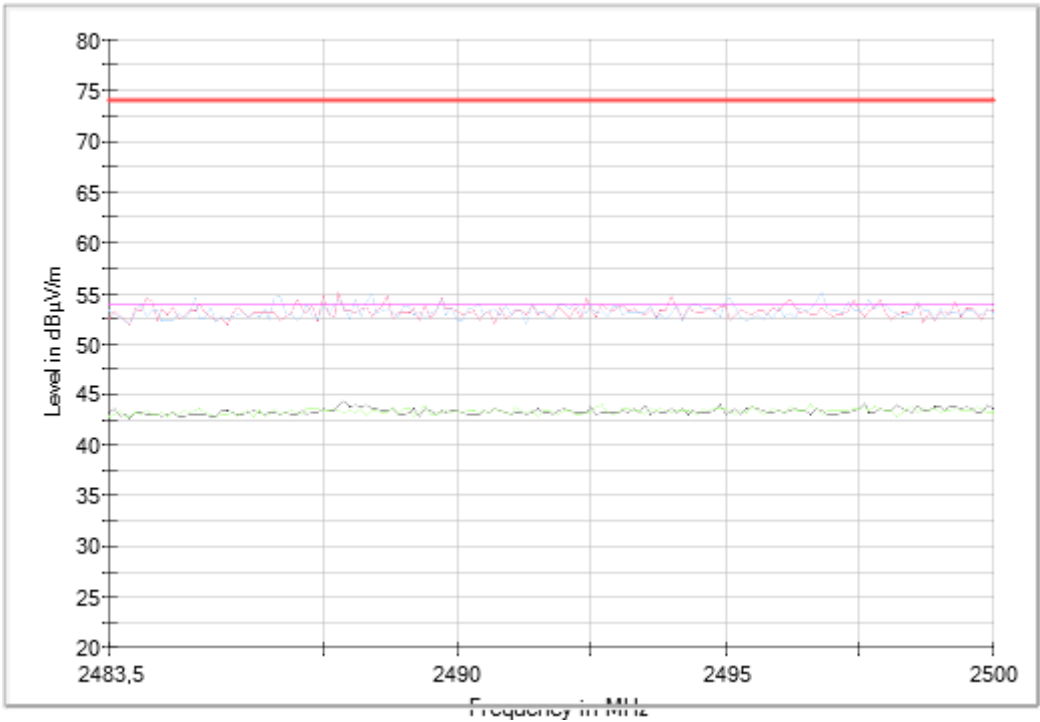
Active Port = 1

Modulation = BTLE (GFSK 1 Mbit/s)

Images:



Full Spectrum



Operation Band MHz = [2400, 2483.5]

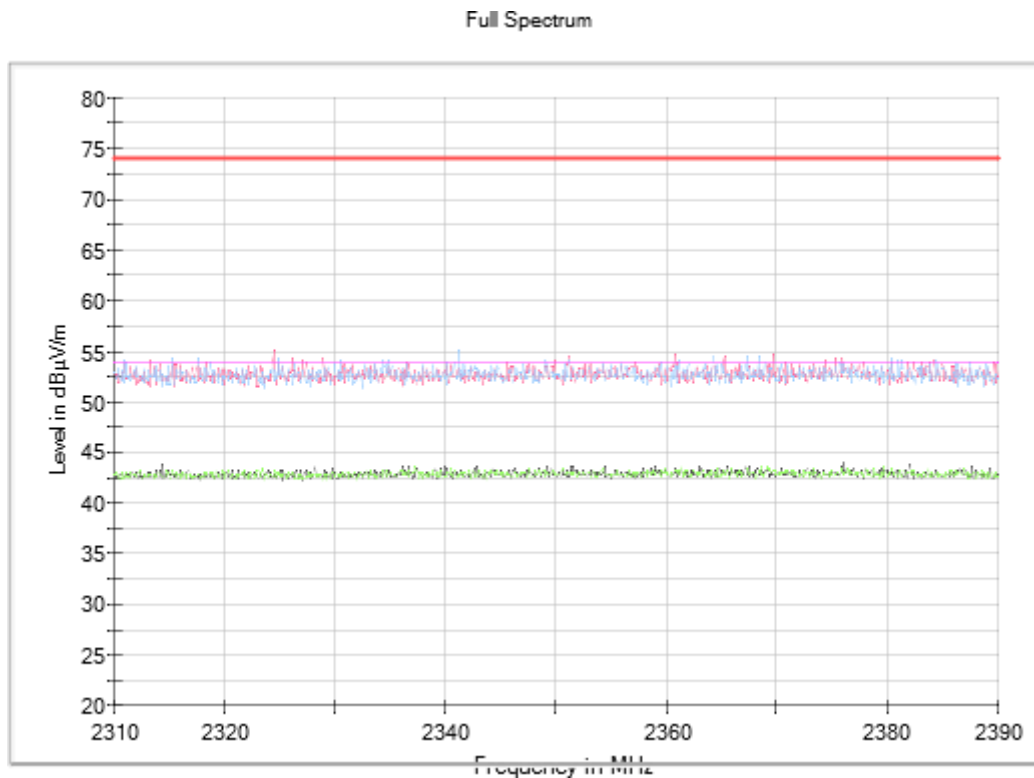
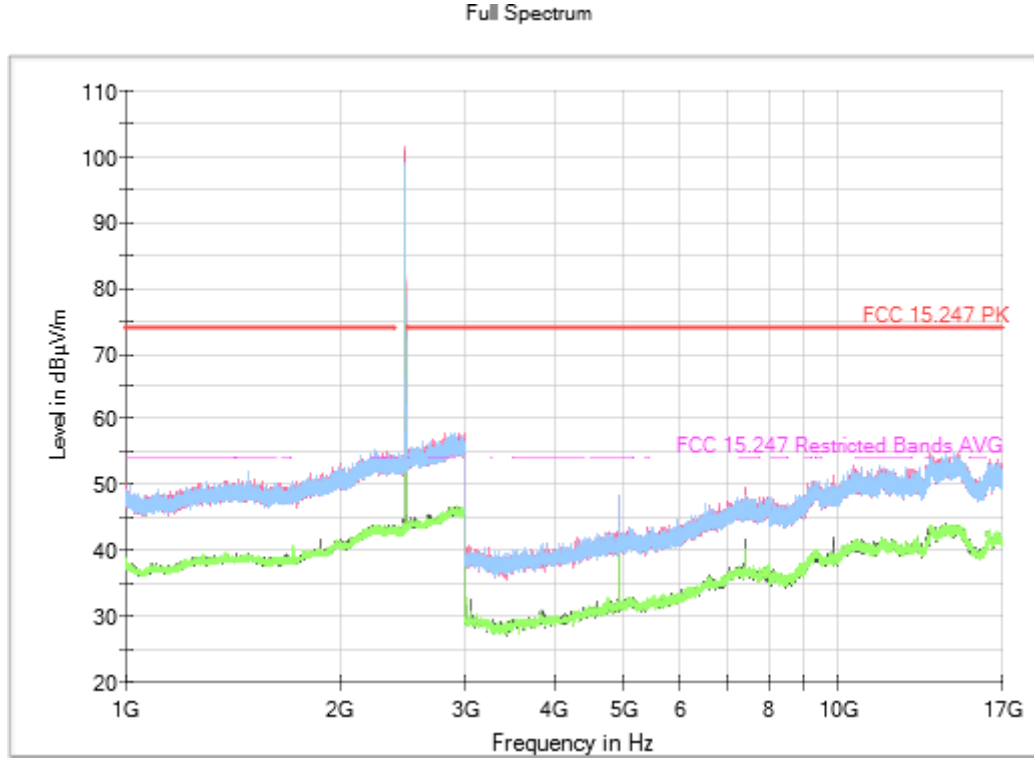
Frequency Range GHz = [1, 17]

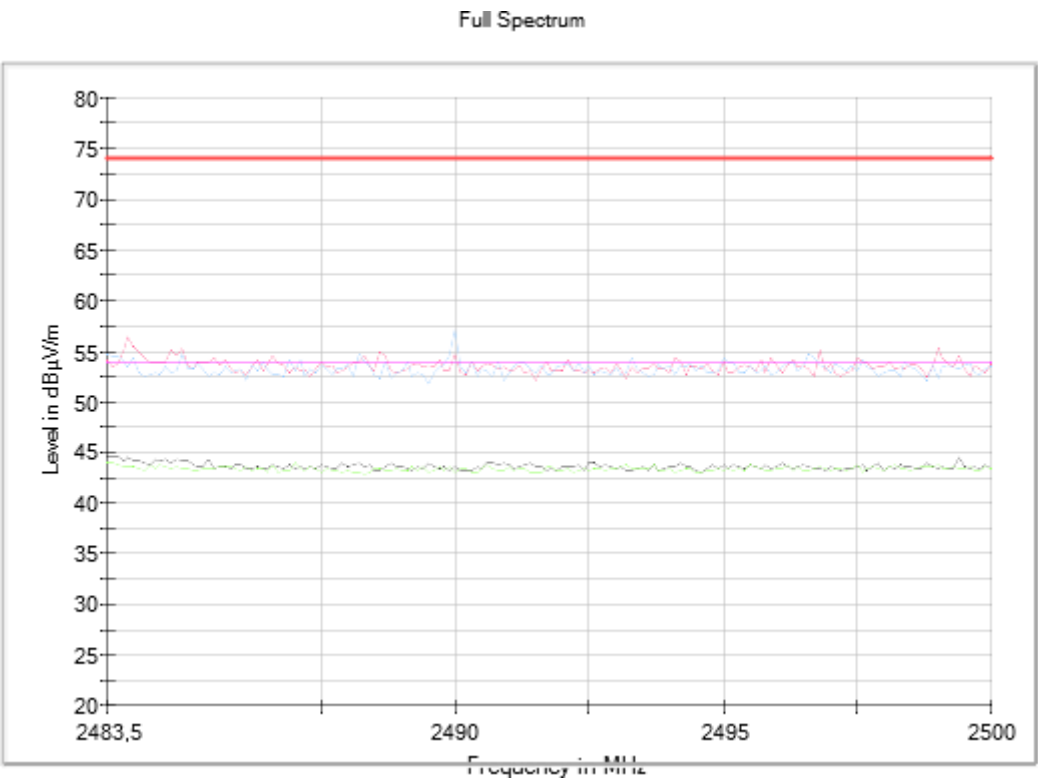
Equipment Type = Digital Transmission System (DTS) Frequency MHz = 2480.00000

Active Port = 1

Modulation = BTLE (GFSK 1 Mbit/s)

Images:





Tables:
Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
1 GHz - 2,39 GHz	400 kHz	PK+	1 MHz	0,01 s	0 dB
2,39 GHz - 2,484 GHz	40 kHz	PK+	100 kHz	0,01 s	0 dB
2,484 GHz - 3 GHz	400 kHz	PK+	1 MHz	0,01 s	0 dB
3 GHz - 17 GHz	400 kHz	PK+	1 MHz	0,01 s	0 dB

Operation Band MHz = [2400, 2483.5]

Equipment Type = Digital Transmission
System (DTS)

Active Port = 1

Frequency Range GHz = [17, 26]

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

Modulation = The spurious frequencies detected do not depend on the modulation.

Images:

Full Spectrum



Tables:

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
17 GHz - 26 GHz	400 kHz	PK+	1 MHz	0,01 s	0 dB

Appendix C: Test results. Bluetooth Low Energy (1M). D-ANT antenna.

INDEX

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FCC 47 CFR PART 15.247 / RSS-247	49
RSS-247 6.6 / FCC 15.247 (d) Emission limitations radiated (Transmitter)	49

TEST CONDITIONS

(*): Data provided by the client.

POWER SUPPLY (*):

Vnominal: 3.3 Vdc
Type of Power Supply: Internal DC

ANTENNA (*):

Type of Antenna: D-ANT01
Maximum Declared Antenna Gain: 3.1 dBi (peak)

TEST FREQUENCIES (*):

Modulation	Data rates	Low Channel	Middle Channel	High Channel
BTLE GFSK	1M 1 Mbit/s	2402 MHz	2440 MHz	2480 MHz

During transmitter test the EUT was controlled by a SW tool provided by the client to operate in a continuous transmit mode on the modulation schemes and test channels as required.

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).

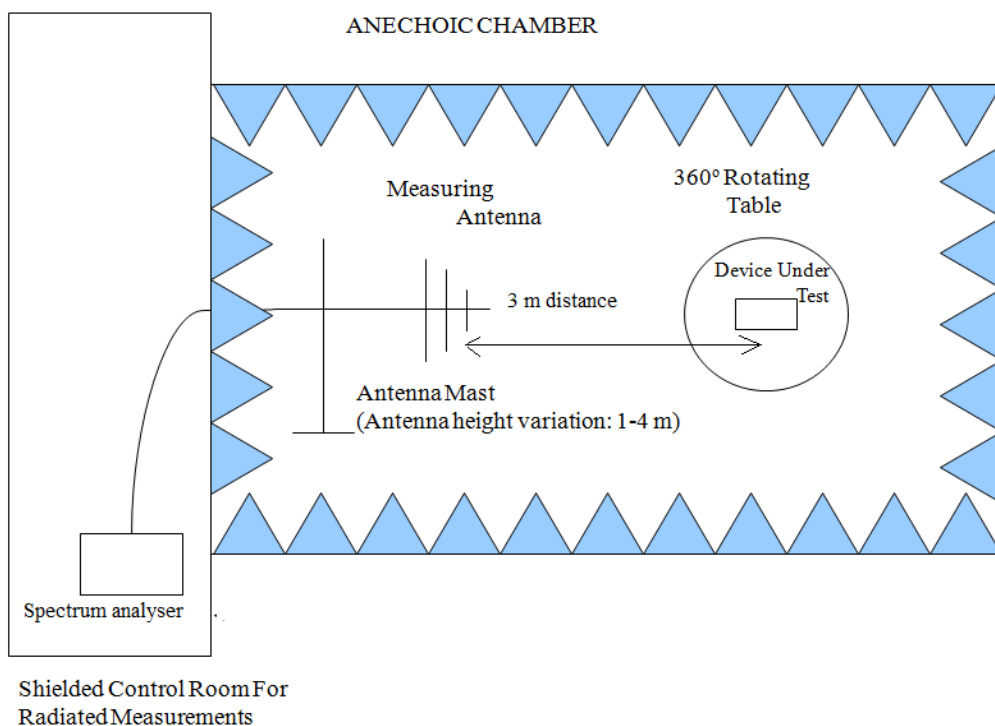
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

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

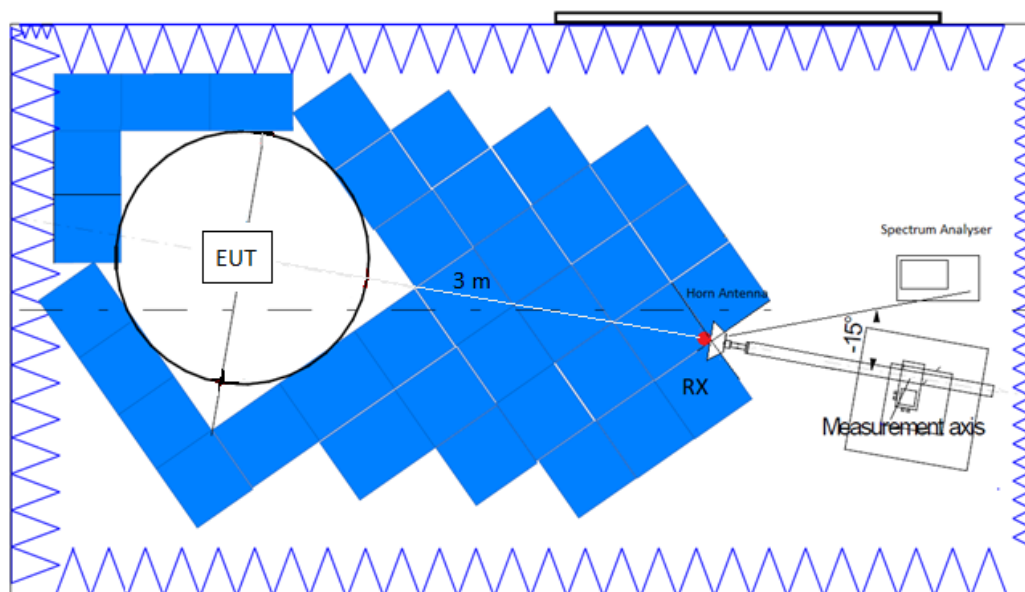
Measurements were made in both horizontal and vertical planes of polarization.

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.

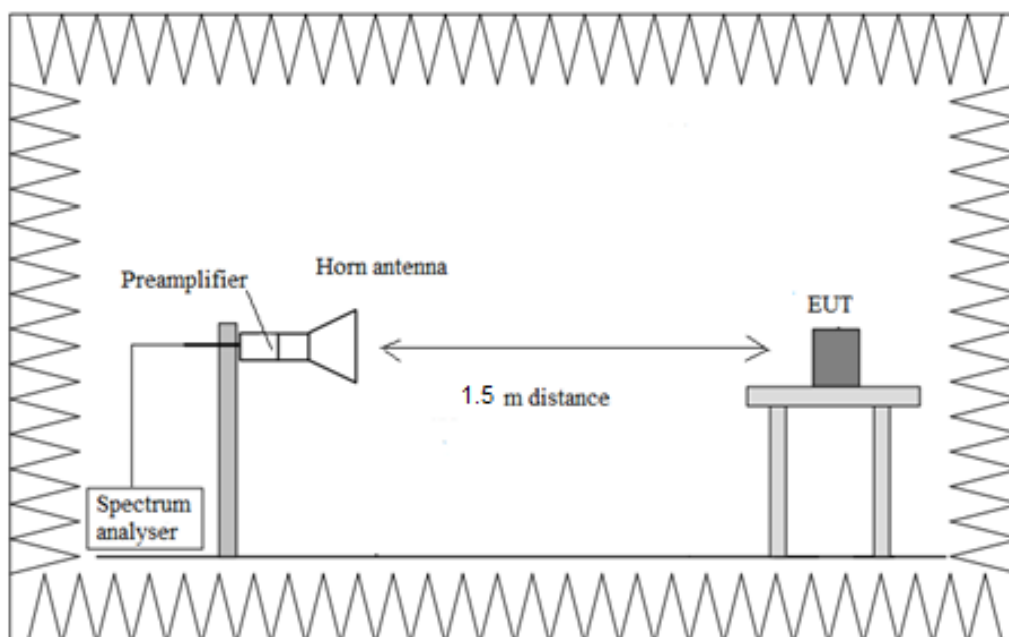
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup $f > 17$ GHz:



SAMPLE CALCULATION

For radiated measurements:

Values measures by the test receiver / analyzer are converted to field strength, in dBuV/m, at the regulatory distance using the following calculation:

$$\text{Unwanted Lvl (dBuV/m)} = \text{Raw Rec (dBuV)} + \text{Preamp (dB)} + \text{Trd Corre. (dB/m)} + \text{SigPath (dB)}$$

Where,

Raw Rec (dBuV): Measured voltage in the receiver / spectrum analyzer in dBuV

Preamp (dB): Path loses due to preamplifier

Trd Corr. (dB/m): Antenna factor in dB/m

SigPath (dB) = Cable loss (dB) – External Gain amplifier (dB) – Distance factor (dB)

Cable loss (dB): Cable loss

External Gain amplifier (dB): Gain from external amplifier (when used)

Distance factor (dB): Distance factor in dB. When measurement distance is different to limit distance

The field strength, calculated by this way is compared with the regulatory limit.

TEST CASES DETAILS

FCC 47 CFR Part 15.247 / RSS-247

RSS-247 6.6 / FCC 15.247 (d) 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 ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	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.

Frequency range tested for Radiated emissions:

Start frequency: no radiofrequency signal generated in the device found below 10th sub-harmonic, no further investigation required.

Stop frequency: it has been performed the radiated spurious emissions until 10th harmonic.

Modulation: BTLE (GFSK 1 Mbit/s)

Results

Operation Band (MHz)	Freq Rng (GHz)	Equipment	Unwanted Freq (MHz)	Unwanted Lvl (dBµV/m)	Pol	Detector	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
[2400, 2483.5]	[0.03, 1]	Digital Transmission System (DTS)	30.606	30.49	V	PK	-35.8	3.0	15.7	47.6
			30.606	24.75	V	QP	-35.8	3.0	15.7	41.8
			42.549	34.64	V	PK	-35.7	3.0	8.9	58.4
			42.549	30.02	V	QP	-35.7	3.0	8.9	53.7
			47.793	37.61	V	PK	-35.6	3.0	7.4	62.9
			47.793	32.51	V	QP	-35.6	3.0	7.4	57.8
			98.415	29.40	V	PK	-35.2	3.0	7.9	53.8
			98.415	24.86	V	QP	-35.2	3.0	7.9	49.2
			166.467	36.55	V	PK	-34.3	3.0	9.3	58.5
			166.467	26.31	V	QP	-34.3	3.0	9.3	48.3
			332.246	32.03	V	PK	-33.1	3.0	14.1	48.1
			332.246	21.25	V	QP	-33.1	3.0	14.1	37.3

Verdict

Pass

Attachments

Operation Band MHz = [2400, 2483.5]

Equipment Type = Digital Transmission System (DTS)

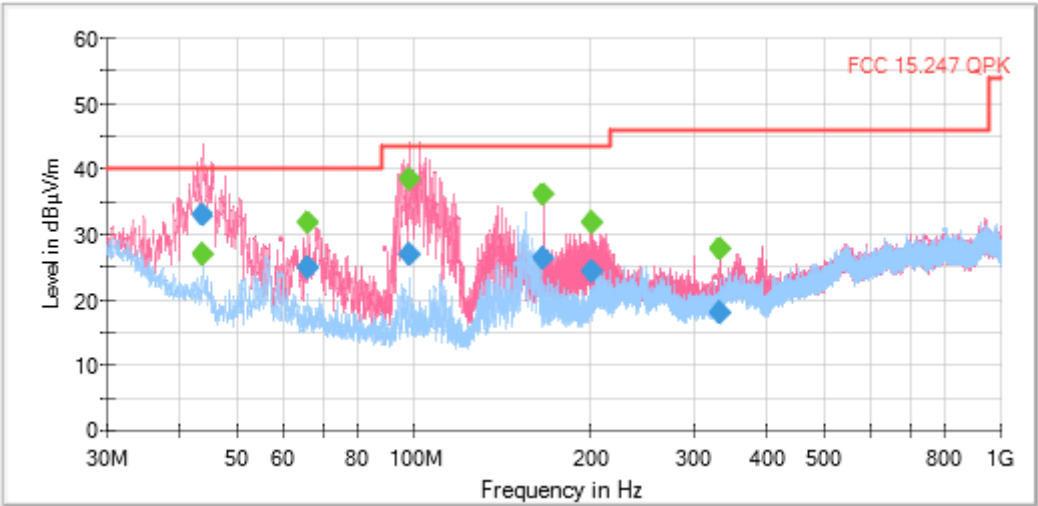
Active Port = 1

Frequency Range GHz = [0.03, 1]

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

Modulation = The spurious frequencies detected do not depend on the modulation.

Images:



Tables:
Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30,312 kHz	PK+	100 kHz	1 s	0 dB

Operation Band MHz = [2400, 2483.5]

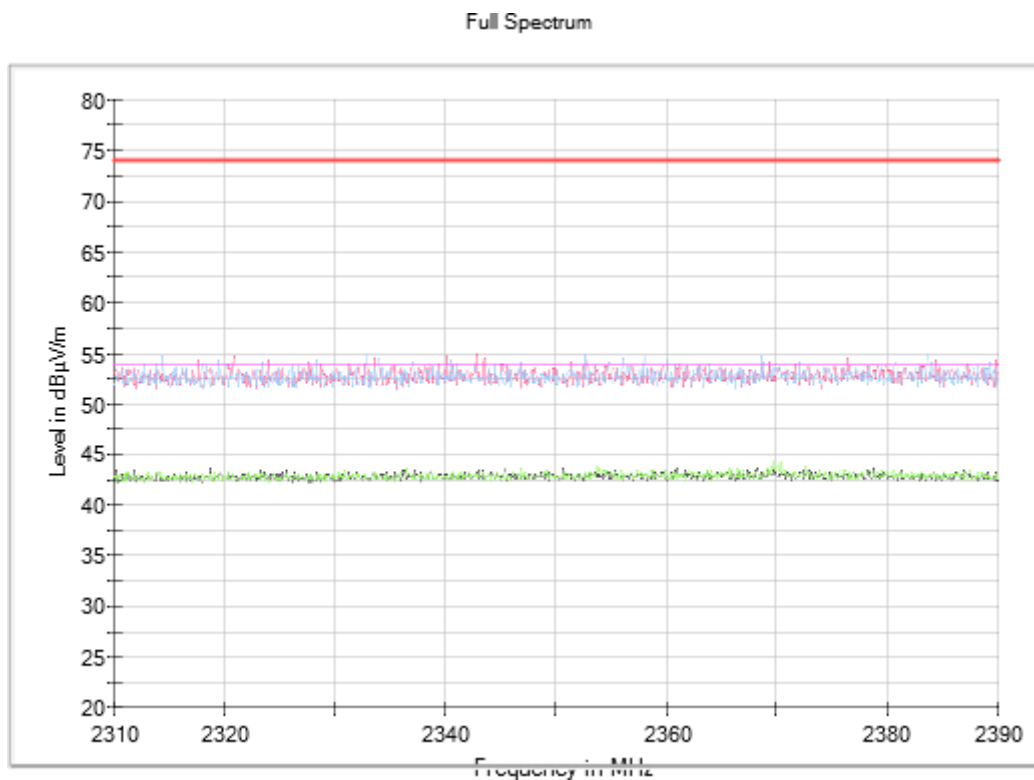
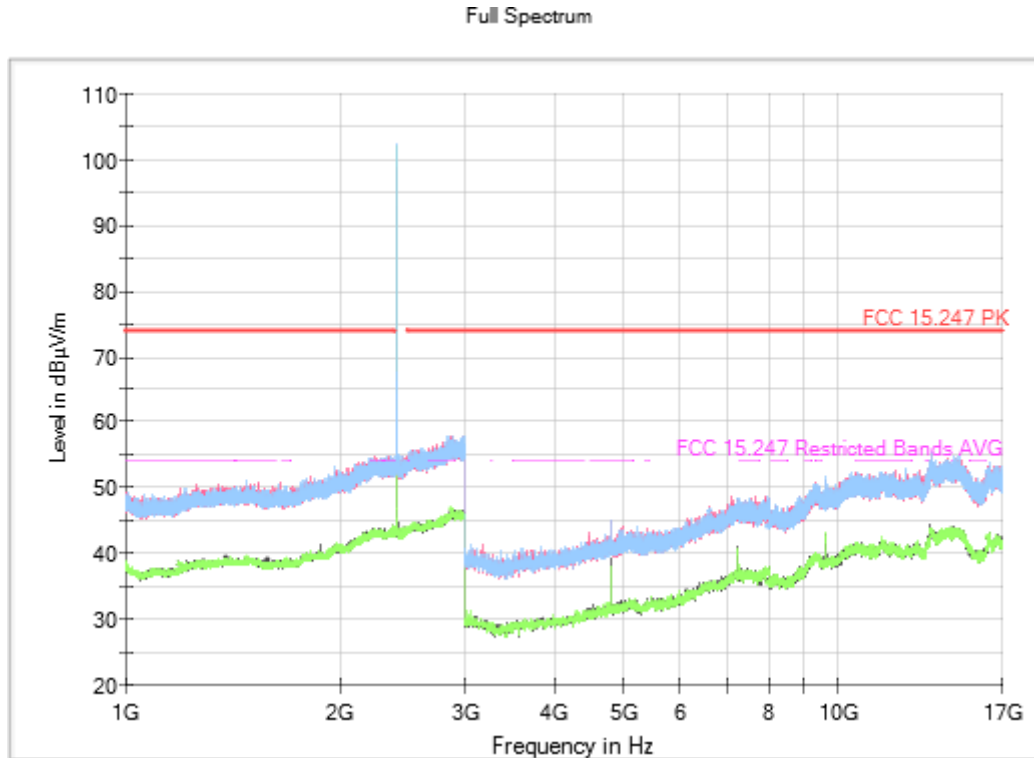
Frequency Range GHz = [1, 17]

Equipment Type = Digital Transmission System (DTS) Frequency MHz = 2402.00000

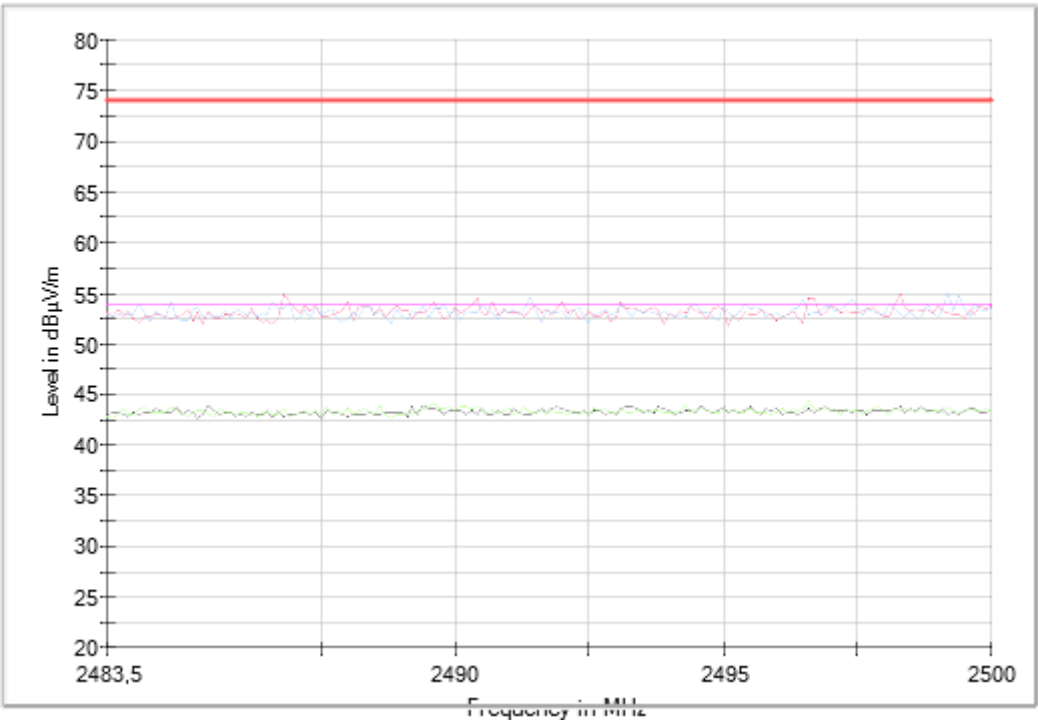
Active Port = 1

Modulation = BTLE (GFSK 1 Mbit/s)

Images:



Full Spectrum



Operation Band MHz = [2400, 2483.5]

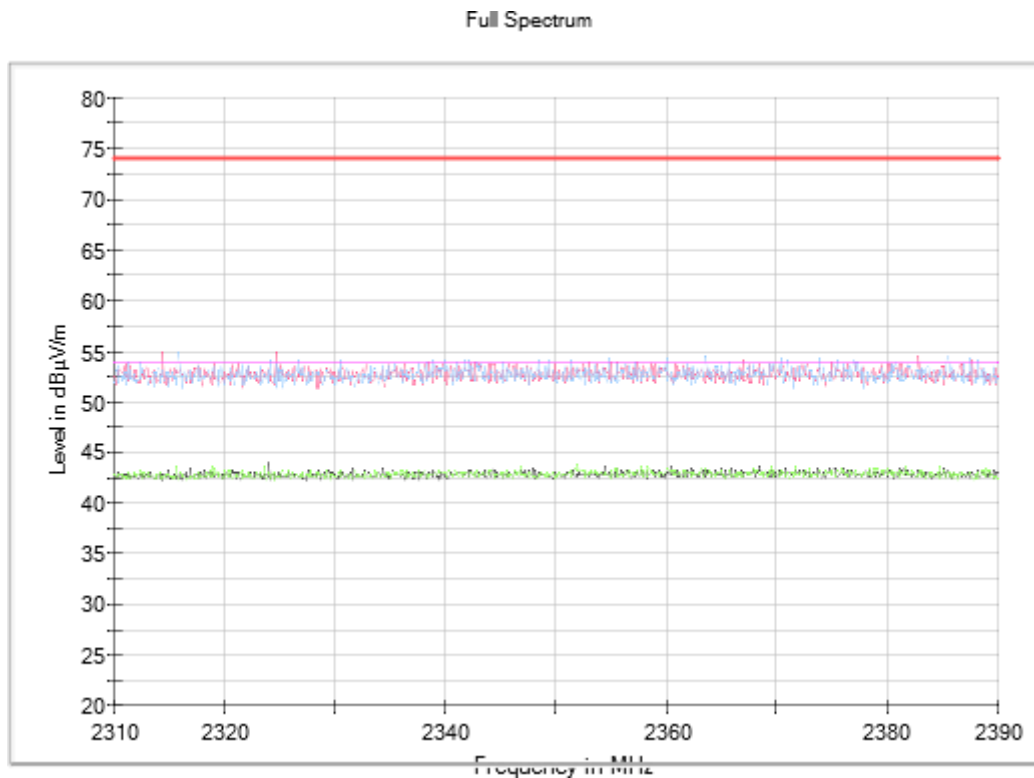
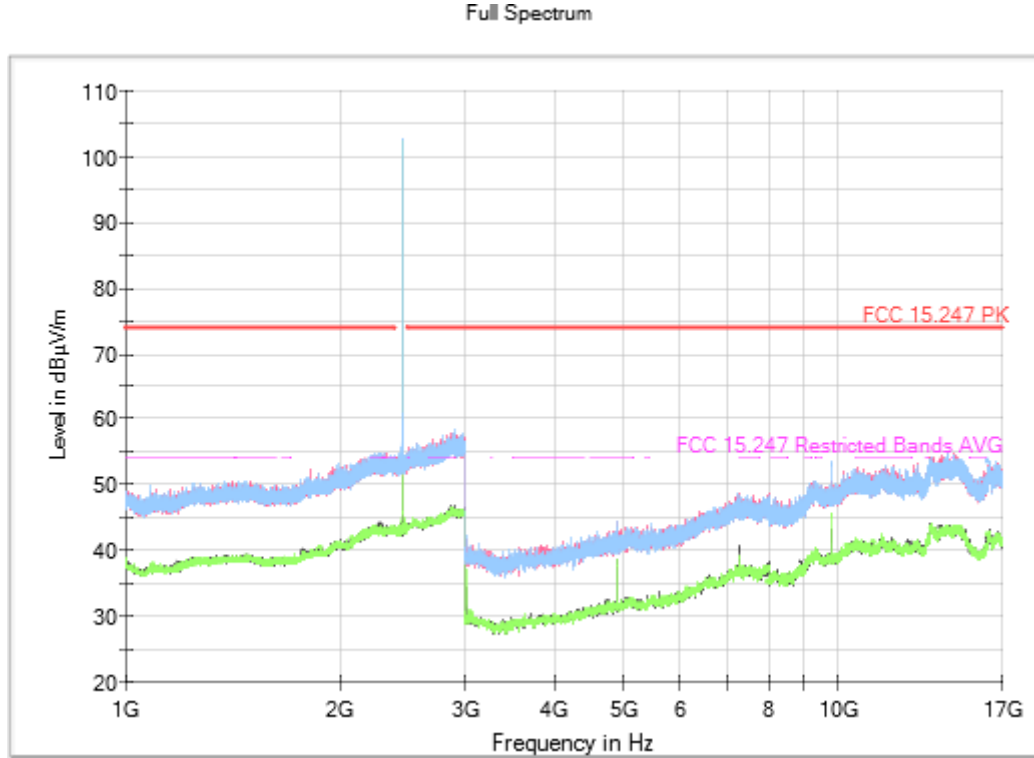
Frequency Range GHz = [1, 17]

Equipment Type = Digital Transmission System (DTS) Frequency MHz = 2440.00000

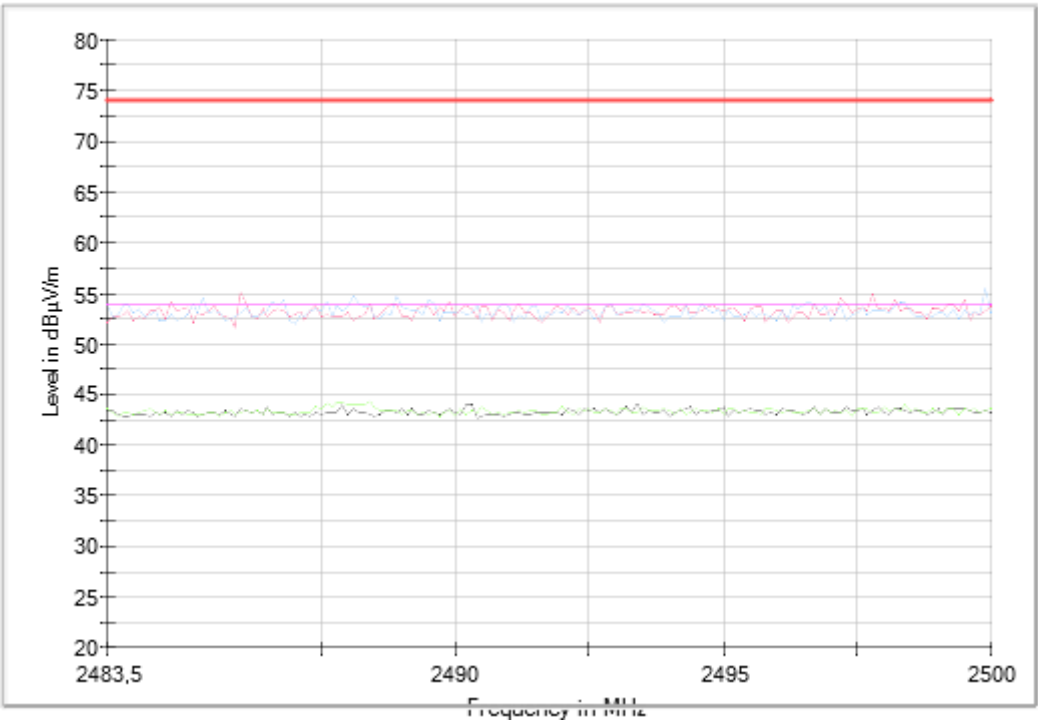
Active Port = 1

Modulation = BTLE (GFSK 1 Mbit/s)

Images:



Full Spectrum



Operation Band MHz = [2400, 2483.5]

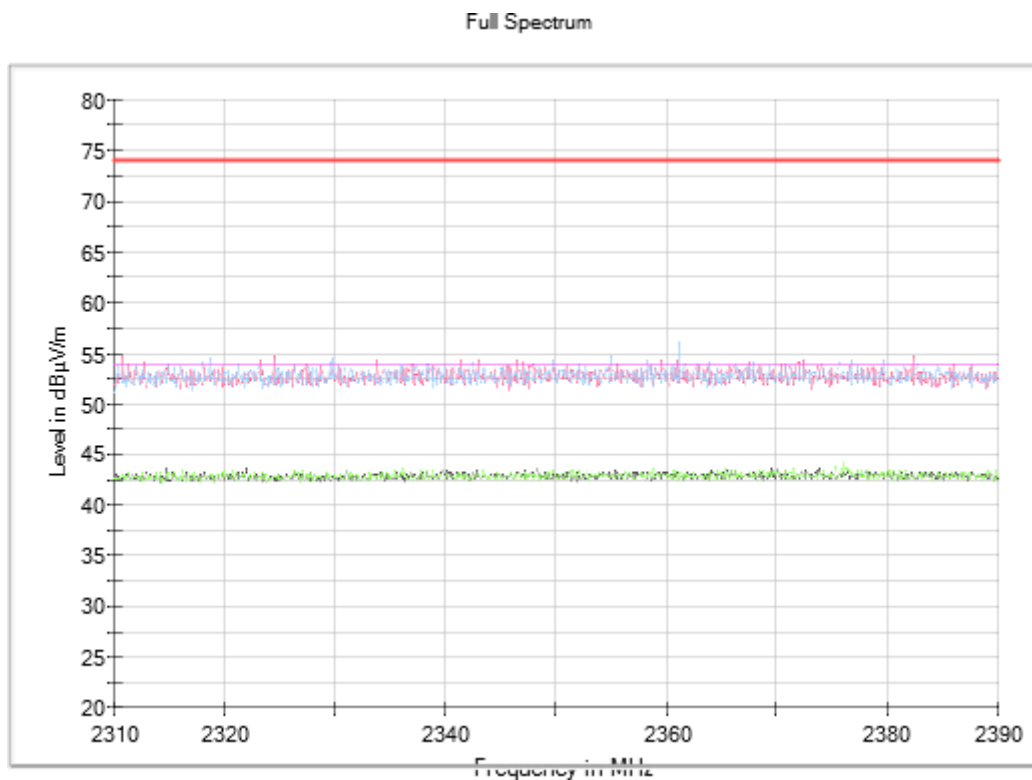
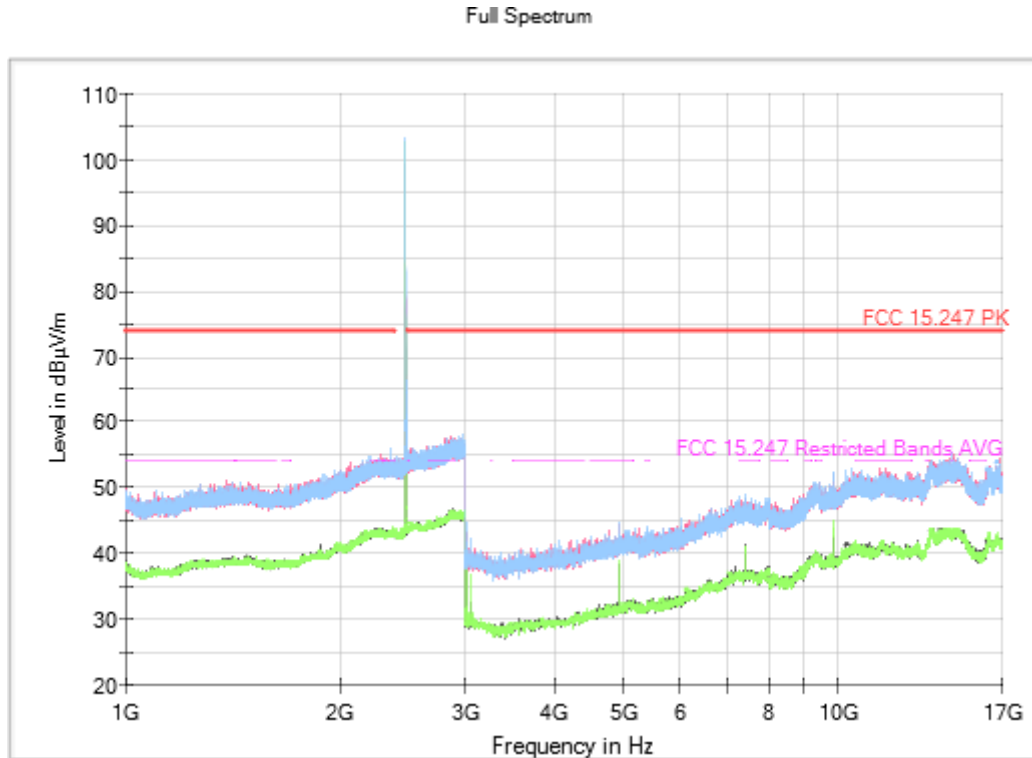
Frequency Range GHz = [1, 17]

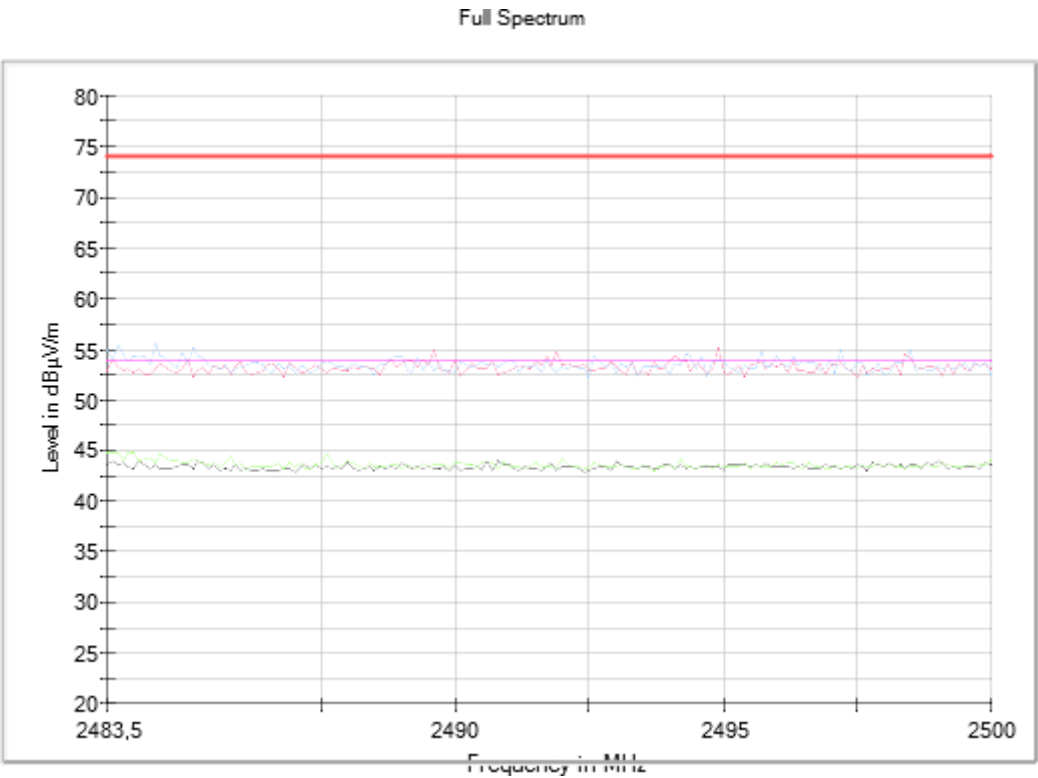
Equipment Type = Digital Transmission System (DTS) Frequency MHz = 2480.00000

Active Port = 1

Modulation = BTLE (GFSK 1 Mbit/s)

Images:





Tables:
Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
1 GHz - 2,39 GHz	400 kHz	PK+	1 MHz	0,01 s	0 dB
2,39 GHz - 2,484 GHz	40 kHz	PK+	100 kHz	0,01 s	0 dB
2,484 GHz - 3 GHz	400 kHz	PK+	1 MHz	0,01 s	0 dB
3 GHz - 17 GHz	400 kHz	PK+	1 MHz	0,01 s	0 dB

Operation Band MHz = [2400, 2483.5]

Equipment Type = Digital Transmission
System (DTS)

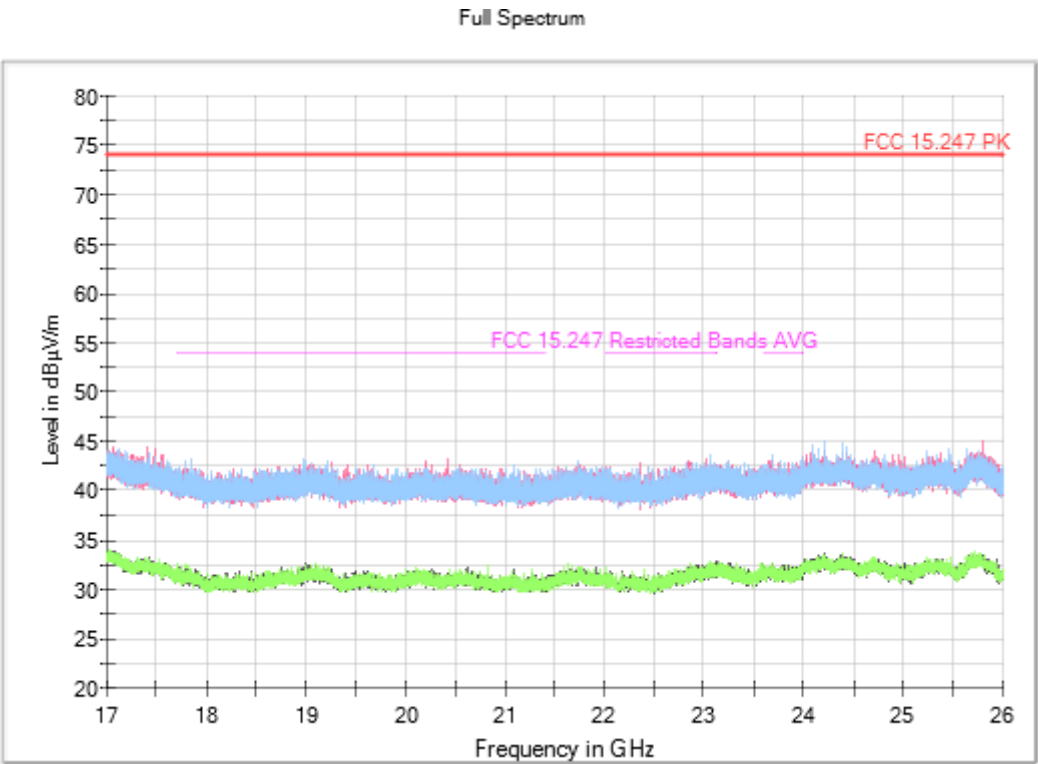
Active Port = 1

Frequency Range GHz = [17, 26]

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

Modulation = The spurious frequencies detected do not depend on the modulation.

Images:



Tables:

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
17 GHz - 26 GHz	400 kHz	PK+	1 MHz	0,01 s	0 dB