DEKRA Certification, Inc.
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Sterling, VA 20164
United States of America

FCC LISTED, REGISTRATION NUMBER: 2764.01

ISED LISTED REGISTRATION NUMBER: 23595-1

Test Report No:
4007ERM.001

Test Report

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

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

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

(*) Identification of item tested	BT unit
(*) Trademark	Visteon Corporation
(*) Model and /or type reference	SAB01
Other identification of the product	FCC ID: NT8-SAB01 IC: 3043A-SAB01 HVIN: 25224
(*) Features	BT 5.0 LE
Manufacturer	VISTEON CORPORATION One Village Center Drive. Van Buren Township, MI Postcode/Zip Code: 48111.
Test method requested, standard	USA FCC Part 15.247 (10-1-21 Edition): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (10-1-21 Edition): Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 amendment 1 (March 2019). Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid Systems Devices Operating Under Section 15.247 of the FCC Rules. 558074 D01 Meas Guidance v05r02 dated April 2, 2019. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Domingo Galvez EMC&RF Lab Manager Digitally signed by Domingo Galvez DN: cn=Domingo Galvez, o=Dekra Certification Inc., ou=Regulatory Lab Manager, email=domingo.galvez@dekra.com, c=US
Date of issue	08-23-2023
Report template No	FDT08_23 (*) “Data provided by the client”

Index

Acronyms

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

Competences and guarantees

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

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

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

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

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

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

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 Certification Inc.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Certification Inc. and the Accreditation Bodies.

Uncertainty

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

Test case	Frequency (MHz)	U (k=2)	Units
RF Power and PSD	2402-2483	0.88	dB
Occupied Bandwidth		1.87	%
Dwell Time		0.01	%
Band Edge		0.64	dB
Radiated Spurious Emission	30-180	4.27	dB
	180-1000	3.14	dB
	1000-18000	3.30	dB
	18000-40000	3.49	dB

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample consists of a gateway unit, which links together the steering switch, vehicle meter and Drive mode application and allows the user to interact safely with their smartphone device contents while driving.

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

Usage of samples

Samples undergoing test have been selected by: The client.

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

Id	Control Number	Description	Manufacturer/ Model	Serial Nº	Date of Reception	Application
S/01	3922/07	RF Conducted Sample	VIsteon / SAB01	-	02/21/2023	Element Under Test
S/01	3922/02	Harness Cable	-	-	02/21/2023	Accessory
S/01	3922/03	Test Box	-	-	02/21/2023	Accessory
S/01	3922/06	Mini USB cable	-	-	02/21/2023	Accessory

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

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

Id	Control Number	Description	Manufacturer/ Model	Serial Nº	Date of Reception	Application
S/02	4007/12	Radiated Sample	Visteon / SAB	SAAF0000J7	07/25/2023	Element Under Test
S/02	3922/02	Harness Cable	-	-	02/21/2023	Accessory
S/02	3922/03	Test Box	-	-	02/21/2023	Accessory
S/02	3922/06	Mini USB cable	-	-	02/21/2023	Accessory

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

Test sample description

Ports……:	Port name and description	Cable					
		Specified max length [m]	Attached during test	Shielded	Coupled to patient(3)		
	8 Pin external connector		☒	☐	☐		
			☐	☐	☐		
			☐	☐	☐		
Supplementary information to the ports……:	No Data Provided						
Rated power supply .....:	Voltage and Frequency			Reference poles			
				L1	L2	L3	N	PE
	☐	AC:		☐	☐	☐	☐	☐
	☐	AC:		☐	☐	☐	☐	☐
	☒	DC: Nominal voltage DC 13.2V						
	☐	DC:						
Rated Power .....:	No Data Provided						
Clock frequencies.....:	32.768kHz						
Other parameters.....:	No Data Provided						
Software version .....:	SWD10X-26055						
Hardware version.....:	PWB25224						
Dimensions in cm (W x H x D) ....:	56.8 x 30.2 x 84.6						
Mounting position.....:	☐	Table top equipment					
	☐	Wall/Ceiling mounted equipment					
	☐	Floor standing equipment					
	☐	Hand-held equipment					
	☒	Other: Installed on 2 and 4 wheels vehicle					
Modules/parts.....:	Module/parts of test item		Type		Manufacturer		
	No Data Provided						

Accessories (not part of the test item) .....:	Description	Type	Manufacturer
	SAB01 Harness		
	SAB01 Test Box		
Documents as provided by the applicant.....:	Description	File name	Issue date
	Declaration Equipment Data	FDT30_18 Declaration Equipment Data_R2	August 18, 2023

Copy of marking plate:

Identification of the client

VISTEON CORPORATION
One Village Center Drive. Van Buren Township
MI 48111
USA

Testing period and place

Test Location	DEKRA Certification Inc.
Date (start)	06-22-2023
Date (finish)	08-01-2023

Document history

Report number	Date	Description
4007ERM.001	08-23-2023	First release.

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: Juliana Cherry, Koji Nishimoto and Qi Zhang.

Testing verdicts

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

Summary

Bluetooth Low Energy 5.1 (1M)

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

List of equipment used during the test

Conducted Measurements

CONTROL NUMBER	DESCRIPTION	Serial No	LAST CALIBRATION	NEXT CALIBRATION
897	AMETEK PROG DC Power supply	1707A01906	N/A	N/A
1039	FSV40 Signal Analyzer 40GHz	101627	2022-11-01	2024-11-01
1041	SMB100A Signal Generator	180180	2022-10-06	2024-10-06
1042	SMBV100A Vector Signal Generator	262575	2022-03-16	2024-03-16
1107	Ethernet SNMP Thermometer- RF1 Room	60038026952	2022-10-18	2024-10-18
1313	Wireless Measurement Software R&S EMC32	-	N/A	N/A

Radiated Measurements

CONTROL NUMBER	DESCRIPTION	Serial No	LAST CALIBRATION	NEXT CALIBRATION
878	Power supply (AMETEK / PROG-DC-PS)	1707A01783	N/A	N/A
1012	ESR26 Emi Test Receiver	101478	2022-04-12	2024-04-12
1014	FSV40 Signal Analyzer 40ghz	101626	2022-08-01	2024-08-01
1056	3116C Double-Ridged Waveguide Horn Antenna 18-40 GHz	213179	2023-02-23	2026-02-23
1058	3115 Double-Ridged Waveguide Horn Antenna 1-18 GHz	211373	2023-06-26	2026-06-26
1065	3142E Biconilog Antenna	208587	2020-08-13	2023-08-13
1108	Ethernet SNMP Thermometer- CR Room	60038026954	2022-10-18	2024-10-18
1111	Ethernet SNMP Thermometer	60038026577	2022-10-18	2024-10-18
1179	SEMI-ANECHOIC CHAMBER	F169021	N/A	N/A
1314	Wireless Measurement Software R&S Emc32	1040-OT102236	N/A	N/A
1461	Low Noise Preamplifier (1-18GHz)	2213857B	2022-06-01	2024-06-01

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

Appendix A

PRODUCT INFORMATION

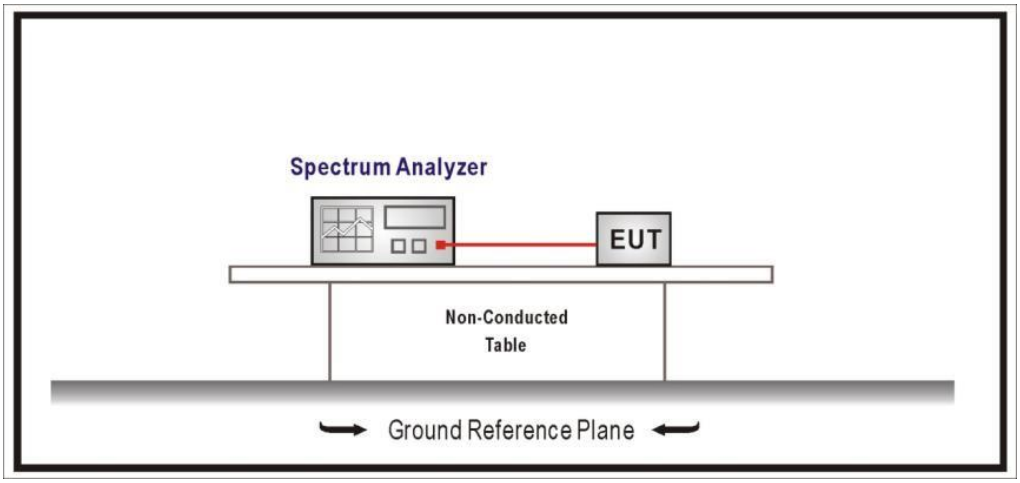
Information	Description
Modulation	GFSK
Operation mode 1: Single Antenna Equipment	
• Operating Frequency Range	2400 – 2483.5 MHz
• Nominal Channel Bandwidth	1 MHz
• RF Output Power	+2.0 dBm
Antenna type	Integral Antenna
Antenna gain	+0.2 dBi
Nominal Voltage	
• Supply Voltage	13.2 Vdc
• Type of power source	DC voltage
Equipment type	Bluetooth Low Energy

TEST CONDITIONS

(*): Data provided by the client.

TEST CONDITIONS	DESCRIPTION
TC/01 (1 Mbps)	Power supply (V): $V_{nominal}$: 13.2 Vdc Temperature: $T_{nominal}$: +20 ºC Data Rate: 1 Mbps Bandwidth: 1 MHz Test Frequencies for Conducted/ Radiated tests: Lowest channel: 2402 MHz Middle channel: 2440 MHz Highest channel: 2480 MHz

CONDUCTED MEASUREMENTS:



RADIATED MEASUREMENTS:

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

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

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

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

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

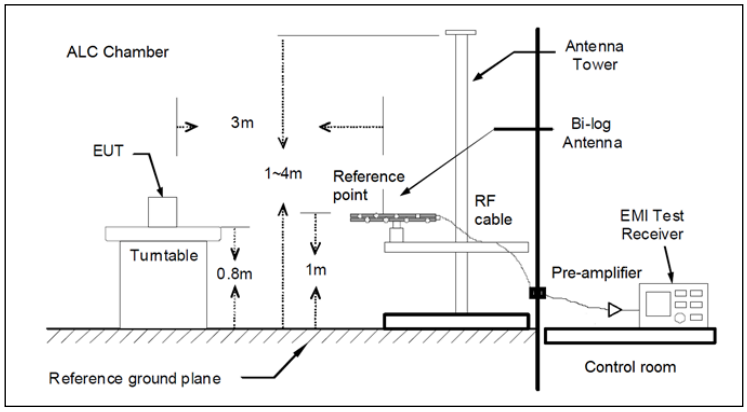


Fig A1: Radiated measurements Setup f < 1 GHz

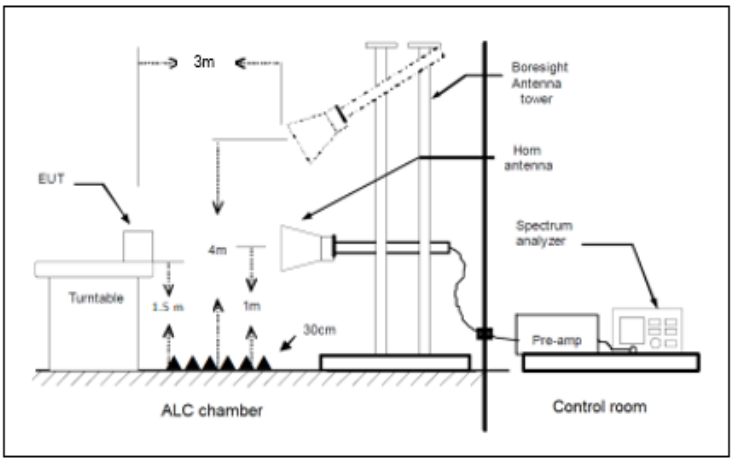


Fig A2: Radiated measurements setup f > 1-18 GHz

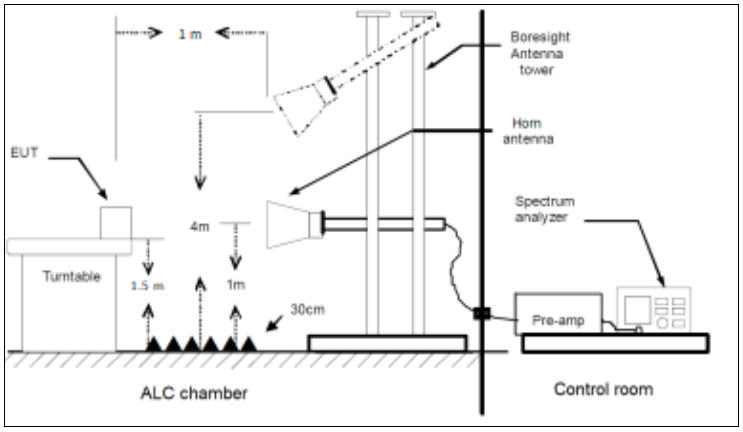


Fig A3: Radiated measurements setup f > 18 GHz

TEST CASES DETAILS

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

Limits

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

Modulation: BTLE 5.1 (GFSK 1 Mbit/s)

Results

Freq (MHz)	BW (MHz)	Emission Bandwidth (MHz)
2402.00000	1	0.673
2440.00000	1	0.673
2480.00000	1	0.673

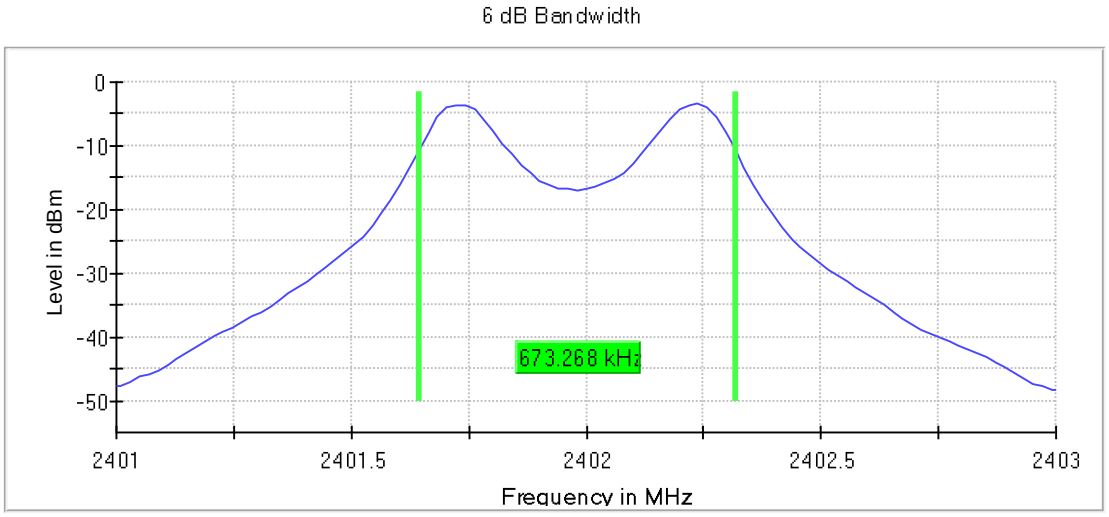
Verdict

Pass

Attachments

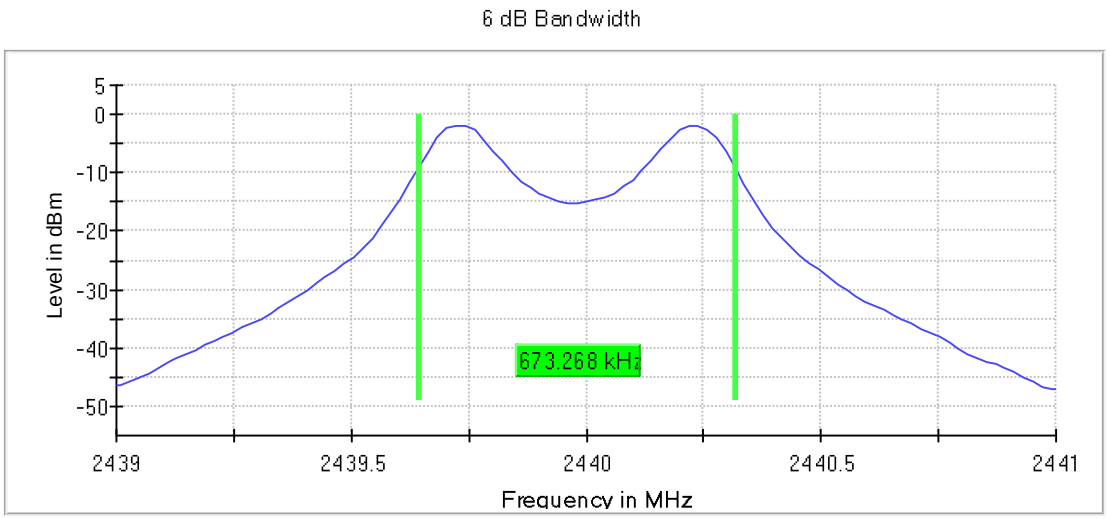
Frequency MHz = 2402.00000, Bandwidth MHz = 1, Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



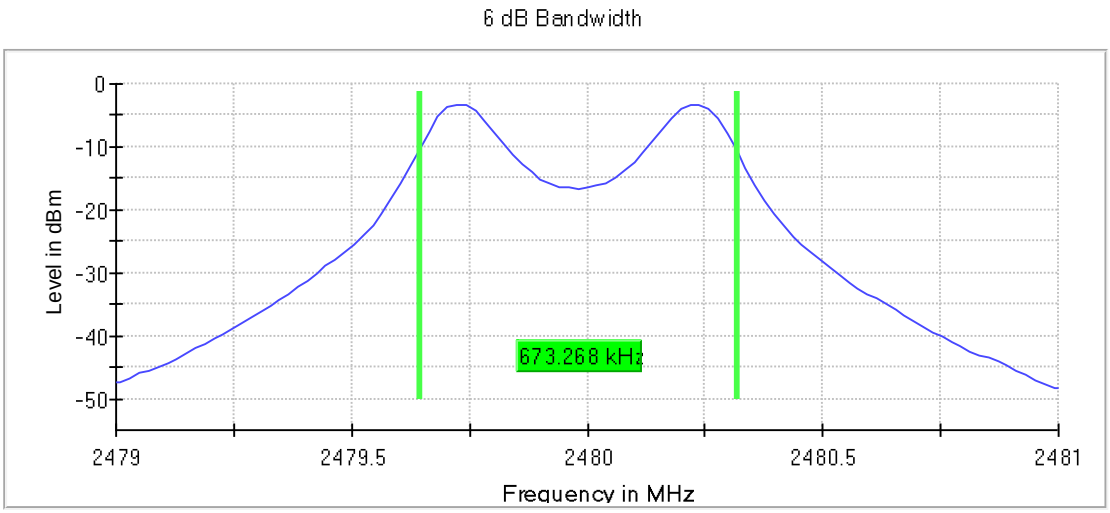
Frequency MHz = 2440.00000, Bandwidth MHz = 1, Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



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

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value
Start Frequency	2.43900 GHz
Stop Frequency	2.44100 GHz
Span	2.000 MHz
RBW	100.000 kHz
VBW	300.000 kHz
SweepPoints	101
Sweeptime	18.938 µs
Reference Level	0.000 dBm
Attenuation	20.000 dB
Detector	MaxPeak
SweepCount	100
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	FFT
Preamp	off
Stablemode	Trace
Stablevalue	0.50 dB
Run	6 / max. 150
Stable	5 / 5
Max Stable Difference	0.06 dB

99dBw Occupied Channel Bandwidth 99%

Limits

No Limit has been set to this test case

Modulation: BTLE 5.1 (GFSK 1 Mbit/s)

Results

Freq (MHz)	Equipment	BW (MHz)	Occ Ch BW (MHz)
2402.00000	Digital Transmission System (DTS)	1	0.66
2440.00000	Digital Transmission System (DTS)		0.66
2480.00000	Digital Transmission System (DTS)		0.67

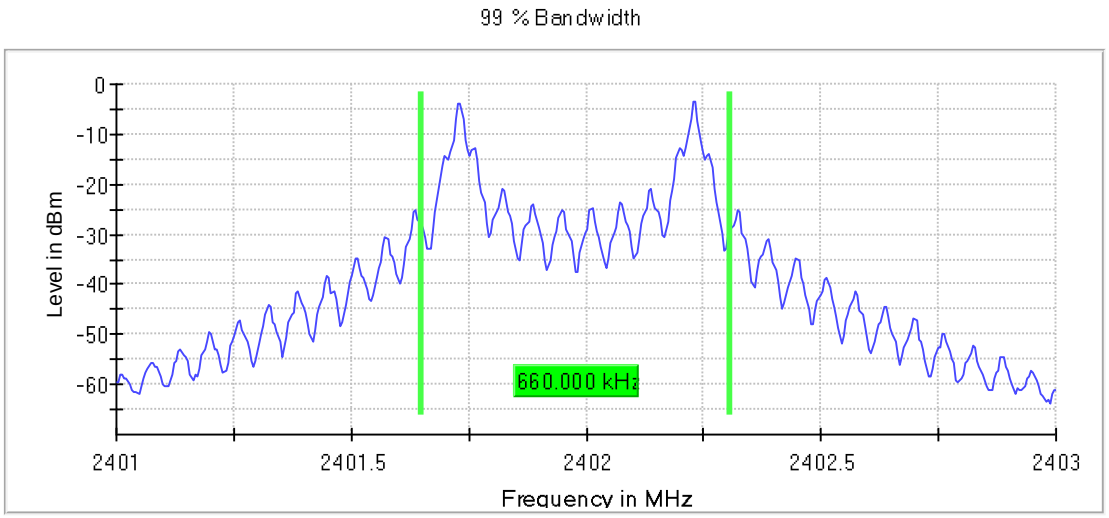
Verdict

Pass

Attachments

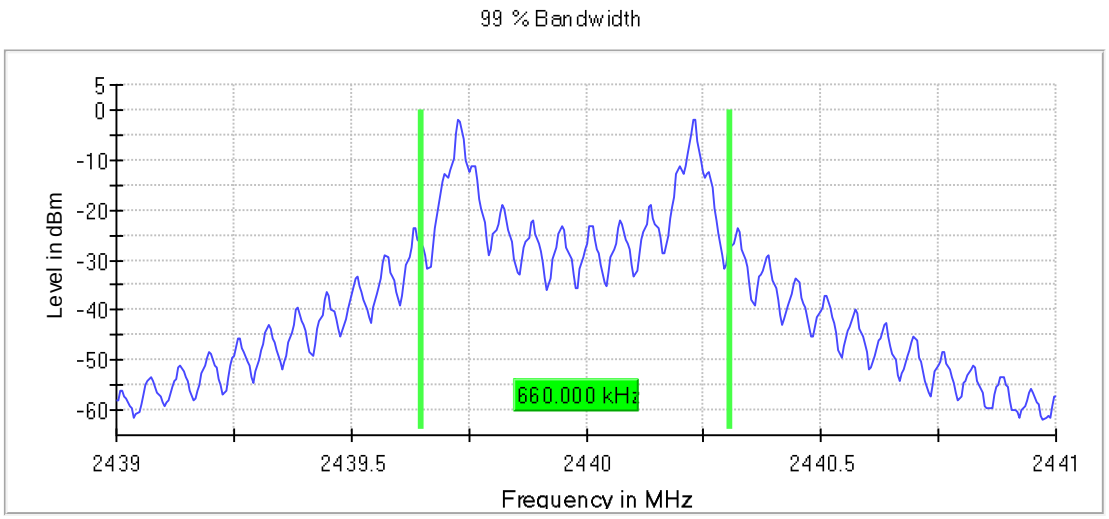
Frequency MHz = 2402.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 1, Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



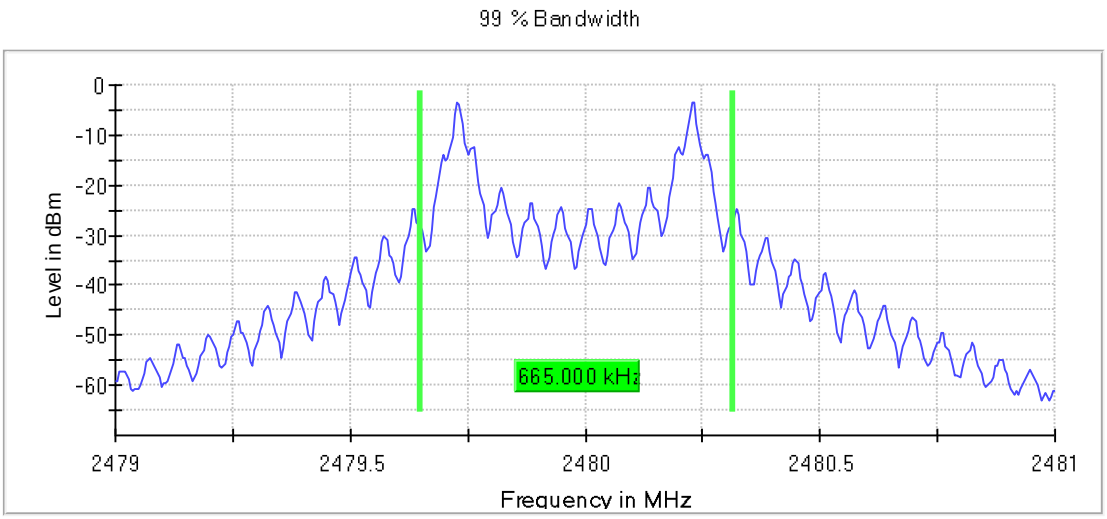
Frequency MHz = 2440.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 1, Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



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

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value
Start Frequency	2.47900 GHz
Stop Frequency	2.48100 GHz
Span	2.000 MHz
RBW	10.000 kHz
VBW	30.000 kHz
SweepPoints	400
Sweeptime	189.648 µs
Reference Level	0.000 dBm
Attenuation	20.000 dB
Detector	MaxPeak
SweepCount	100
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	FFT
Preamp	off
Stablemode	Trace
Stablevalue	0.30 dB
Run	8 / max. 150
Stable	3 / 3
Max Stable Difference	0.20 dB

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

Limits

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

Modulation: BTLE 5.1 (GFSK 1 Mbit/s)

Results

Freq (MHz)	Equipment	BW (MHz)	PSD (dBm)
2402.00000	Digital Transmission System (DTS)	1	-3.467
2440.00000	Digital Transmission System (DTS)		-1.868
2480.00000	Digital Transmission System (DTS)		-3.425

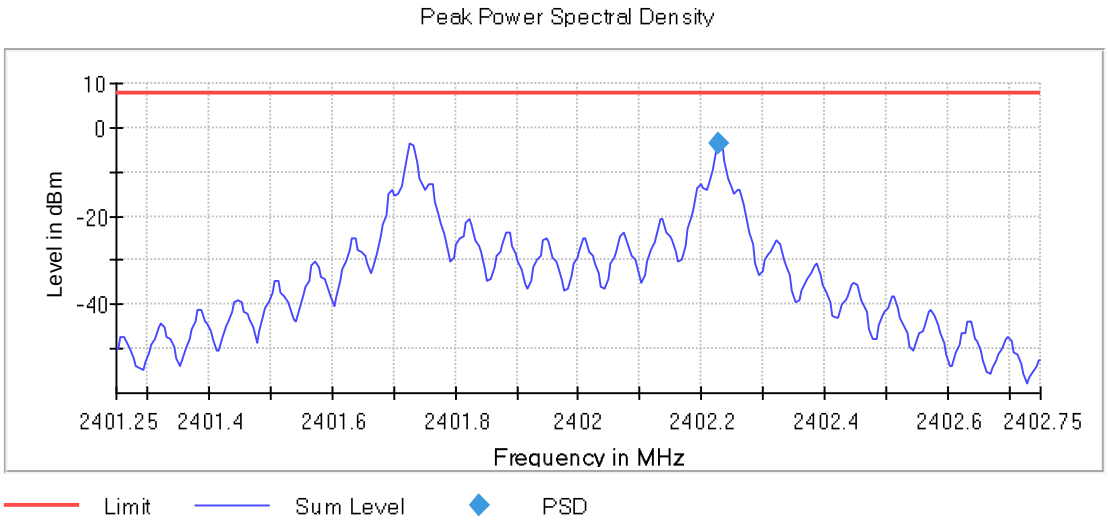
Verdict

Pass

Attachments

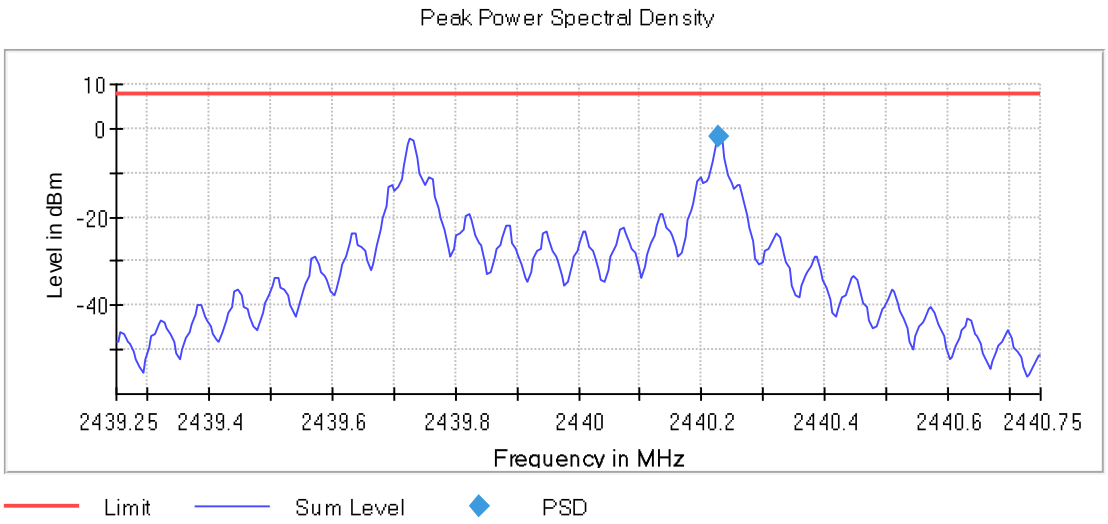
Frequency MHz = 2402.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 1, Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



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

Images:



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

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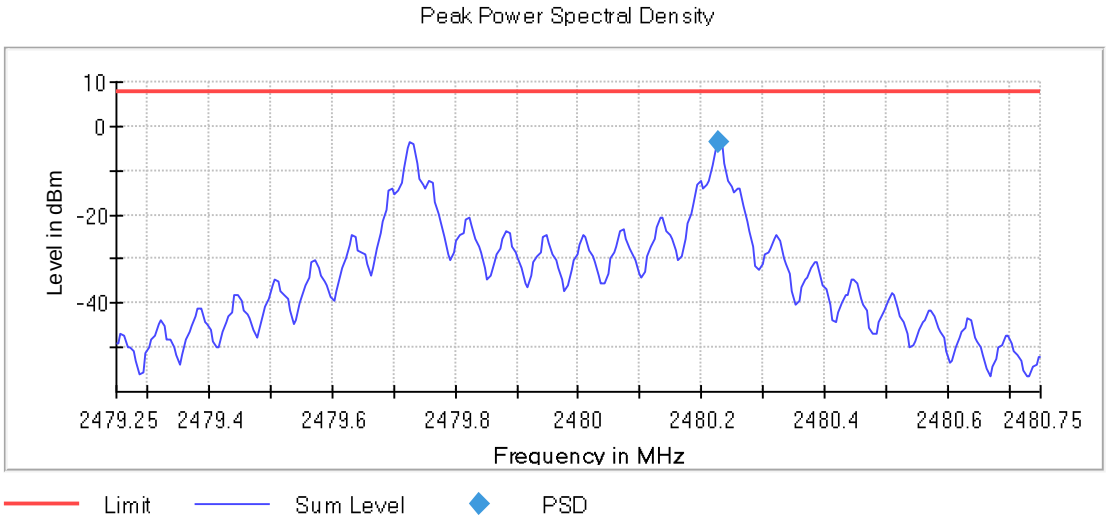


Spectrum Analyzer Parameters

Setting	Instrument Value
Start Frequency	2.47925 GHz
Stop Frequency	2.48075 GHz
Span	1.500 MHz
RBW	10.000 kHz
VBW	30.000 kHz
SweepPoints	300
Sweeptime	1.500 ms
Reference Level	0.000 dBm
Attenuation	20.000 dB
Detector	MaxPeak
SweepCount	100
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	Sweep
Preamp	off
Stablemode	Trace
Stablevalue	0.50 dB
Run	3 / max. 150
Stable	2 / 2
Max Stable Difference	0.17 dB

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

Limits

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

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

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

Maximum declared antenna gain: +0.2 dBi

Modulation: BTLE 5.1 (GFSK 1 Mbit/s)
Results

Freq (MHz)	BW (MHz)	Peak Power (dBm)	Maximum EIRP power (dBm)
2402.00000		-3.4	-3.2
2440.00000	1	-1.8	-1.6
2480.00000		-3.1	-2.9

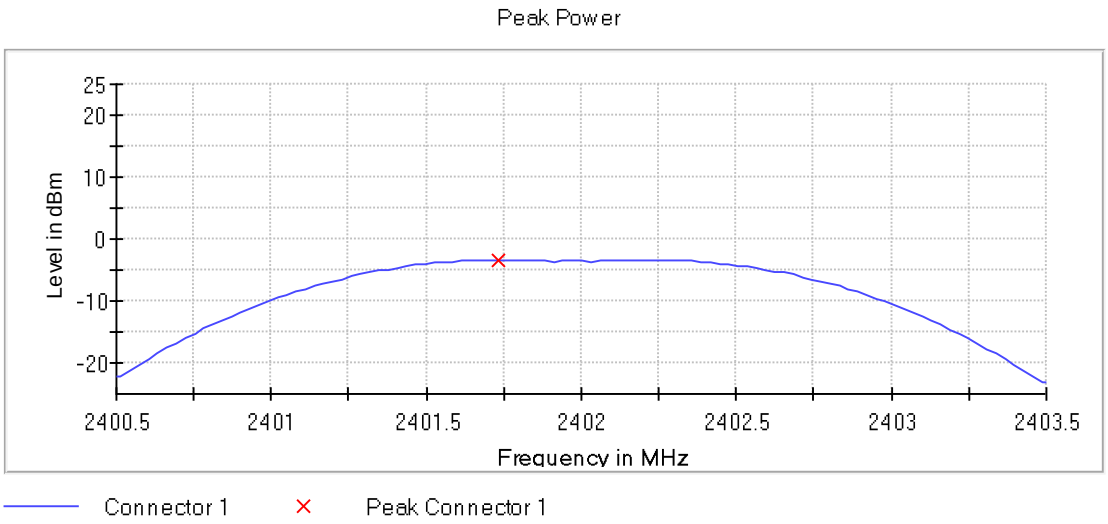
Verdict

Pass

Attachments

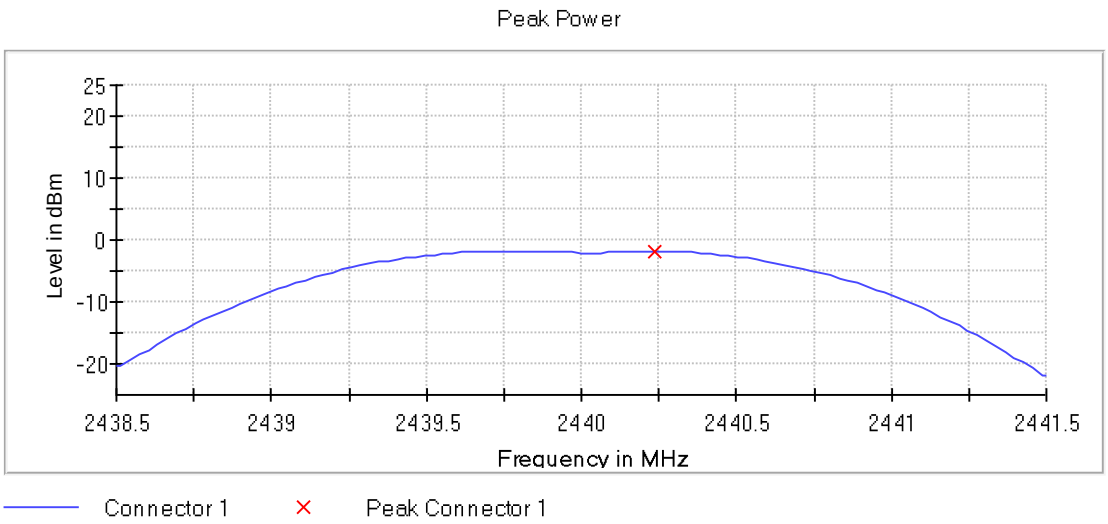
Frequency MHz = 2402.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 1, Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



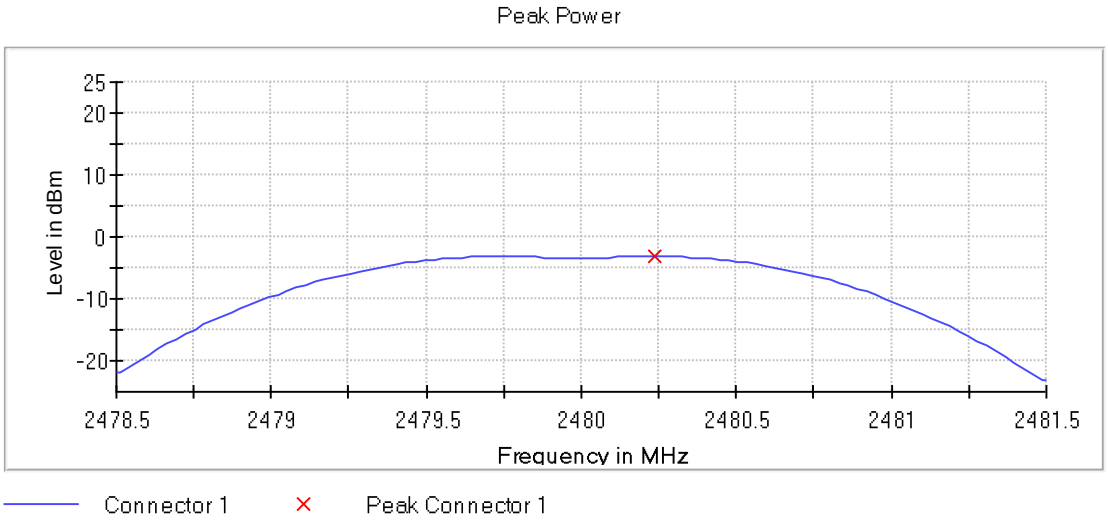
Frequency MHz = 2440.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 1, Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



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

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value
Start Frequency	2.47850 GHz
Stop Frequency	2.48150 GHz
Span	3.000 MHz
RBW	1.000 MHz
VBW	3.000 MHz
SweepPoints	101
Sweeptime	1.907 µs
Reference Level	10.000 dBm
Attenuation	30.000 dB
Detector	MaxPeak
SweepCount	100
Filter	3 dB
Trace Mode	Max Hold
Sweeptype	FFT
Preamp	off
Stablemode	Trace
Stablevalue	0.50 dB
Run	4 / max. 150
Stable	3 / 3
Max Stable Difference	0.00 dB

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

Limits

In any 100 kHz bandwidths outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Modulation: BTLE 5.1 (GFSK 1 Mbit/s)
Results

DUT Frequency	Result
2402.000000	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2318.525000	-54.8	31.3	-23.5	PASS
2318.475000	-55.0	31.5	-23.5	PASS
2326.025000	-55.0	31.5	-23.5	PASS
2381.125000	-55.1	31.7	-23.5	PASS
2310.525000	-55.2	31.7	-23.5	PASS
2311.175000	-55.2	31.7	-23.5	PASS
2388.675000	-55.3	31.8	-23.5	PASS
2399.975000	-55.3	31.8	-23.5	PASS
2312.375000	-55.3	31.8	-23.5	PASS
2315.275000	-55.3	31.9	-23.5	PASS
2326.075000	-55.3	31.9	-23.5	PASS
2325.425000	-55.3	31.9	-23.5	PASS
2388.725000	-55.4	31.9	-23.5	PASS
2368.225000	-55.4	31.9	-23.5	PASS
2373.075000	-55.4	31.9	-23.5	PASS

DUT Frequency	Result
2480.000000	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2491.975000	-54.3	31.1	-23.2	PASS
2491.925000	-54.4	31.2	-23.2	PASS
2486.125000	-55.3	32.0	-23.2	PASS
2483.825000	-55.3	32.1	-23.2	PASS
2490.275000	-55.4	32.1	-23.2	PASS
2486.075000	-55.4	32.2	-23.2	PASS
2485.925000	-55.4	32.2	-23.2	PASS
2487.625000	-55.5	32.3	-23.2	PASS
2490.325000	-55.6	32.4	-23.2	PASS
2485.325000	-55.6	32.4	-23.2	PASS
2487.575000	-55.7	32.5	-23.2	PASS
2487.525000	-55.8	32.5	-23.2	PASS
2485.275000	-55.8	32.5	-23.2	PASS
2485.875000	-55.9	32.6	-23.2	PASS
2497.075000	-55.9	32.7	-23.2	PASS

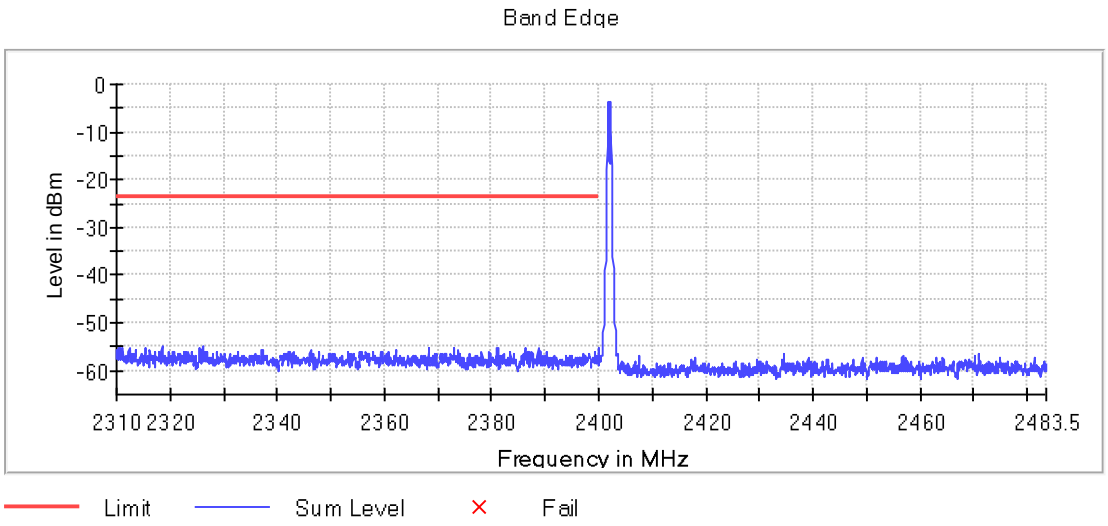
Verdict

Pass

Attachments

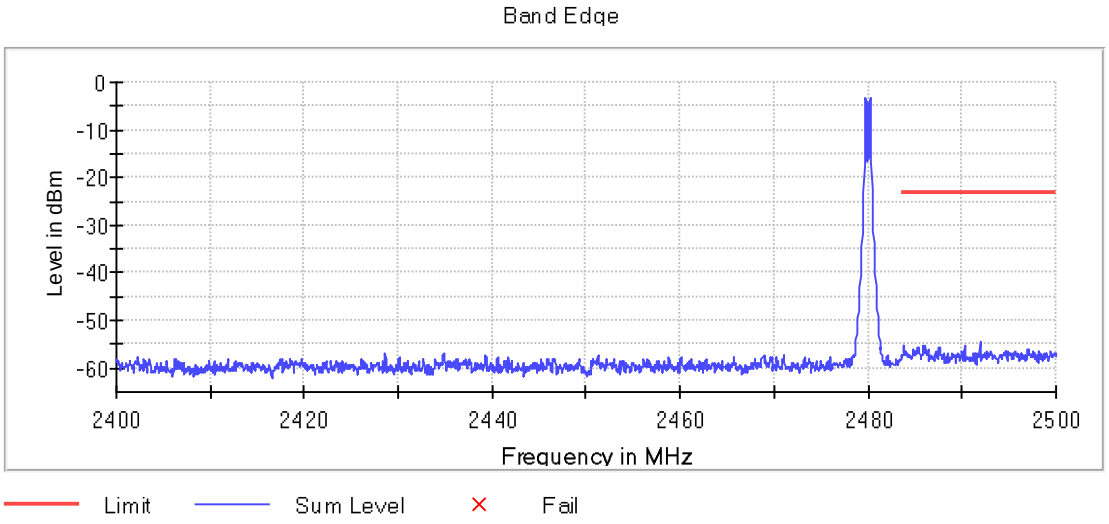
Frequency MHz = 2402.00000, Equipment Type = Digital Transmission System (DTS), Bandwidth MHz = 1, Modulation = BTLE 5.1 (GFSK 1 Mbit/s)

Images:



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

Images:



Spectrum Analyzer Parameters

Setting	Instrument Value 1	Instrument Value 2
Start Frequency	2.31000 GHz	2.40000 GHz
Stop Frequency	2.40000 GHz	2.48350 GHz
Span	90.000 MHz	83.500 MHz
RBW	100.000 kHz	100.000 kHz
VBW	300.000 kHz	300.000 kHz
SweepPoints	1800	1670
Sweeptime	113.672 µs	94.727 µs
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	20.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	FFT
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	4 / max. 150	4 / max. 150
Stable	3 / 3	3 / 3
Max Stable Difference	0.00 dB	0.03 dB

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

Limits

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

Modulation: BTLE 5.1 (GFSK 1 Mbit/s)

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

Verdict

Pass

DUT Frequency (MHz)	Result
2402.000000	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
14411.652465	-42.9	13.7	-29.2	PASS
12013.029431	-50.7	21.5	-29.2	PASS
7205.789099	-51.2	22.0	-29.2	PASS
19218.892796	-52.3	23.1	-29.2	PASS
19208.898534	-53.0	23.8	-29.2	PASS
4807.166065	-53.8	24.6	-29.2	PASS
21617.515831	-58.0	28.8	-29.2	PASS
2395.021008	-59.9	30.7	-29.2	PASS
9604.412133	-66.5	37.3	-29.2	PASS
16820.269762	-71.0	41.8	-29.2	PASS
16810.275499	-71.9	42.7	-29.2	PASS
20108.382172	-73.2	44.0	-29.2	PASS
19748.588717	-73.4	44.2	-29.2	PASS
19788.565767	-73.4	44.3	-29.2	PASS
19048.990331	-73.5	44.3	-29.2	PASS

DUT Frequency (MHz)	Result
2440.000000	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
14641.520506	-43.3	9.9	-33.3	PASS
12202.920421	-45.2	11.9	-33.3	PASS
7315.725988	-51.5	18.2	-33.3	PASS
7325.720251	-51.9	18.6	-33.3	PASS
19518.720676	-52.6	19.2	-33.3	PASS
4877.125903	-60.1	26.7	-33.3	PASS
21957.320761	-62.4	29.1	-33.3	PASS
17080.120591	-63.5	30.2	-33.3	PASS
9754.326073	-68.2	34.8	-33.3	PASS
9764.320336	-69.3	36.0	-33.3	PASS
19378.800999	-71.6	38.3	-33.3	PASS
19828.542818	-72.5	39.2	-33.3	PASS
19778.571504	-72.6	39.3	-33.3	PASS
16040.717276	-73.1	39.7	-33.3	PASS
20168.347748	-73.1	39.8	-33.3	PASS

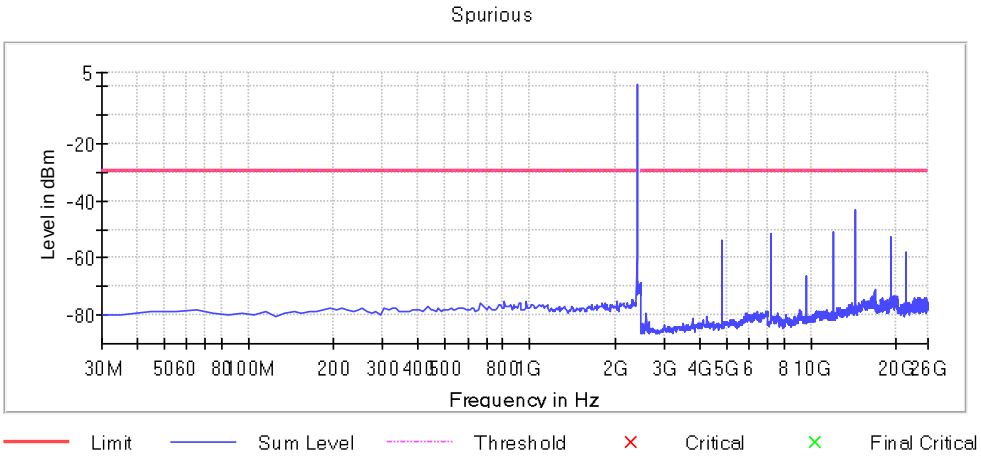
DUT Frequency (MHz)	Result
2480.000000	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
12402.805674	-42.6	9.4	-33.2	PASS
14881.382809	-44.7	11.4	-33.2	PASS
7445.651402	-52.9	19.7	-33.2	PASS
7435.657140	-53.2	20.0	-33.2	PASS
19838.537080	-54.2	21.0	-33.2	PASS
4957.080004	-63.2	30.0	-33.2	PASS
17359.959945	-64.2	30.9	-33.2	PASS
22317.114216	-64.2	30.9	-33.2	PASS
22327.108479	-65.0	31.7	-33.2	PASS
9924.228538	-69.8	36.5	-33.2	PASS
9914.234275	-70.1	36.9	-33.2	PASS
16380.522206	-72.9	39.7	-33.2	PASS
19348.818211	-73.0	39.8	-33.2	PASS
19818.548555	-73.1	39.8	-33.2	PASS
19378.800999	-73.2	40.0	-33.2	PASS

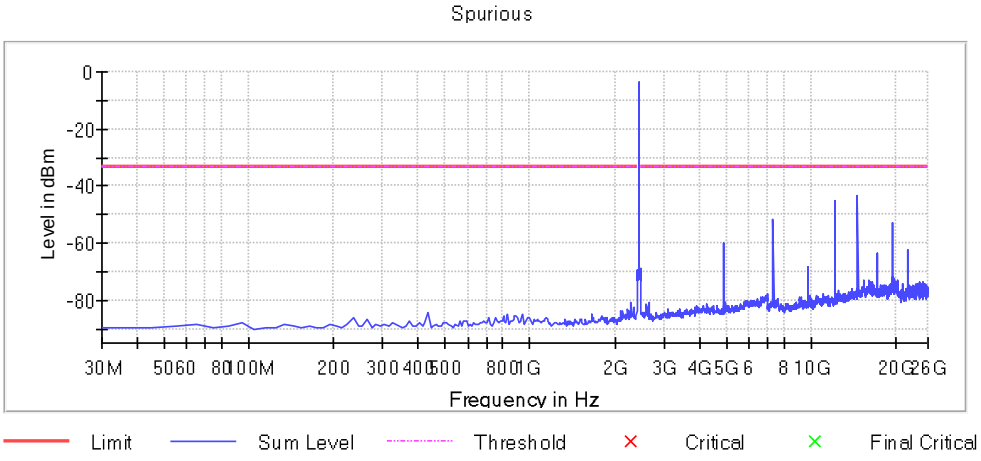
Results

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

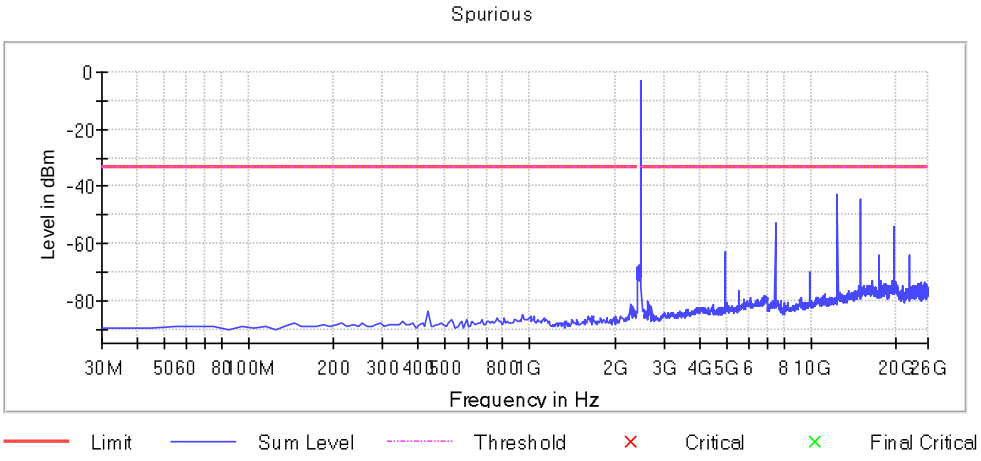
Lowest Channel (2402 MHz)



Middle Channel (2440 MHz)



Highest Channel (2480 MHz)



Spectrum Analyzer Parameters

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

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

Limits

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

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

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

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

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

Verdict

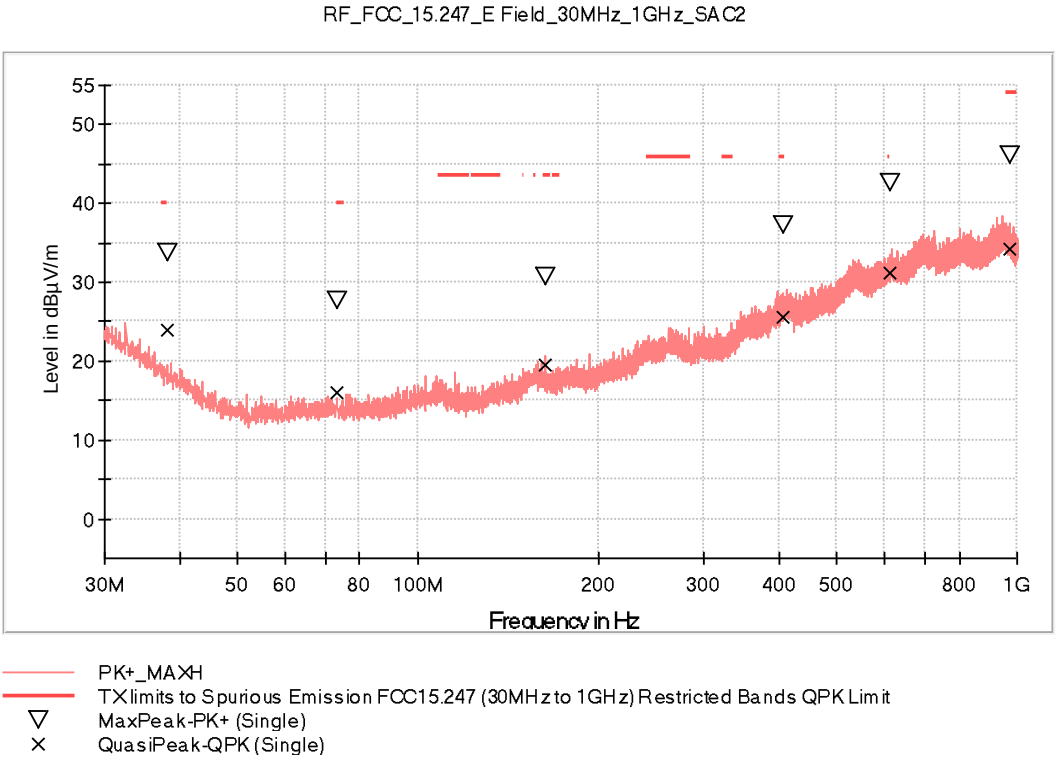
Pass

Modulation: BTLE 5.1 (GFSK 1 Mbit/s)
Results

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

Middle Channel

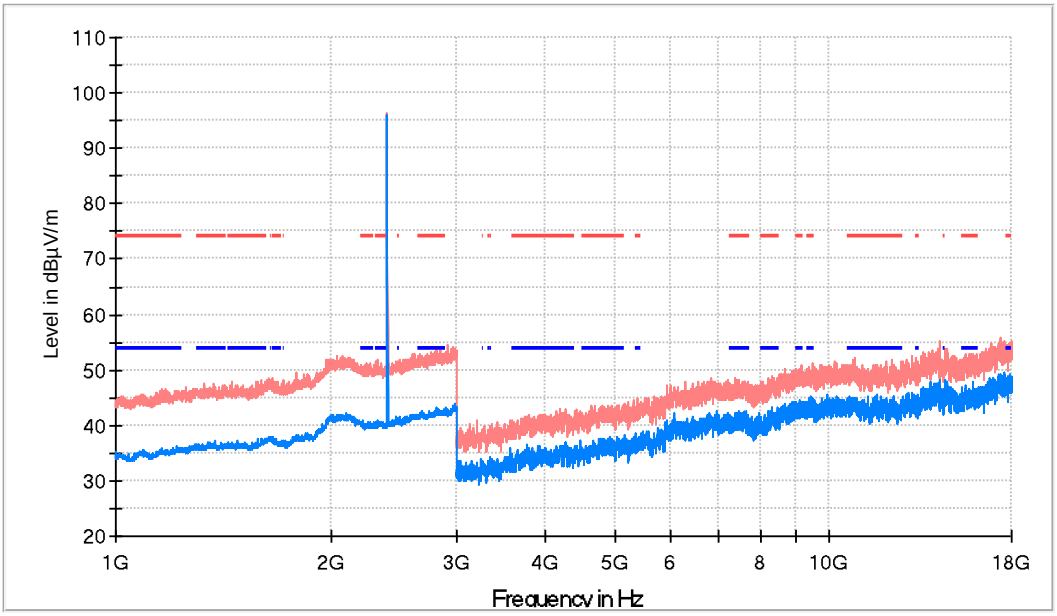
Frequency MHz = 2402.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BTLE 5.1 (GFSK 2 Mbit/s), Frequency Range GHz = [0.03, 1]



Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Pol	Margin - QPK (dB)	Limit - QPK (dBµV/m)
38.148000	33.8	24.0	H	16.0	40.0
73.262000	27.6	16.1	V	23.9	40.0
162.599000	30.8	19.5	V	24.1	43.5
406.796500	37.2	25.7	V	20.3	46.0
612.921500	42.7	31.1	H	14.9	46.0
969.881500	46.1	34.2	H	19.8	54.0

Frequency range 1 - 18 GHz

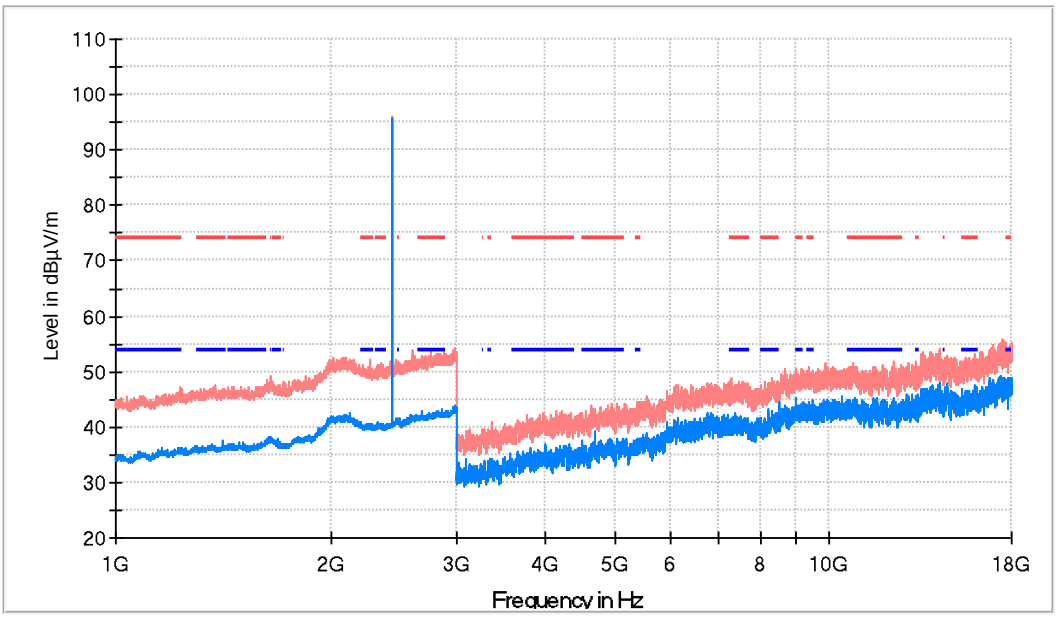
Lowest Channel
Frequency MHz = 2402.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BTLE 5.1 (GFSK 2 Mbit/s), Frequency Range GHz = [1, 18]



Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
2807.000000	51.5	43.2	V	10.8	54.0
11635.500000	50.2	45.4	V	8.6	54.0
17937.000000	54.4	49.1	H	4.9	54.0

Frequency range 1 - 18 GHz

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

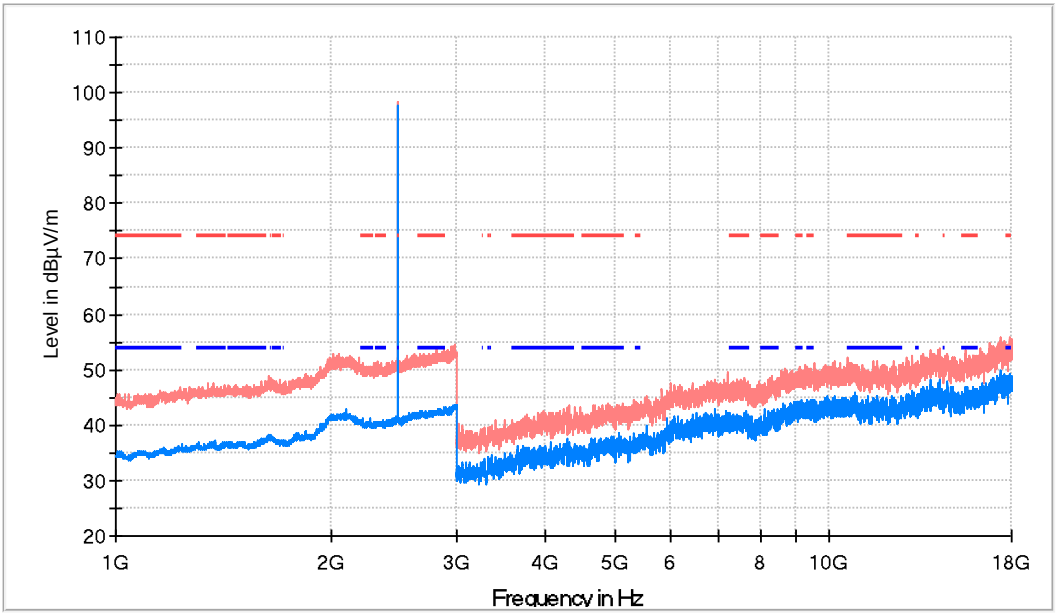


Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
2873.000000	51.7	43.2	V	10.8	54.0
12287.000000	50.1	45.3	H	8.7	54.0
17936.500000	52.9	49.0	H	5.0	54.0

Frequency range 1 - 18 GHz

Highest Channel

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

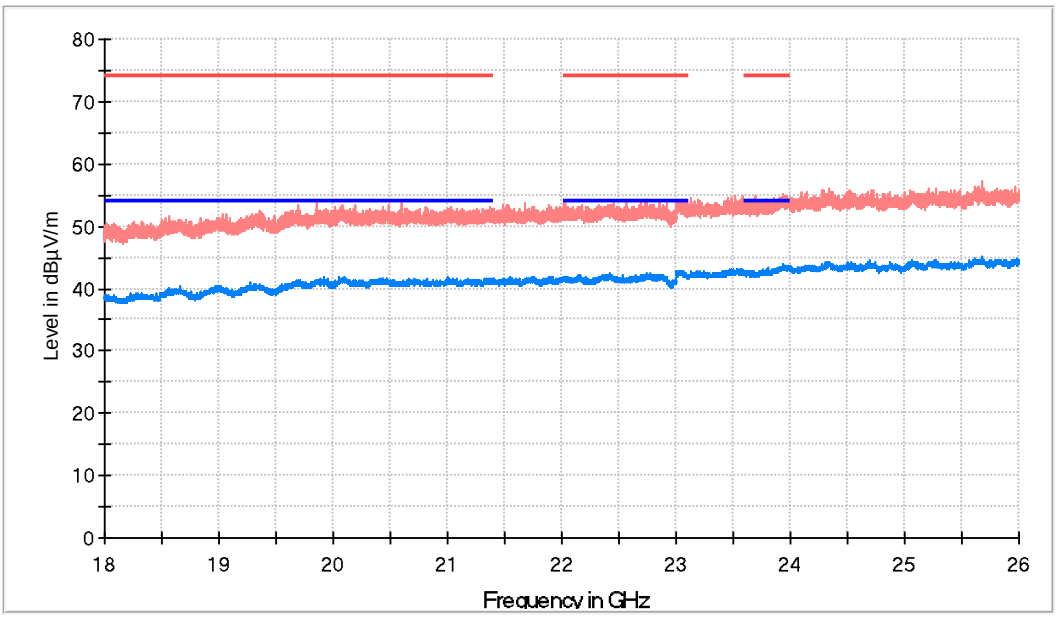


Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
2899.000000	51.9	43.1	V	10.9	54.0
10840.50000	49.8	45.9	H	8.1	54.0
17938.00000	53.1	49.3	V	4.7	54.0

Frequency range 18 - 26 GHz

Lowest Channel

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

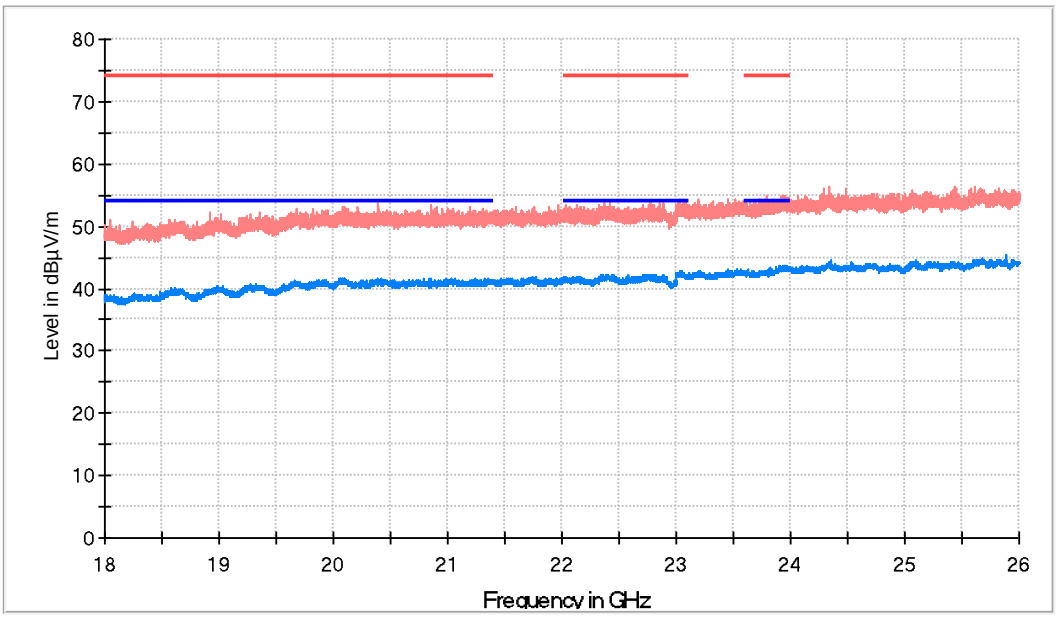


Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
19855.000000	53.9	41.2		12.8	54.0
23007.000000	54.3	42.5		11.5	54.0
23928.000000	55.1	43.2		10.8	54.0

Frequency range 18 - 26 GHz

Middle Channel

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

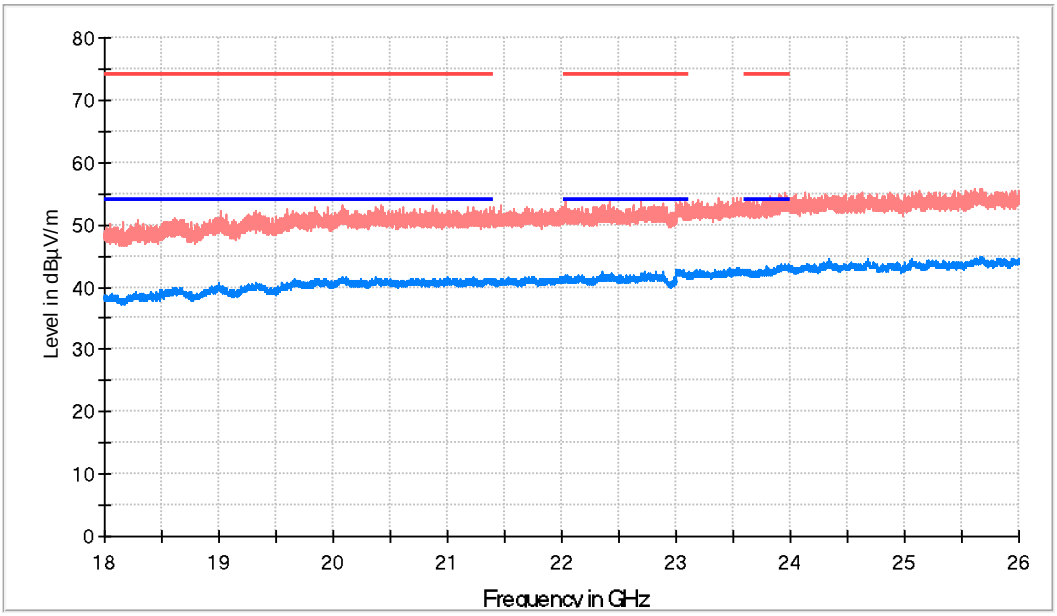


Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
20395.000000	53.7	41.6		12.4	54.0
23065.500000	54.3	42.3		11.7	54.0
23940.500000	55.0	43.2		10.8	54.0

Frequency range 18 - 26 GHz

Highest Channel

Frequency MHz = 2480.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BTLE 5.1 (GFSK 1 Mbit/s), Frequency Range GHz = [18, 26]

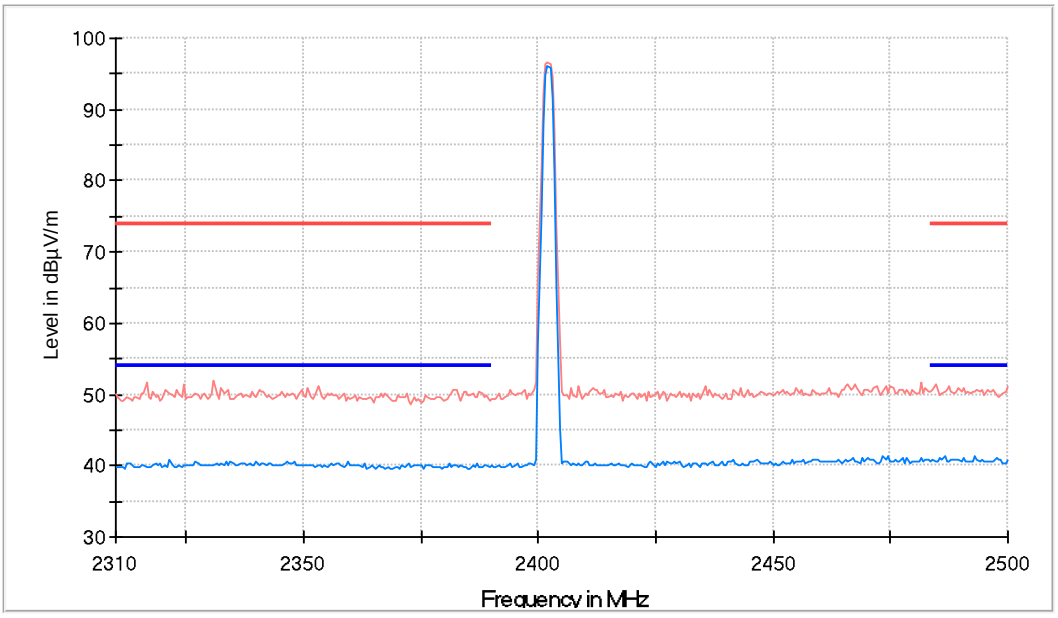


Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
20424.000000	53.3	40.8		13.2	54.0
23029.500000	54.2	42.0		12.0	54.0
23959.500000	55.2	43.0		11.0	54.0

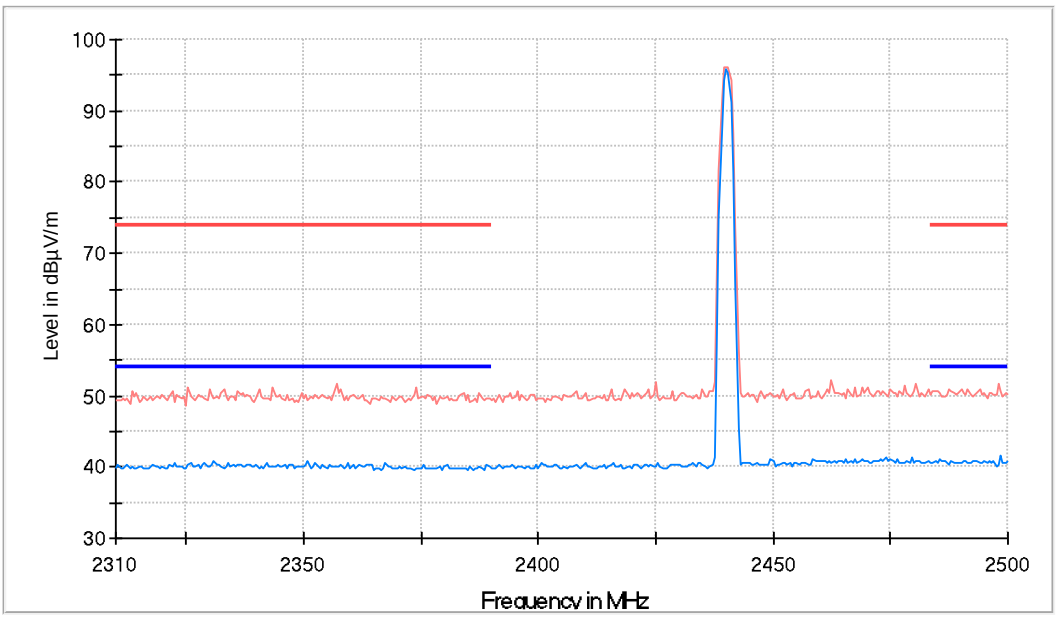
Restricted Bands (2.31 GHz - 2.5 GHz)

Lowest Channel

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

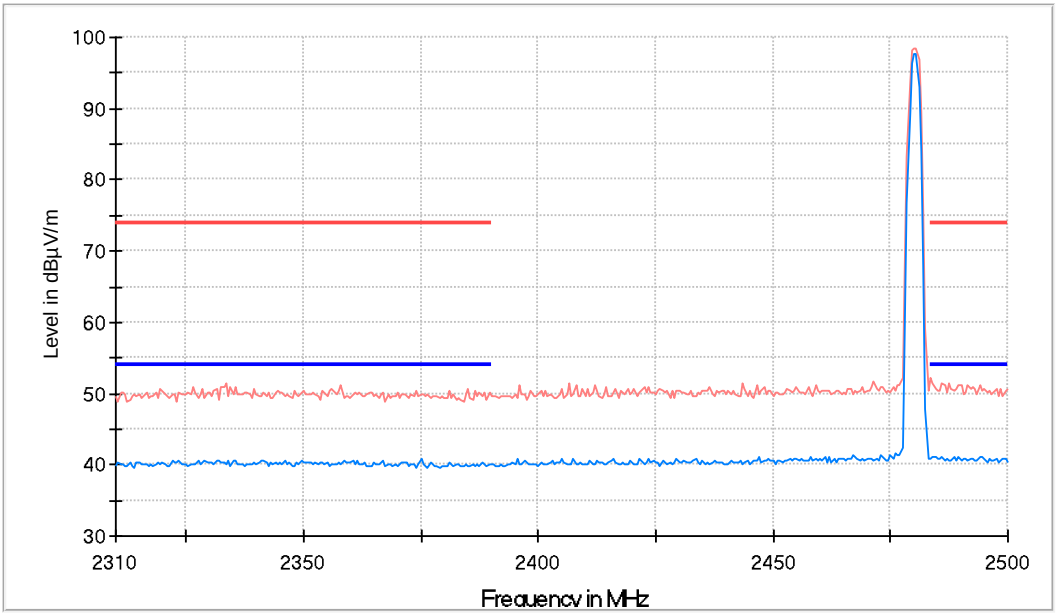


Middle Channel
Frequency MHz = 2440.00000, Equipment Type = Frequency Hopping Spread Spectrum systems (DSS), Modulation = BTLE 5.1 (GFSK 2 Mbit/s), Frequency Range GHz = [1, 18]



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

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



Spectrum Analyzer Parameters

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

Spectrum Analyzer Parameters

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

Spectrum Analyzer Parameters

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