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

Test Report No:
NIE: 67442RRF.003

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

(*) Identification of item tested	Communications device
(*) Trademark	Ring LLC
(*) Model and /or type reference	5AT3T3
Other identification of the product	FCC ID: 2AEUPBHAXN001 IC: 20271-BHAXN001
(*) Features	--
Applicant	Ring LLC 1523 26th Street, Santa Monica, 90404, California, United States
Test method requested, standard	USA FCC Part 15.247 (10-1-20 Edition): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (10-1-20 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)	José Manuel Gómez Industrial & Automotive EMC Lab. Manager  Firmado digitalmente por 53680346W JOSE MANUEL GOMEZ (C:A29507456) Fecha: 2021.08.26 10:58:51 +02'00'
Date of issue	2021-08-26
Report template No	FDT08_23 (*) "Data provided by the client"

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

DEKRA Testing and Certification S.A.U. is an ISED-recognized accredited testing laboratory, CABid: ES1909, 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.

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

Uncertainty

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

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 of the model number 5AT3T3 is a communications device.

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.

Usage of samples

Samples under test have been selected by: The client.

- Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Reception
67442/036	Communications Device	5AT3T3	GCB1ES0011370003	2021/06/01
67442/037	AC/DC Power Adapter	DSA-36PDB FUS	GB51PR0110770SEX	2021/06/01

Sample S/01 has undergone the test(s): The tests indicated in the Appendix A.

Test sample description

Ports…… :	Port name and description	Cable					
		Specified max length [m]	Attached during test	Shielded	Coupled to patient		
	AC power port	>3m	Yes	No			
	USB power port	<3m	Yes	Yes			
	Ethernet ports	>3m	Yes	No			
Supplementary information to the ports…… :							
Rated power supply .....:	Voltage and Frequency			Reference poles			
				L1	L2	L3	N	PE
	X	AC: 110V (60Hz).		X			X	
	X	DC: 12V, 3A						
Rated Power .....:	Not provided.						
Clock frequencies.....:	Not provided.						
Other parameters .....:	Not provided.						
Software version .....:	Not provided.						
Hardware version .....:	Not provided.						
Dimensions in cm (W x H x D) ....:	Not provided.						
Mounting position .....:	X	Table top equipment					
		Wall/Ceiling mounted equipment					
		Floor standing equipment					
		Hand-held equipment					
		Other:					
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	

(3) Only for Medical Equipment

Identification of the client

Ring LLC

1523 26th Street, Santa Monica, 90404, California, United States

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2021-06-15
Date (finish)	2021-06-21

Document history

Report number	Date	Description
67442RRF.003	2021-08-26	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: Daniel Mejías, Antonio Manuel Sánchez and Jaime Barranquero.

Used instrumentation:

Conducted Measurements:

		Last Calibration	Due Calibration
1.	Spectrum Analyzer 9kHz-6GHz ROHDE AND SCHWARZ FSL6	2021/04	2023/04

Radiated Measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber VI ALBATROSS P29419	2020/01	2023/01
2.	Shielded Room ALBATROSS PROJECTS GMBH P29419	N/A	N/A
3.	Ultralog Antenna 30MHz-6GHz, ROHDE AND SCHWARZ HL562E_UPG	2019/10	2022/10
4.	EMI Test Receiver 2Hz-44GHz, ROHDE AND SCHWARZ ESW44	2019/10	2021/10
5.	Horn Antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2019/11	2022/11
6.	Preamplifier 30 dB 500MHz-18GHz, SCHWARZBECK BBV 9718 C	2021/02	2022/02

Testing verdicts

Not applicable:	N/A
Pass:	P
Fail:	F
Not measured:	N/M

Summary

1. SRD 915 MHz: FSK-FHSS (50 Kbps, 150 Kbps, 250 Kbps).

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		**Verdict**	**Remark**
FCC 15.247 (a)(1) / RSS-247 5.1. (a)	20 dB Bandwidth and Carrier frequency separation	P	
FCC 15.247 (a)(1)(i) / RSS-247 5.1. (c)	Number of hopping channels	P	
FCC 15.247 (a)(1)(i) / RSS-247 5.1. (c)	Time of occupancy (Dwell Time)	P	
FCC 15.247 (b) / RSS-247 5.4. (a)	Maximum output power and antenna gain	P	
FCC 15.247 (d) / RSS-247 5.5.	Band-edge compliance of conducted emissions (Transmitter)	P	
FCC 15.247 (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	
Supplementary information and remarks: None.			

Appendix A: Test results

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TEST CONDITIONS

(*) Declared by the Client.

POWER SUPPLY (*):

Vnominal:	110 Vac
Type of Power Supply:	AC/DC Adapter.

ANTENNA (*):

Type of Antenna:	Integral (stamped metal).
Maximum Declared Antenna Gain:	+4.1 dBi

TEST FREQUENCIES AND POWER SETTINGS:

	Low 902.2 MHz	Middle 915 MHz	High 927.8 MHz
FSK 50 Kbps	18 dBm	18 dBm	17 dBm

	Low 902.4 MHz	Middle 914.8 MHz	High 927.6 MHz
FSK 150 Kbps	20 dBm	20 dBm	20 dBm

	Low 902.5 MHz	Middle 915 MHz	High 927.5 MHz
FSK 250 Kbps	20 dBm	20 dBm	20 dBm

HOPPING CHANNELS:

- FSK-FHSS 50 Kbps: The equipment can operate as a FHSS system using 129 hopping channels.
- FSK-FHSS 150 Kbps: The equipment can operate as a FHSS system using 64 hopping channels.
- FSK-FHSS 250 Kbps: The equipment can operate as a FHSS system using 51 hopping channels.

CONDUCTED MEASUREMENTS:

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

RADIATED MEASUREMENTS:

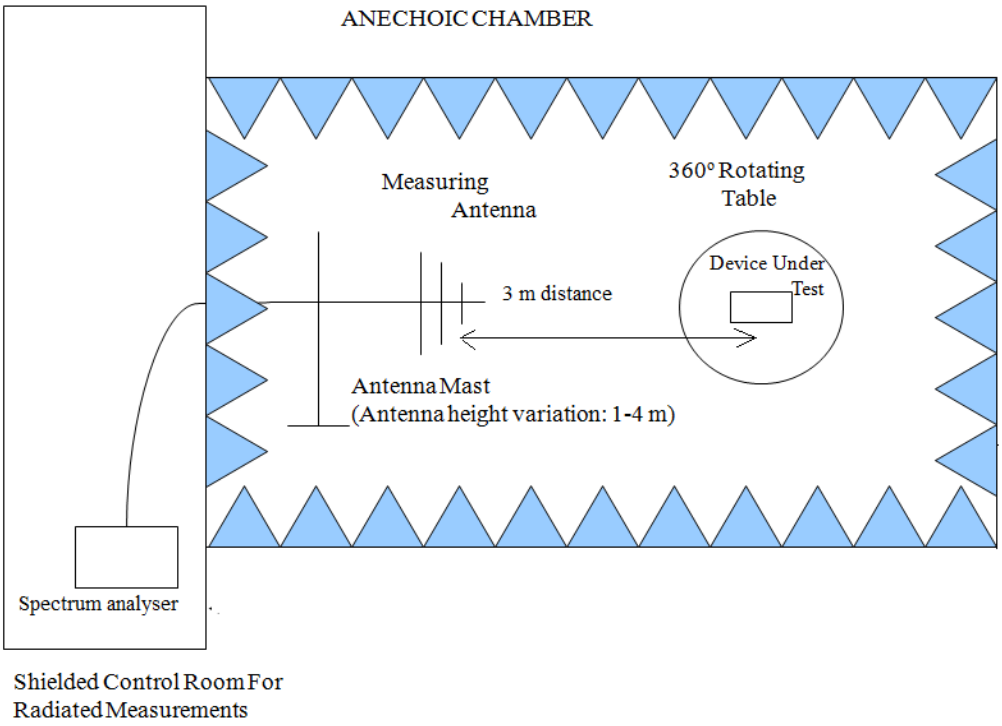
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz and 1 GHz-10 GHz Double ridge horn antenna) is situated at a distance of 3 m.

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.

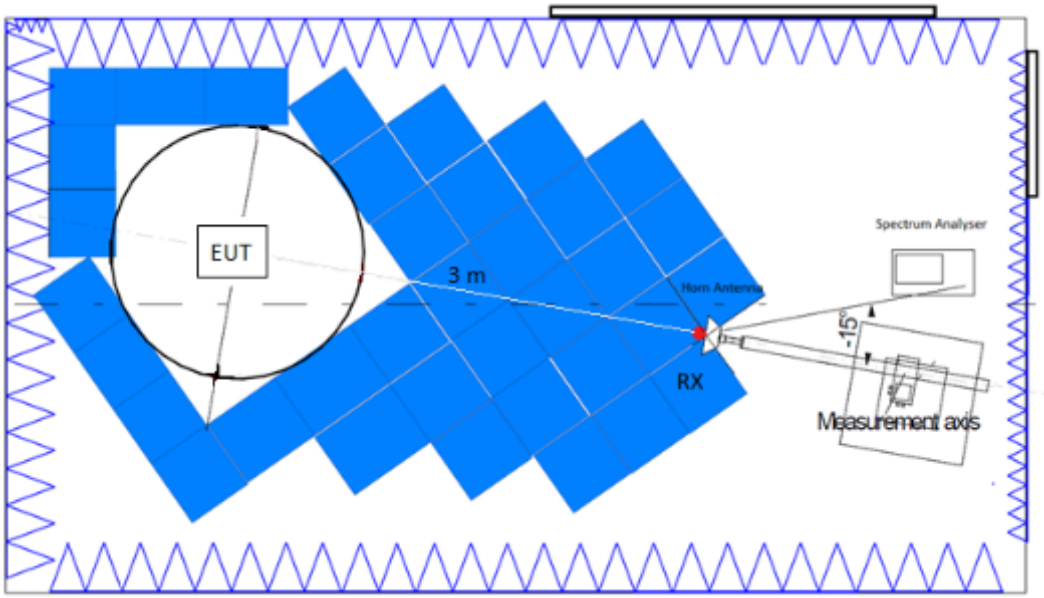
Measurements were made in both horizontal and vertical planes of polarization.

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 10 GHz:



Occupied Bandwidth

SPECIFICATION:

FCC §2.1049. Measurements required: Occupied bandwidth.

RSS-Gen Clause 6.7.

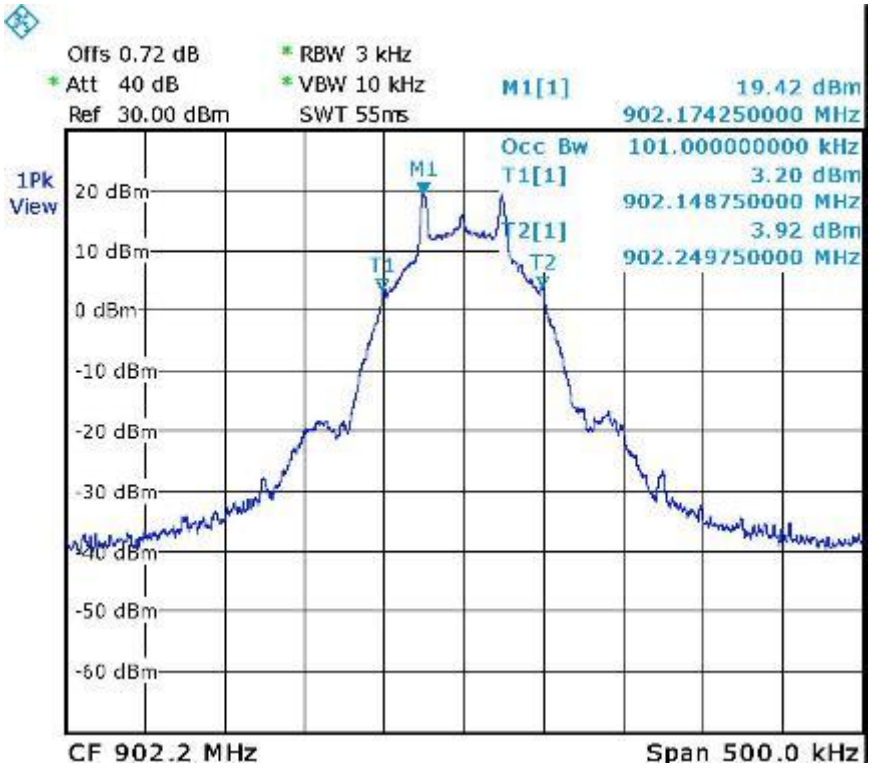
RESULTS:

- **FSK 50 Kbps:**

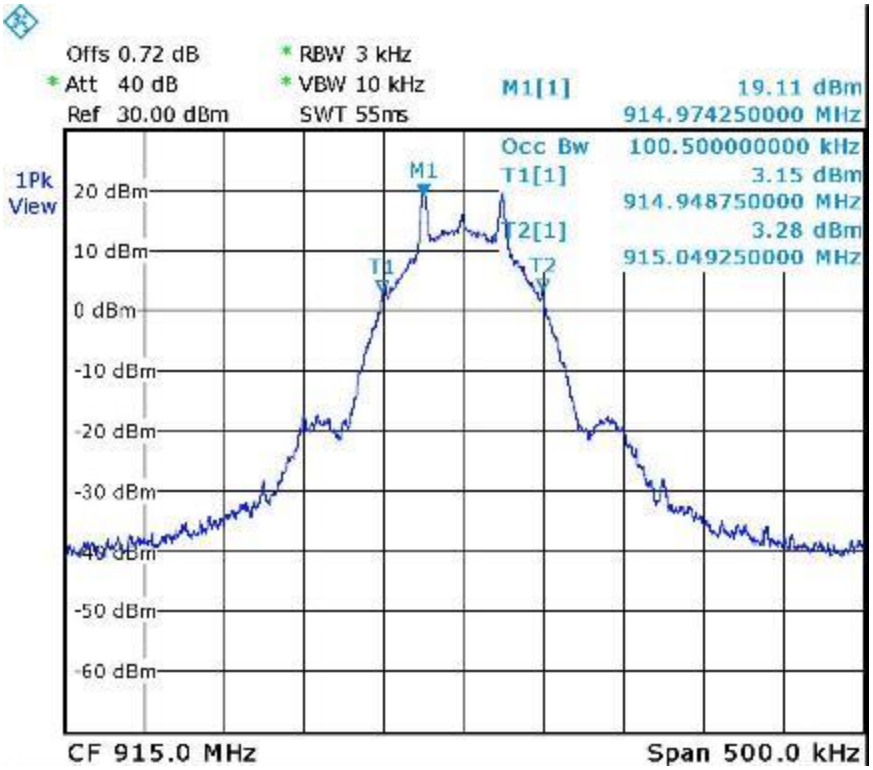
	Low Channel	Middle Channel	High Channel
99% Bandwidth (kHz)	101	100.5	105
-26 dBc Bandwidth (kHz)	121.76	123.58	122.64
Measurement uncertainty (kHz)	<± 0.64		

Verdict: PASS

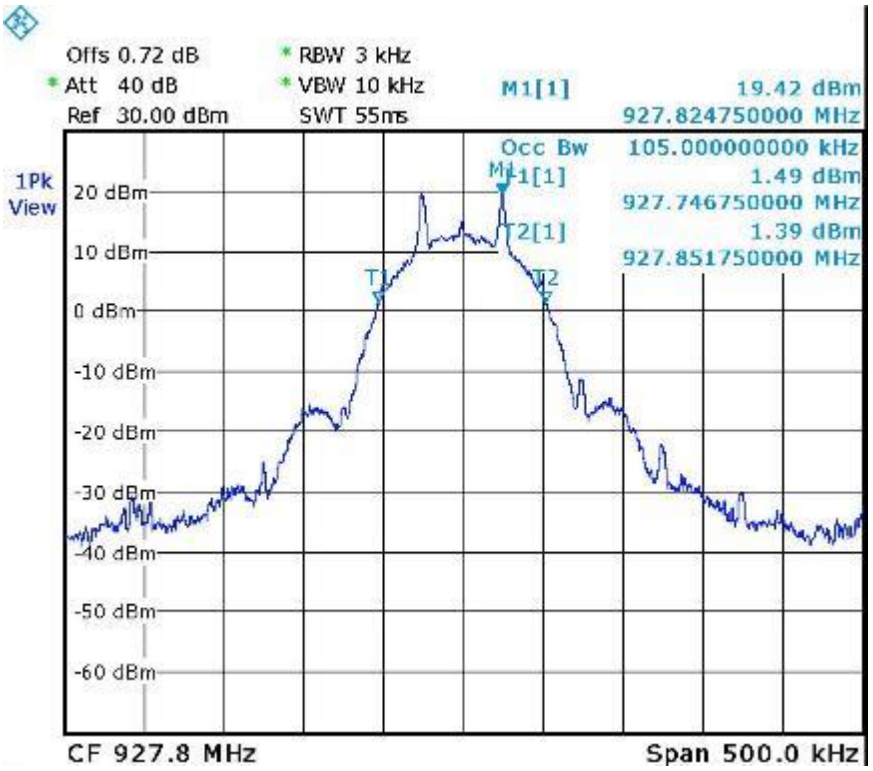
Low Channel:



Middle Channel:



High Channel:

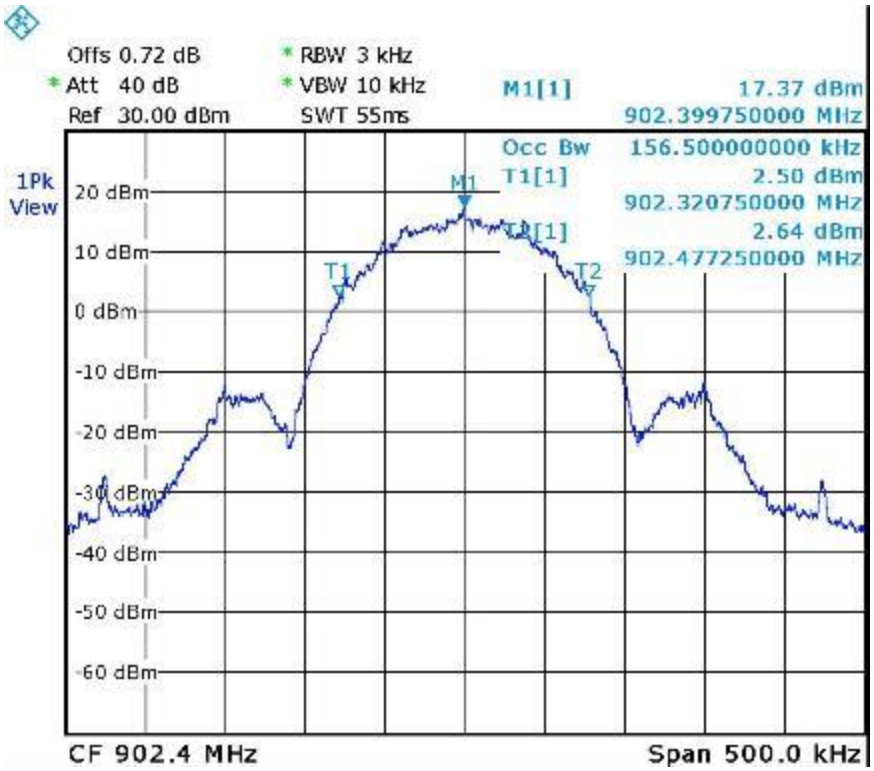


- **FSK 150 Kbps:**

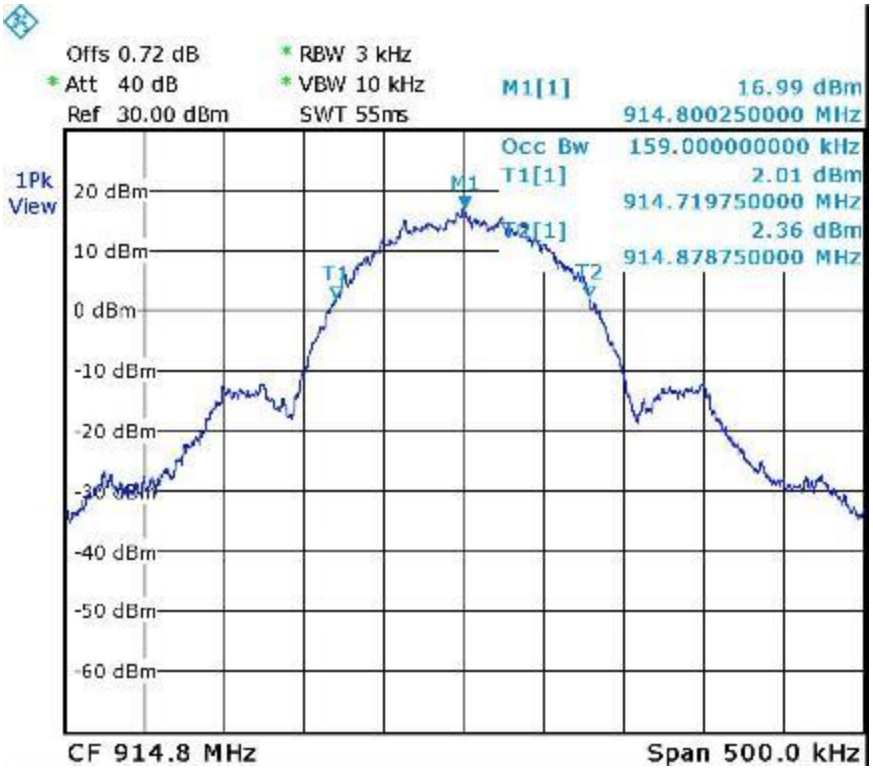
	Low Channel	Middle Channel	High Channel
99% Bandwidth (kHz)	156.5	159	156.5
-26 dBc Bandwidth (kHz)	194.6	194.08	195.61
Measurement uncertainty (kHz)	<± 0.64		

Verdict: PASS

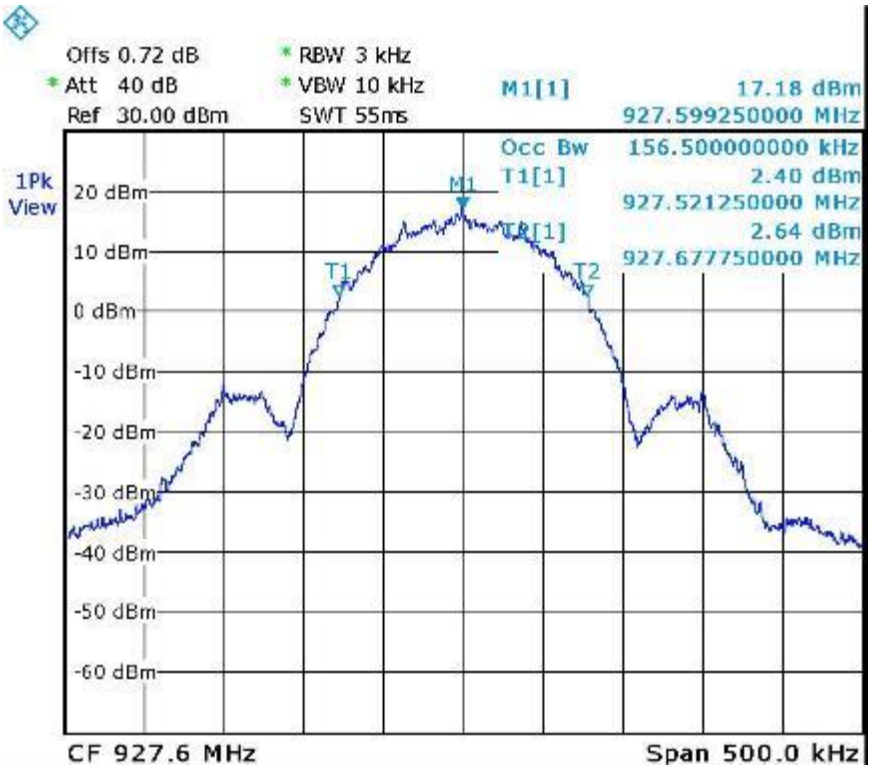
Low Channel:



Middle Channel:



High Channel:

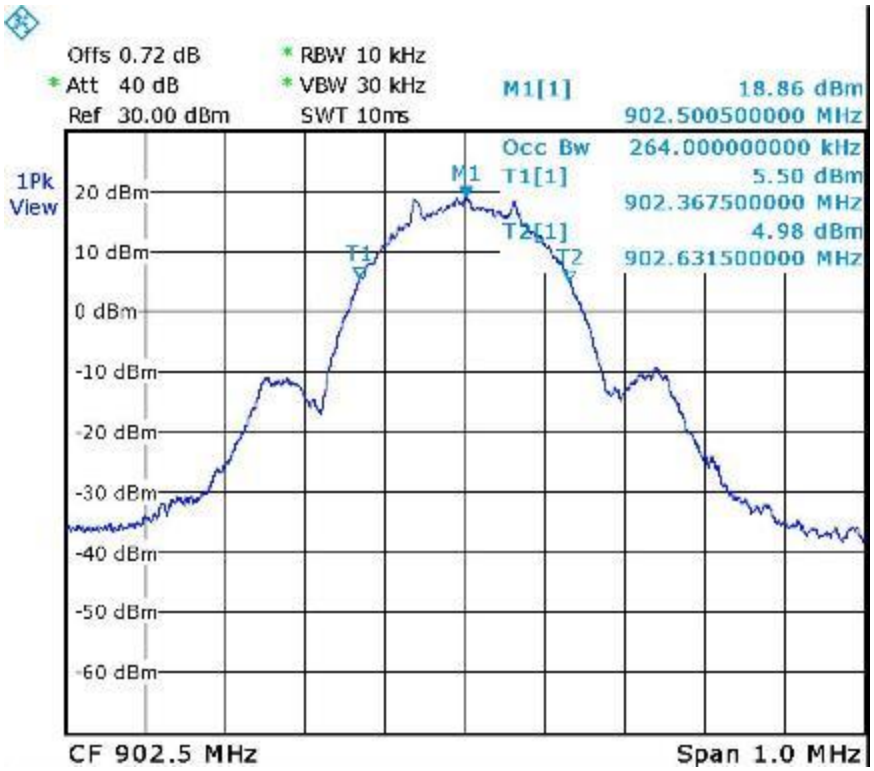


- **FSK 250 Kbps:**

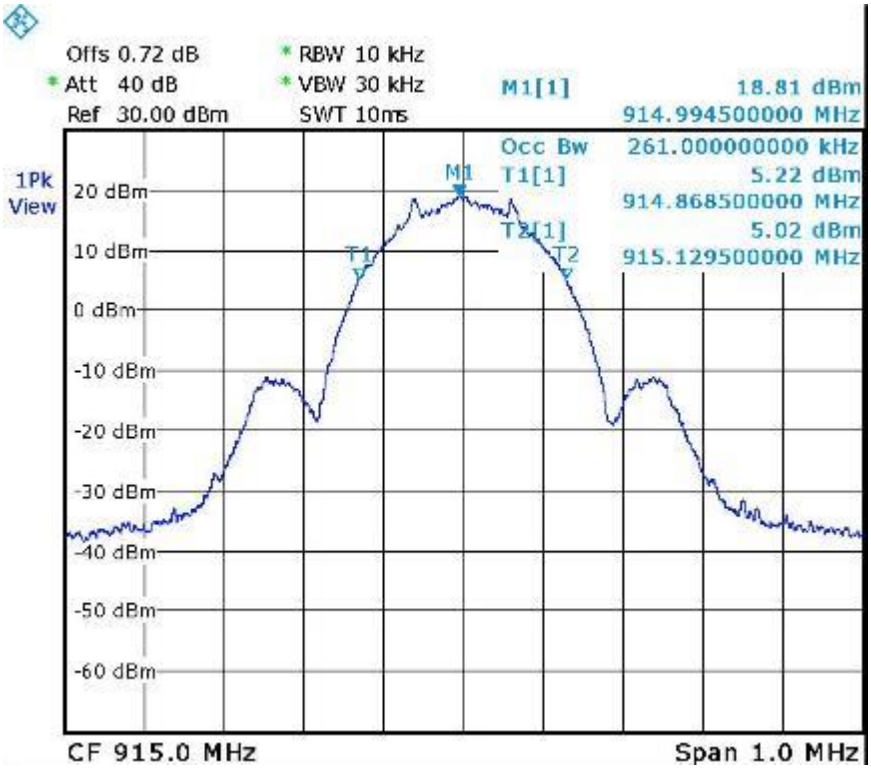
	Low Channel	Middle Channel	High Channel
99% Bandwidth (kHz)	264	261	259
-26 dBc Bandwidth (kHz)	332.8	332.7	326.8
Measurement uncertainty (kHz)	<± 1.75		

Verdict: PASS

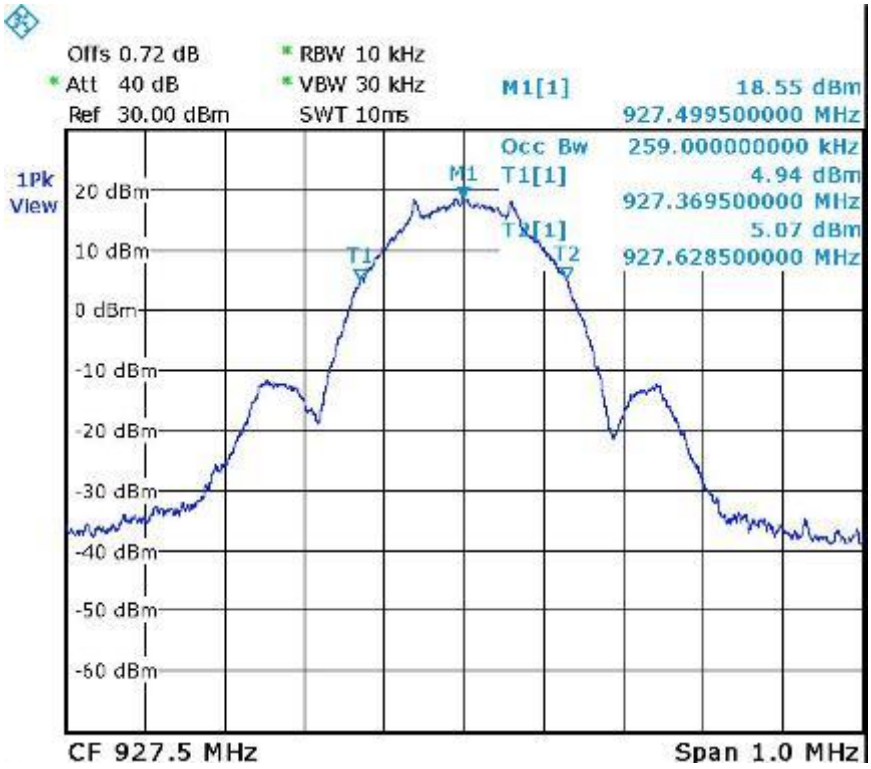
Low Channel:



Middle Channel:



High Channel:



FCC 15.247 (a) (1) / RSS-247 5.1. (a) 20 dB Bandwidth and Carrier frequency separation

SPECIFICATION:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.
If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

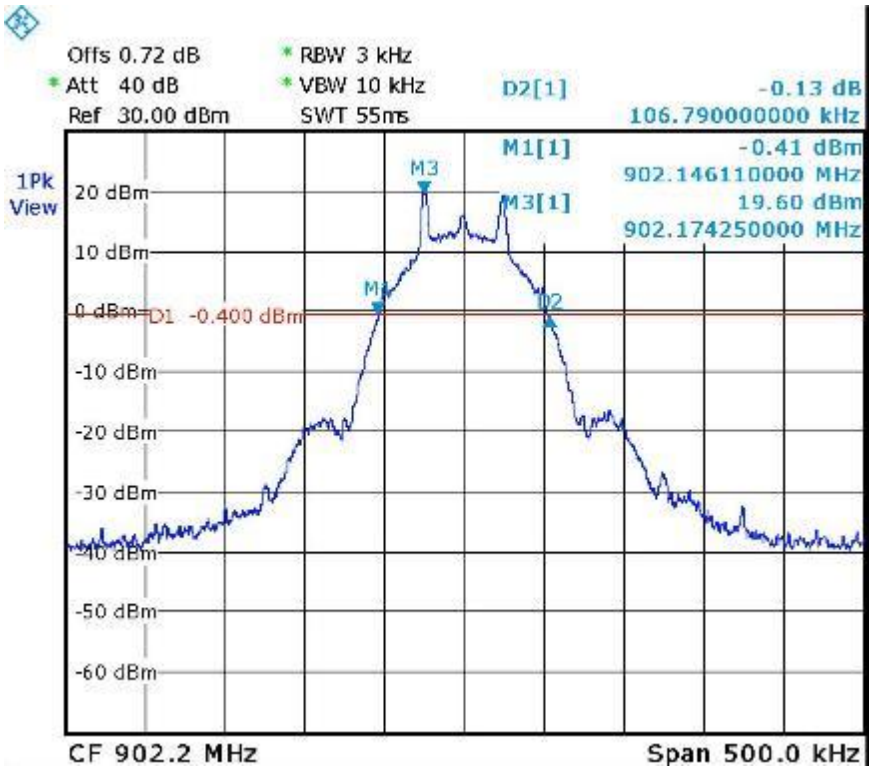
RESULTS:

- **FSK 50 Kbps:**

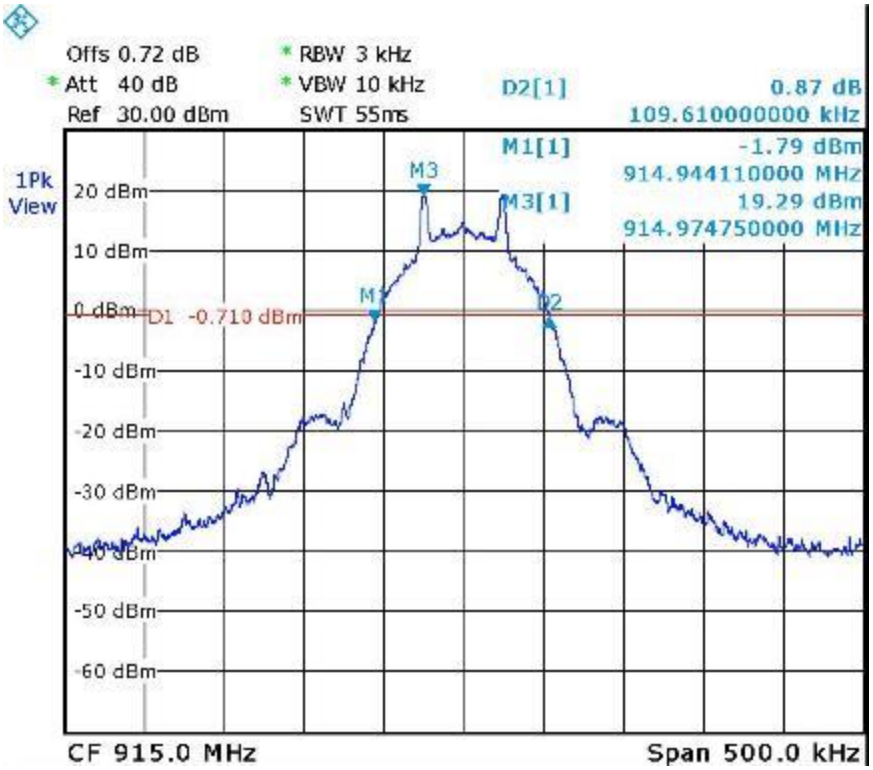
	Low Channel	Middle Channel	High Channel
20 dB Spectrum bandwidth (kHz)	106.79	109.61	108.67
Measurement uncertainty (kHz)	<± 0.64		

Verdict: PASS

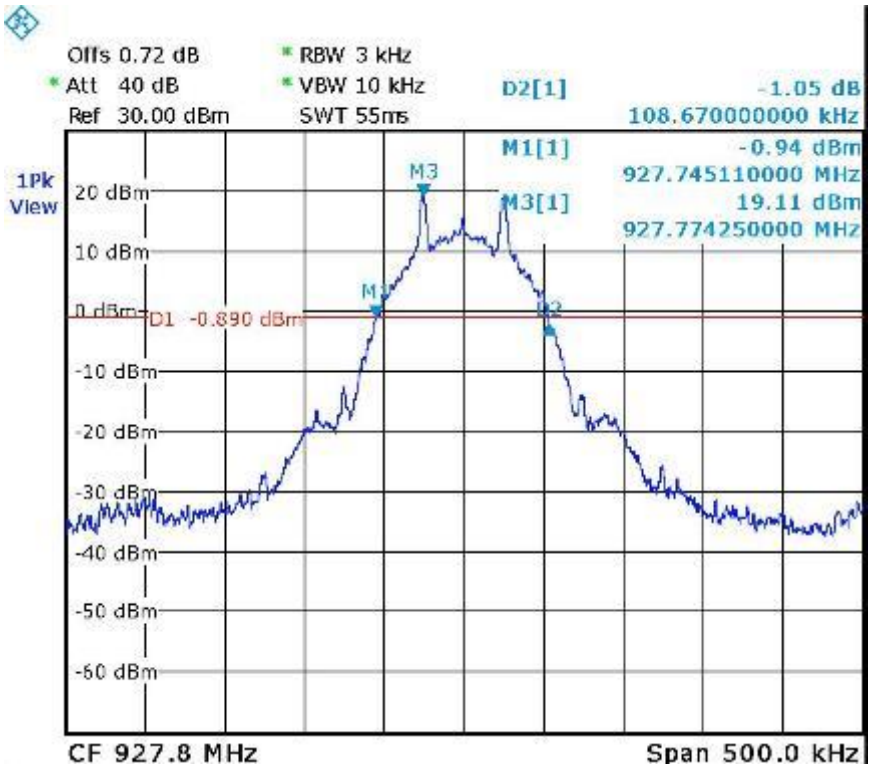
Low Channel:



Middle Channel:

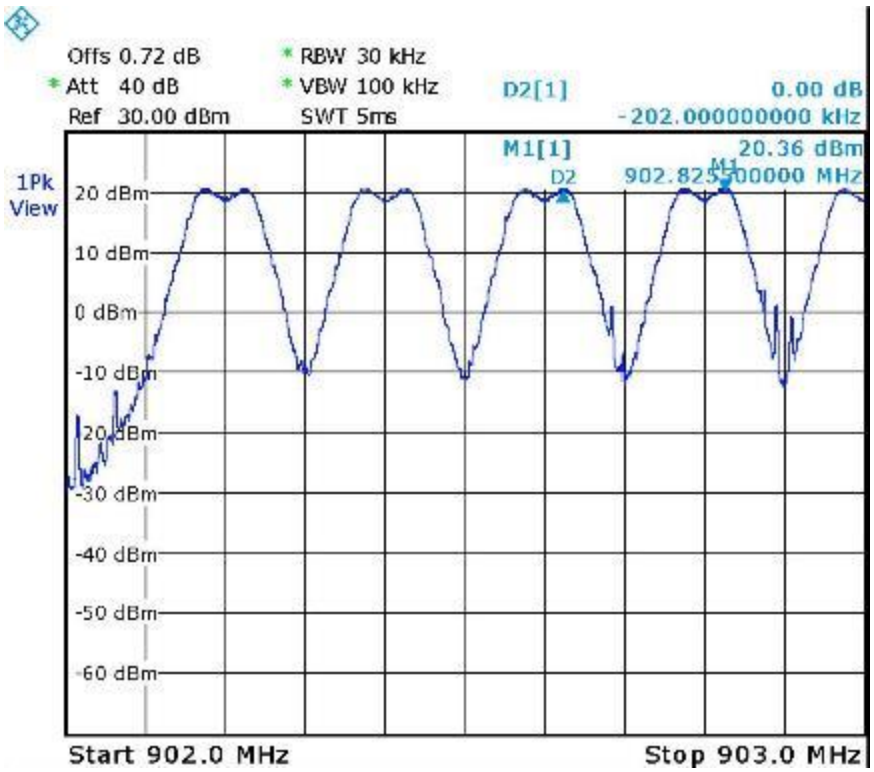


High Channel:



Carrier frequency separation

202 kHz



The hopping channel carrier frequencies are separated by a minimum of the 20 dB bandwidth of the hopping channel.

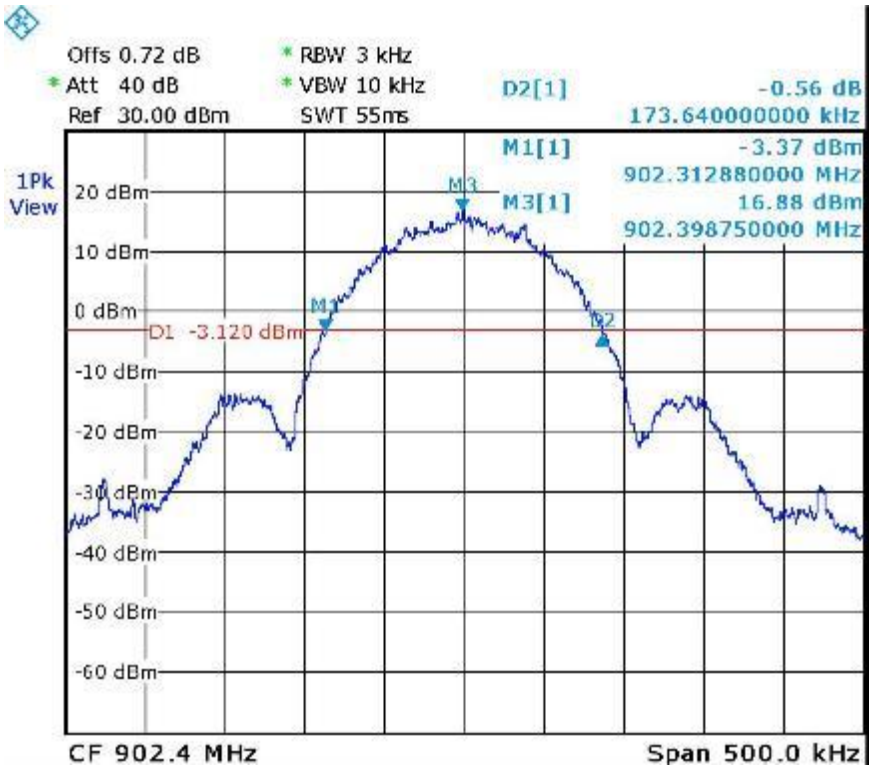
Verdict: PASS

- **FSK 150 Kbps:**

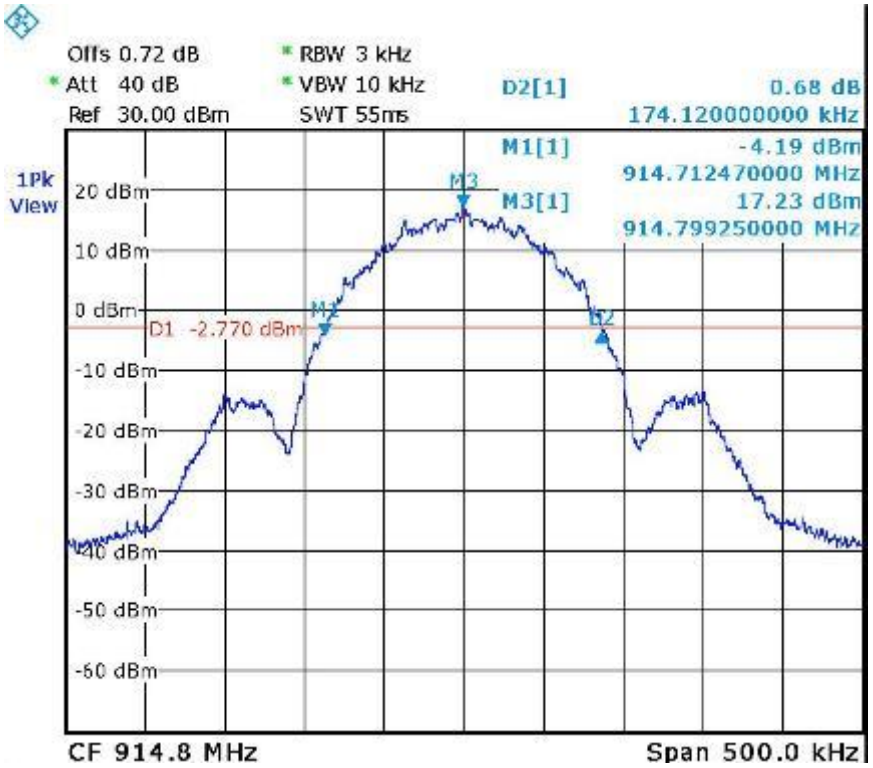
	Low Channel	Middle Channel	High Channel
20 dB Spectrum bandwidth (kHz)	173.64	174.12	174.65
Measurement uncertainty (kHz)	<± 0.52		

Verdict: PASS

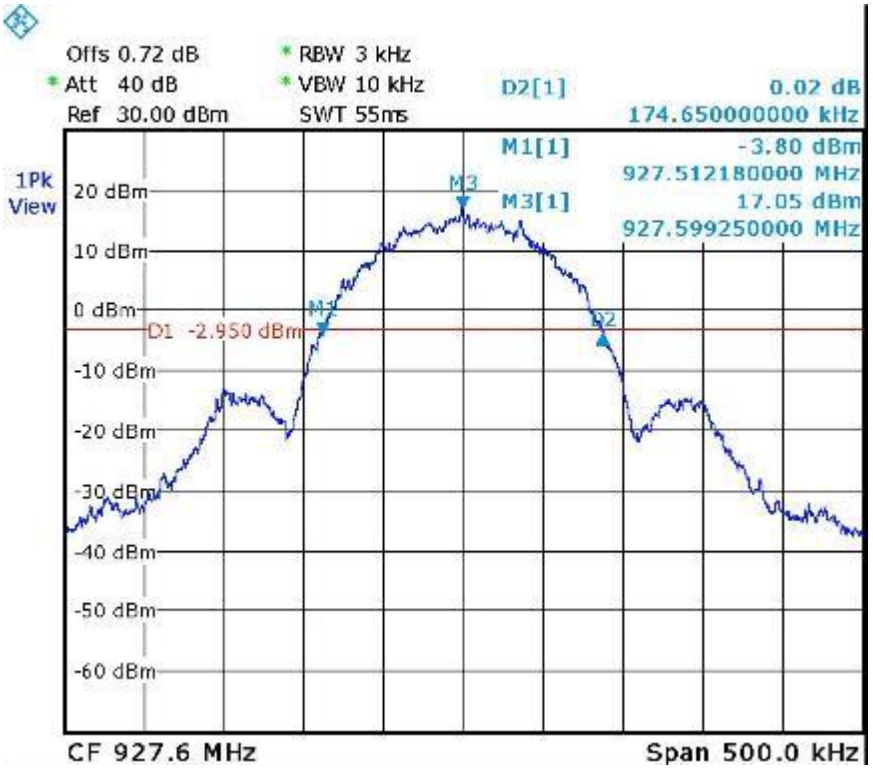
Low Channel:



Middle Channel:

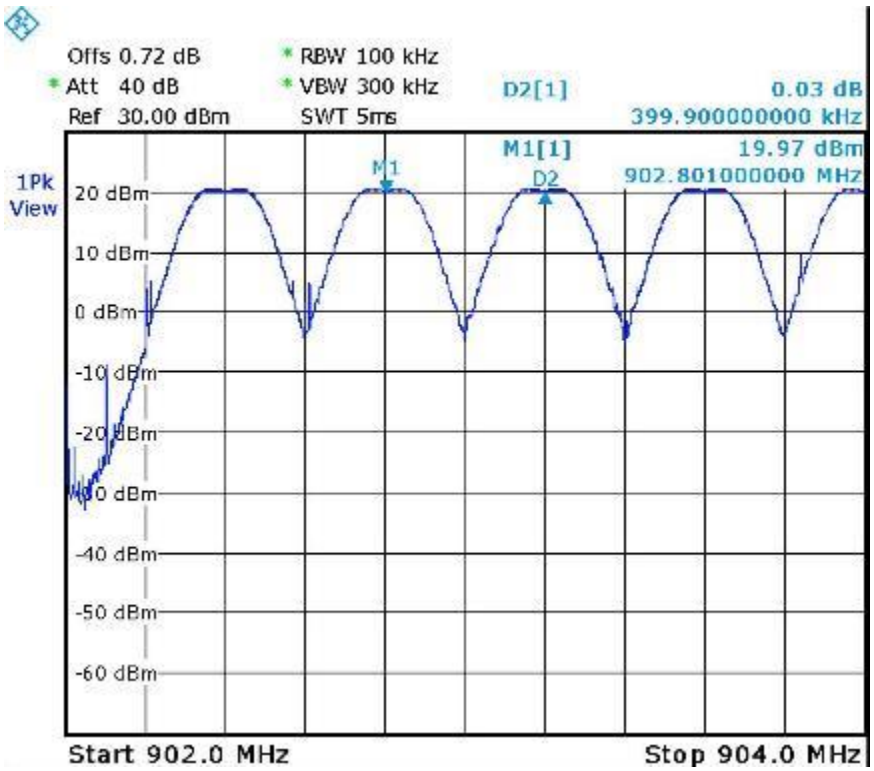


High Channel:



Carrier frequency separation

399.9 kHz



The hopping channel carrier frequencies are separated by a minimum of the 20 dB bandwidth of the hopping channel.

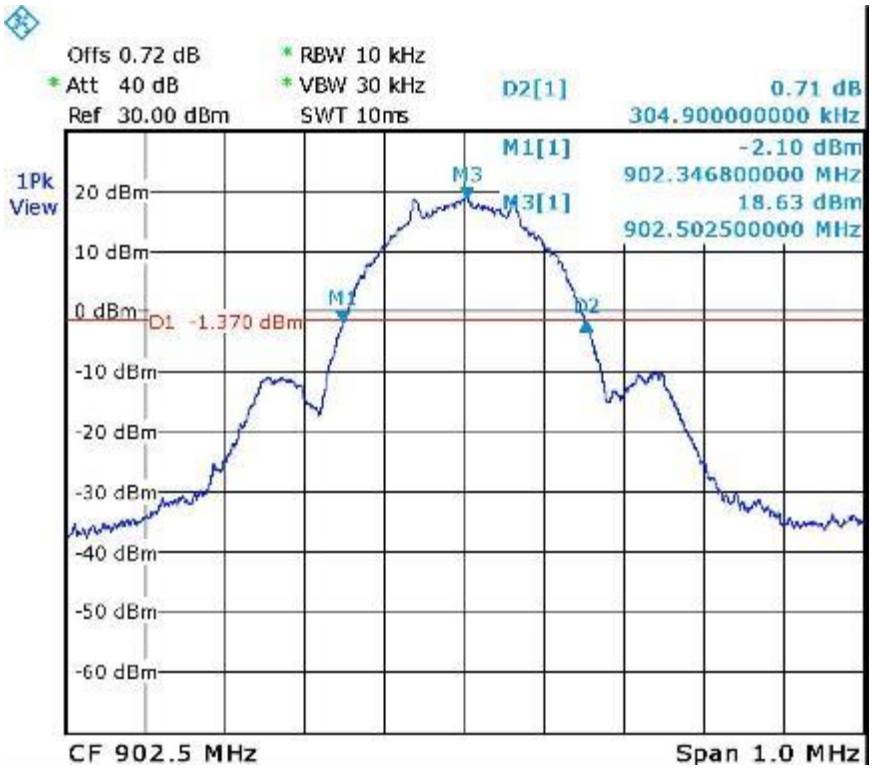
Verdict: PASS

- **FSK 250 Kbps:**

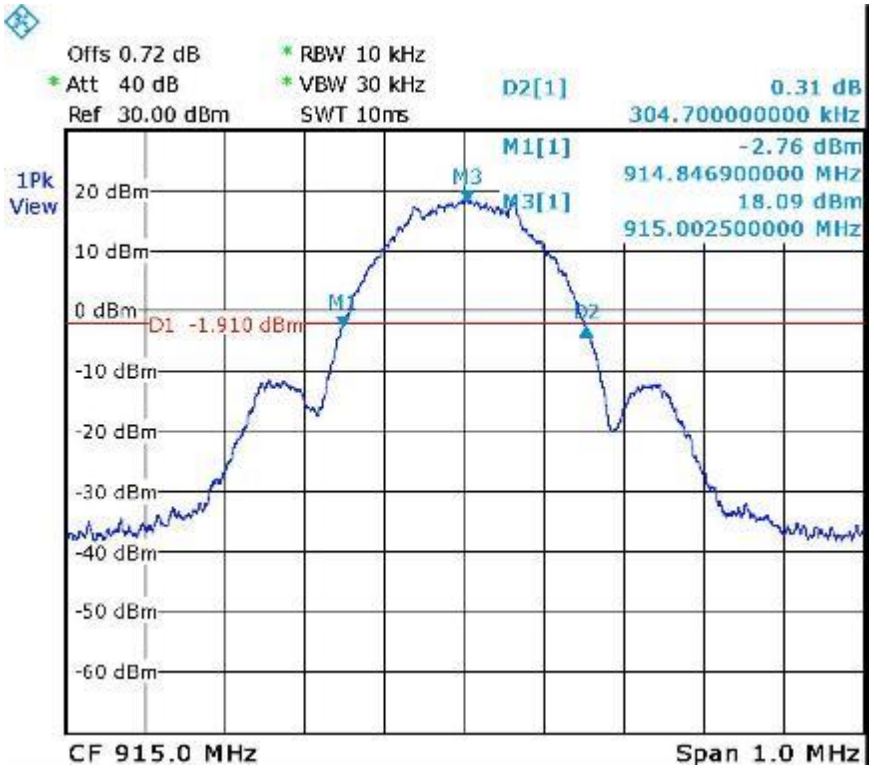
	Low Channel	Middle Channel	High Channel
20 dB Spectrum bandwidth (kHz)	304.9	307.7	296.9
Measurement uncertainty (kHz)	<± 0.52		

Verdict: PASS

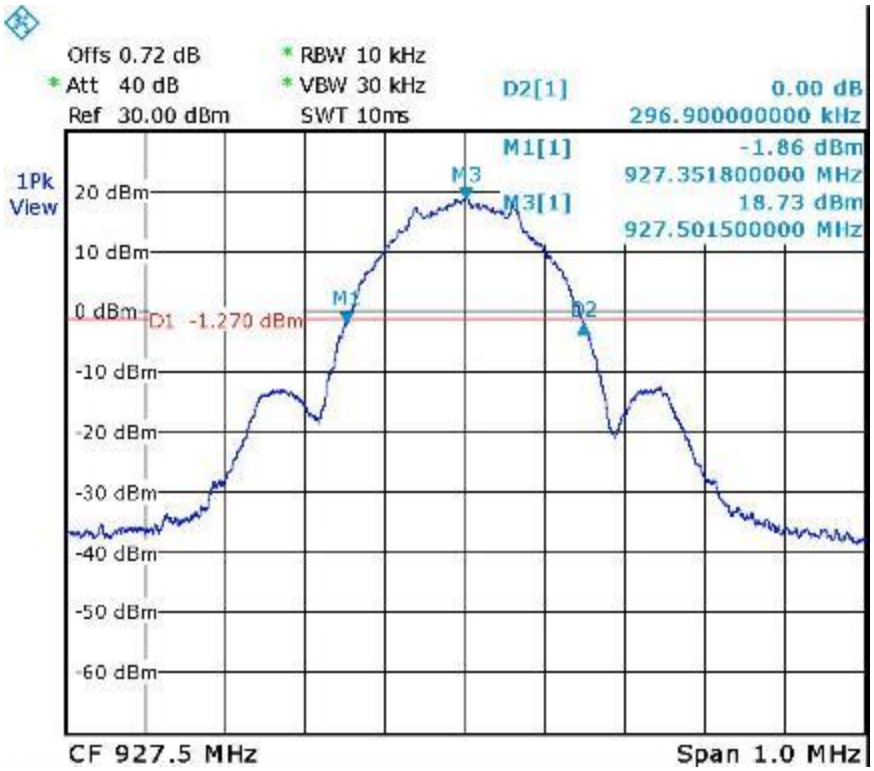
Low Channel:



Middle Channel:

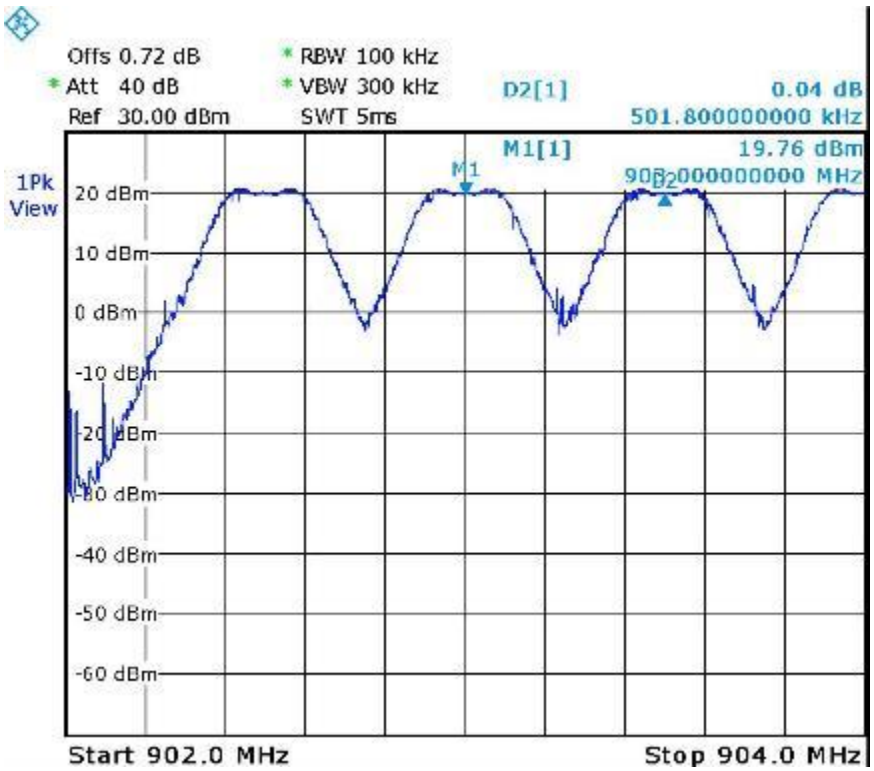


High Channel:



Carrier frequency separation

501.8 kHz



The hopping channel carrier frequencies are separated by a minimum of the 20 dB bandwidth of the hopping channel.

Verdict: PASS

FCC 15.247 (a) (1) (i) / RSS-247 5.1. (c) Number of hopping channels

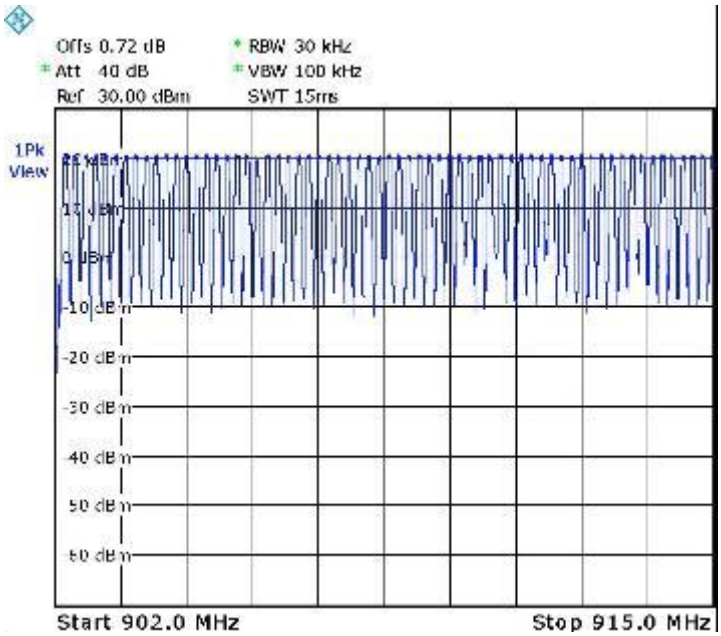
SPECIFICATION:

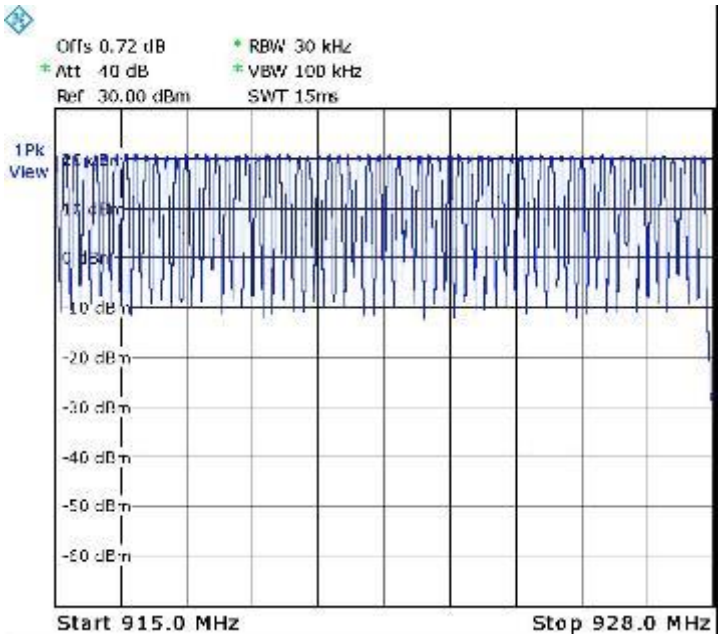
For frequency hopping systems operating in the band 902-928 MHz: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20-second period. If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 10-second period. The maximum 20 dB bandwidth of the hopping channel shall be 500 kHz.

RESULTS:

- **FSK 50 Kbps:**

129 (65+64) is the maximum number of hopping channels when the equipment operates as a frequency hopping system.

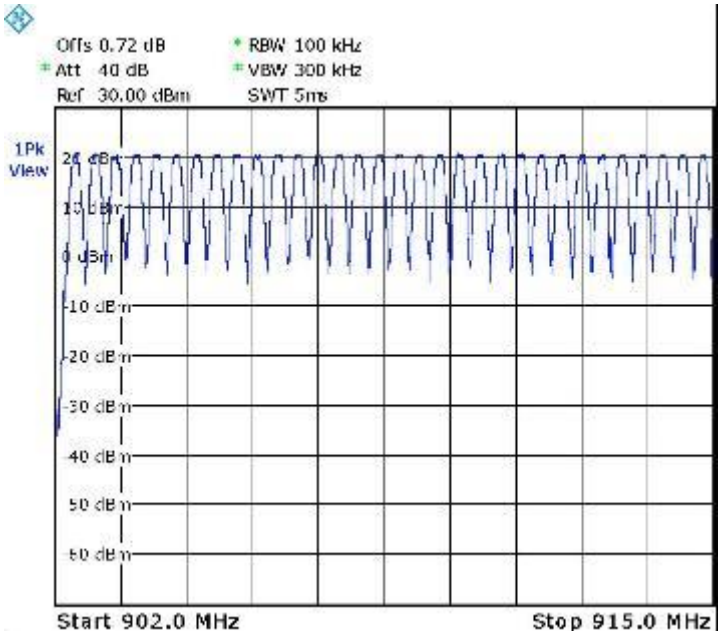


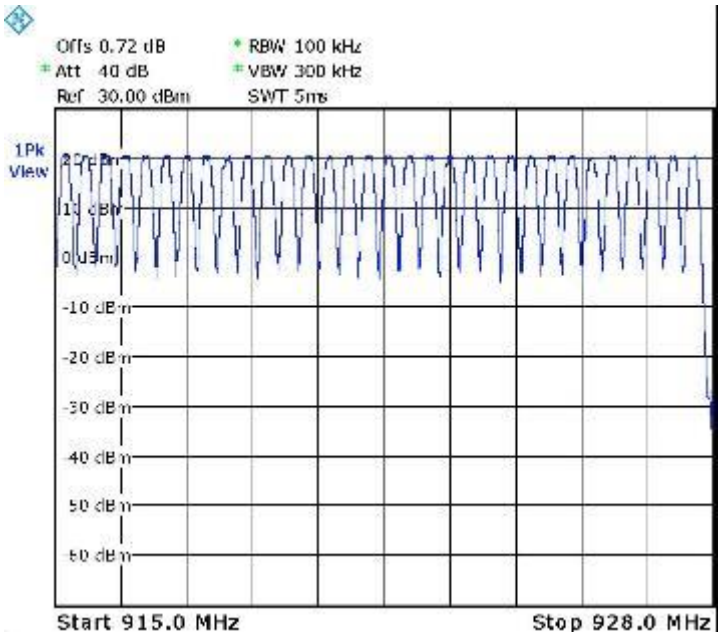


Verdict: PASS

- **FSK 150 Kbps:**

64 (32+32) is the maximum number of hopping channels when the equipment operates as a frequency hopping system.

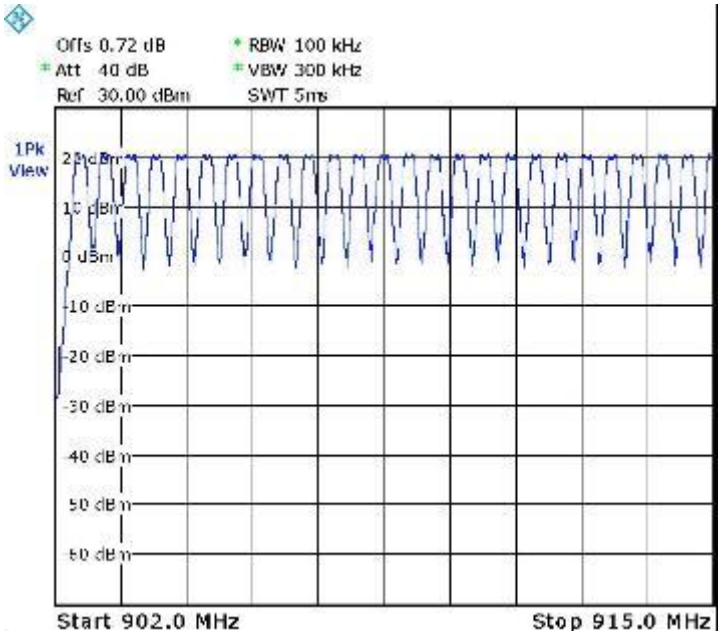


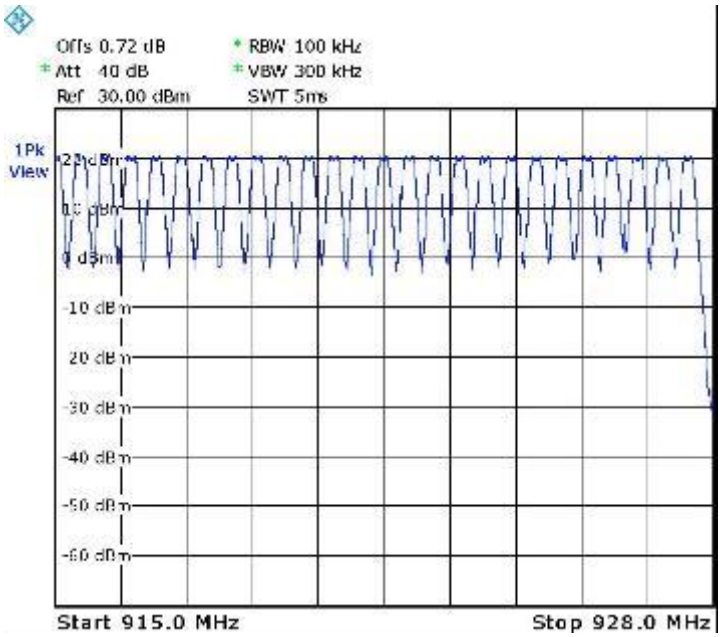


Verdict: PASS

- **FSK 250 Kbps:**

51 (26+25) is the maximum number of hopping channels when the equipment operates as a frequency hopping system.





Verdict: PASS

FCC 15.247 (a) (1) (i) / RSS-247 5.1. (c) Time of occupancy (Dwell Time)

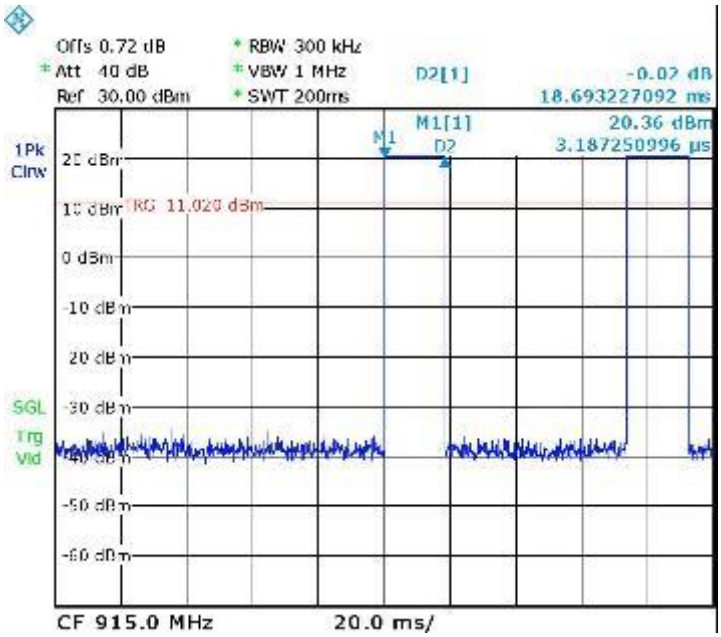
SPECIFICATION:

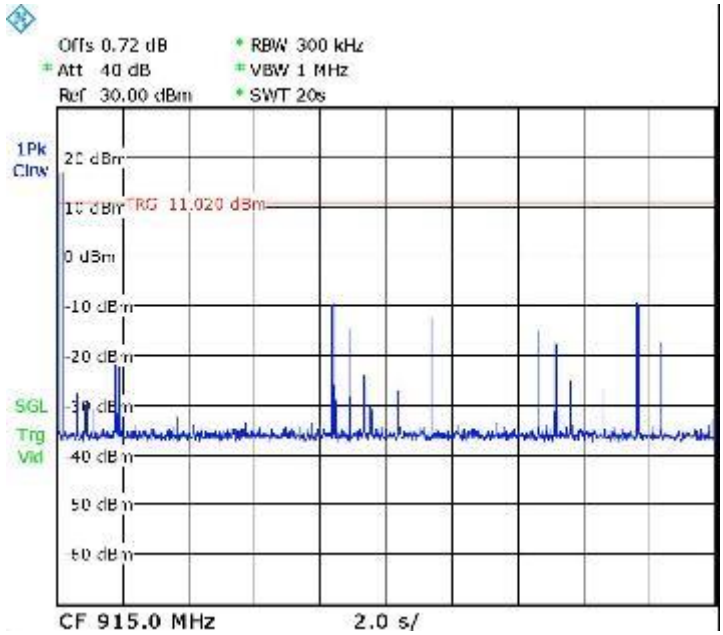
For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

RESULTS:

- **FSK 50 Kbps:**

  - Number of Hopping Frequencies: 129.
  - Transmission Time per Hop: 18.693227092 ms.
  - Number of Hops over a Period: 3.
  - Time Period: 20 s





- Average Time of Occupancy = (Transmission Time per Hop) x (Number of Hops over a Period) = = 56.07968128 ms = 0.05607968128 s

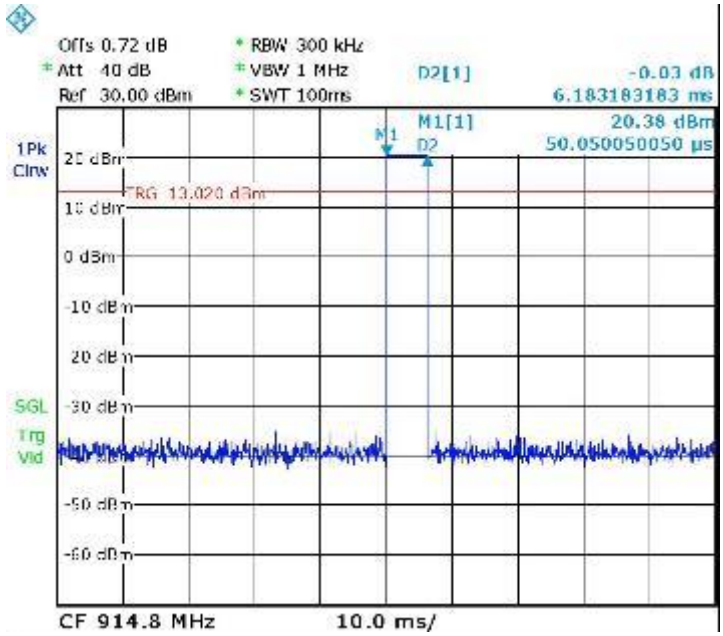
Average Time of Occupancy is < 0.4 s per Time Period.

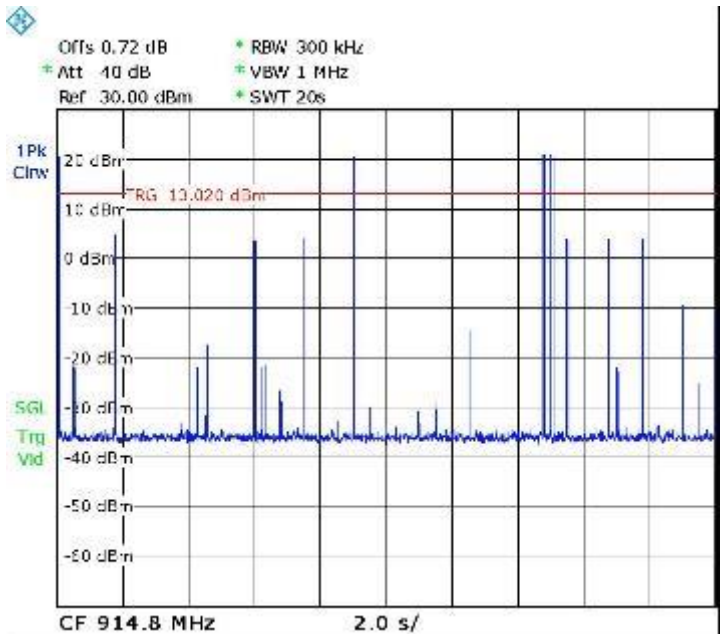
Measurement uncertainty (ms)	<±1.02

Verdict: PASS

- **FSK 150 Kbps:**

  - Number of Hopping Frequencies: 64.
  - Transmission Time per Hop: 6.183183183 ms.
  - Number of Hops over a Period: 9.
  - Time Period: 20 s (Number of Hopping Frequencies x 0.4).





- Average Time of Occupancy = (Transmission Time per Hop) x (Number of Hops over a Period) = = 55.64864865 ms = 0.055648649 s

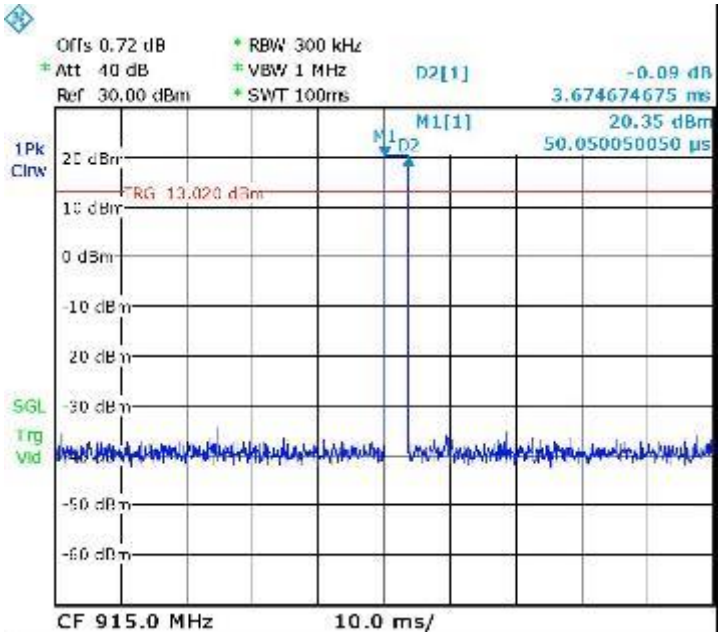
Average Time of Occupancy is < 0.4 s per Time Period.

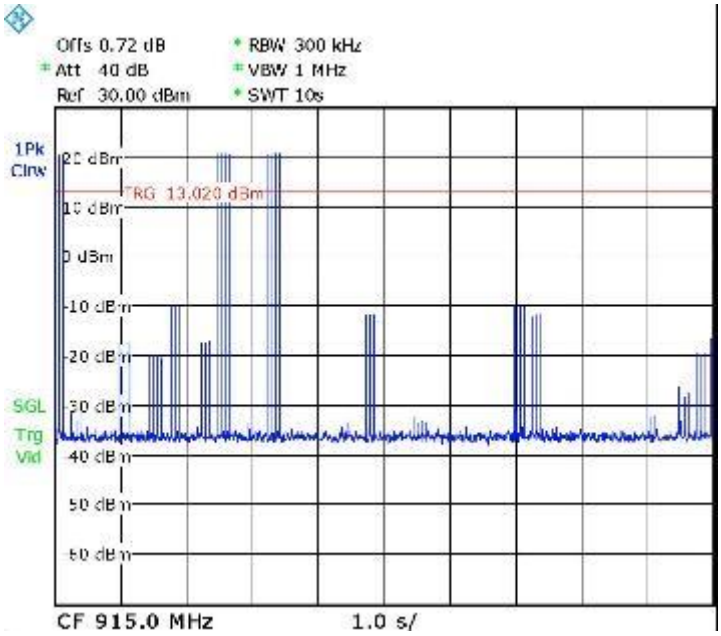
Measurement uncertainty (ms)	<±1.02

Verdict: PASS

- **FSK 250 Kbps:**

  - Number of Hopping Frequencies: 51.
  - Transmission Time per Hop: 3.674674675 ms.
  - Number of Hops over a Period: 12.
  - Time Period: 10 s





- Average Time of Occupancy = (Transmission Time per Hop) x (Number of Hops over a Period) = = 44.0960961 ms = 0.044096096 s

Average Time of Occupancy is < 0.4 s per Time Period.

Measurement uncertainty (ms)	<±1.02

Verdict: PASS

FCC 15.247 (b) / RSS-247 5.4 (a) Maximum output power and antenna gain

SPECIFICATION:

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels.

Additionally for RSS-247:

For FHSs operating in the band 902-928 MHz, the e.i.r.p. shall not exceed 4 W if the hopset uses 50 or more hopping channels; the e.i.r.p. shall not exceed 1 W if the hopset uses less than 50 hopping channels.

RESULTS:

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.

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

Maximum Declared Antenna Gain: +4.1 dBi

The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

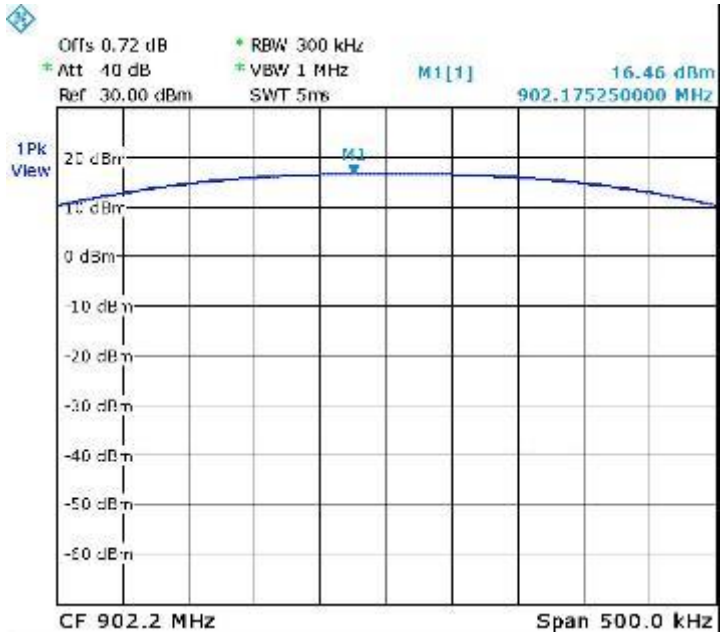
- **FSK 50 Kbps:**

	Low Channel	Middle Channel	High Channel
Maximum Peak Conducted Power (dBm)	16.46	15.95	14.71
Maximum EIRP Peak Conducted Power (dBm)	20.56	20.05	18.81
Measurement uncertainty (dB)	<±2.57		

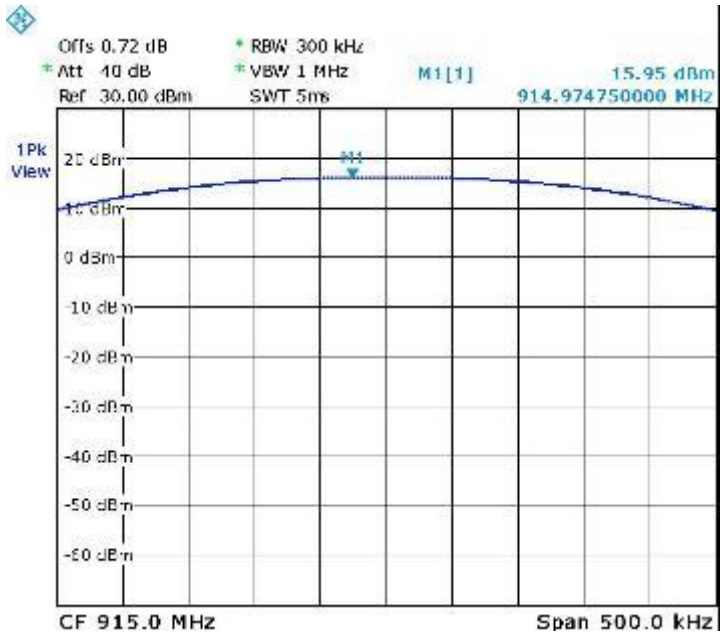
Verdict: PASS

Maximum Output Power – FSK 50 Kbps:

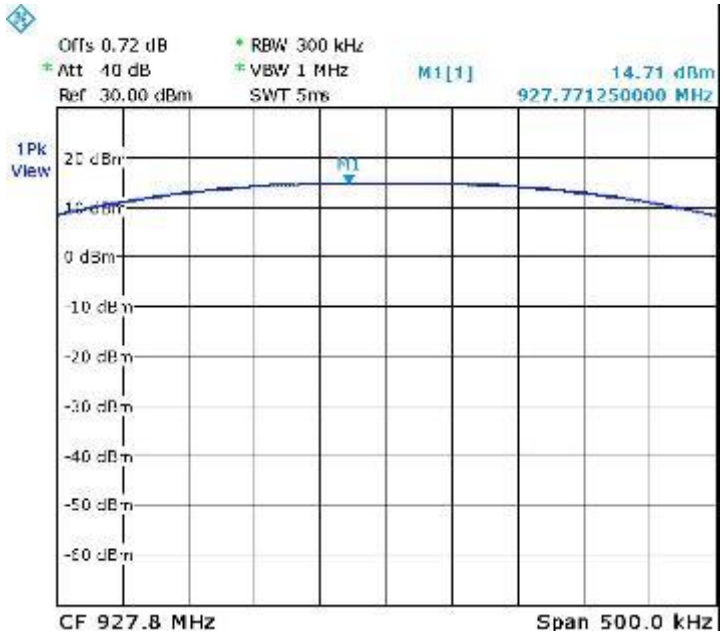
Low Channel:



Middle Channel:



High Channel:



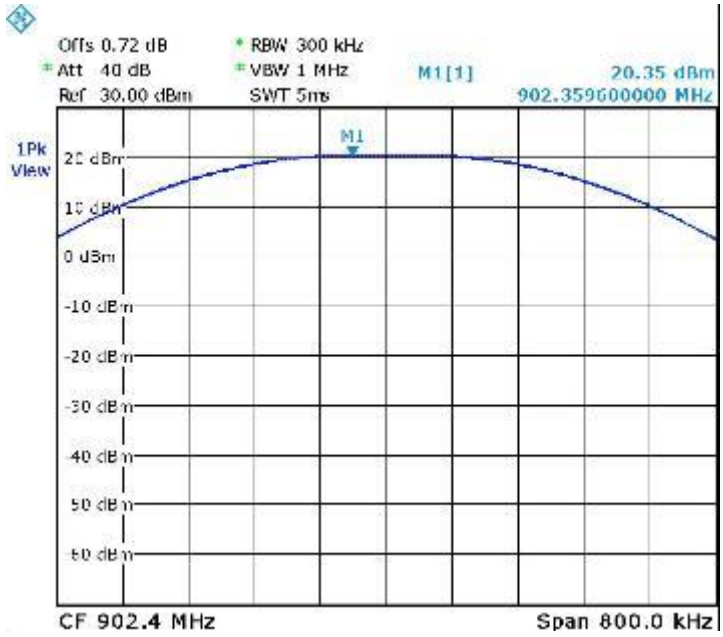
- **FSK 150 Kbps:**

	Low Channel	Middle Channel	High Channel
Maximum Peak Conducted Power (dBm)	20.35	20.4	20.21
Maximum EIRP Peak Conducted Power (dBm)	24.45	24.5	24.31
Measurement uncertainty (dB)	<±2.57		

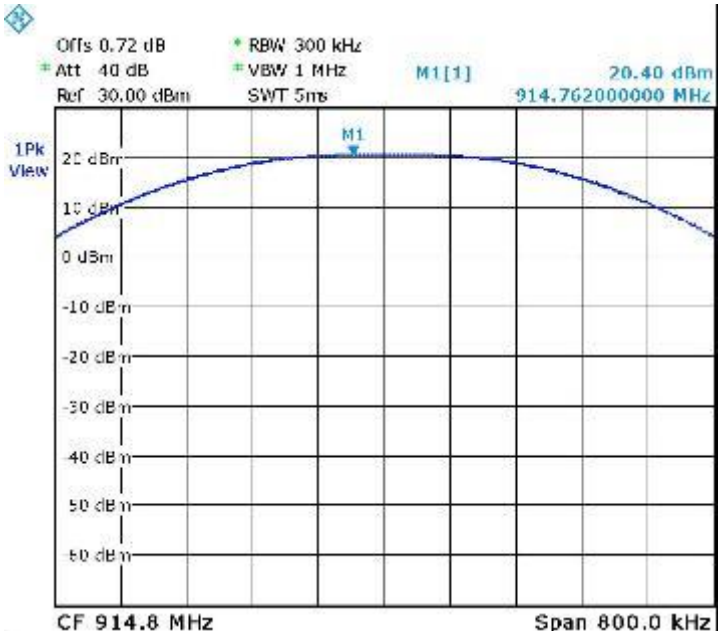
Verdict: PASS

Maximum Output Power – FSK 150 Kbps:

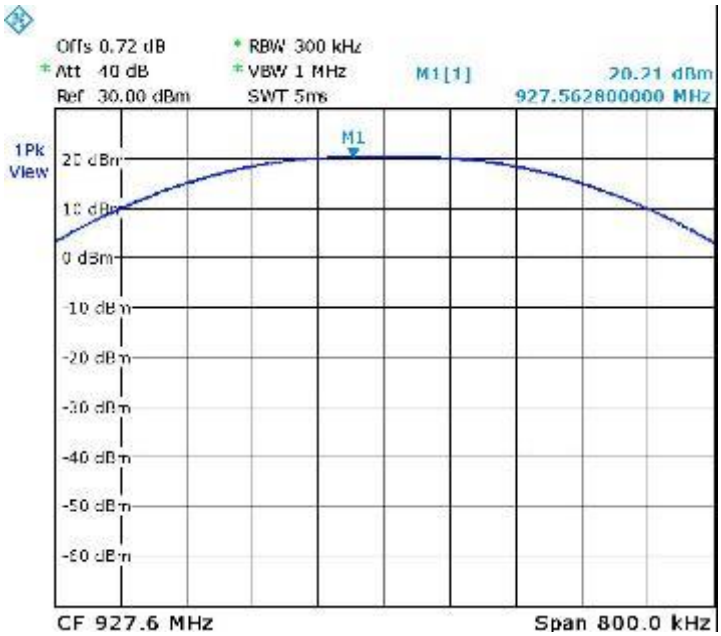
Low Channel:



Middle Channel:



High Channel:



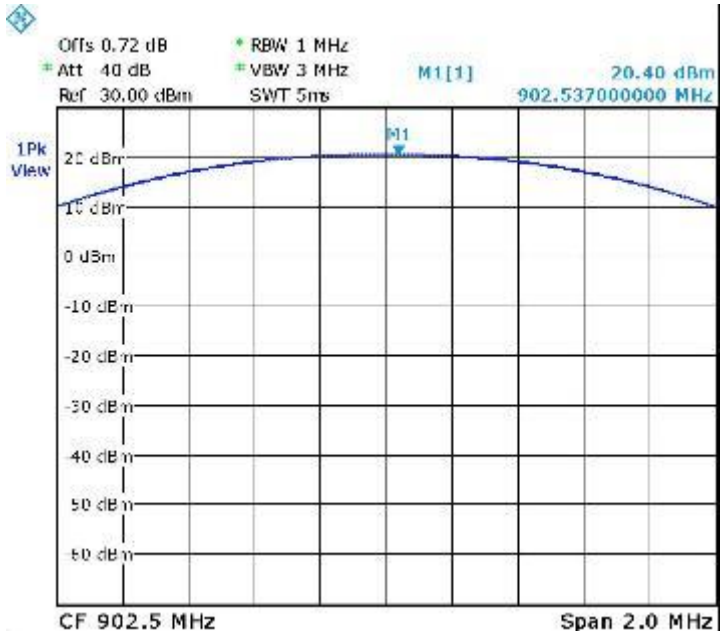
- **FSK 250 Kbps:**

	Low Channel	Middle Channel	High Channel
Maximum Peak Conducted Power (dBm)	20.4	20.43	20.21
Maximum EIRP Peak Conducted Power (dBm)	24.5	24.53	24.31
Measurement uncertainty (dB)	<±2.57		

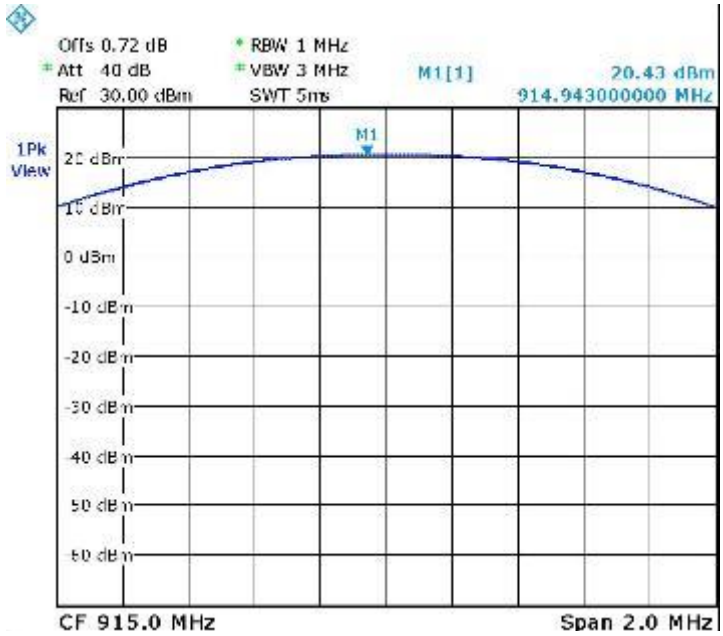
Verdict: PASS

Maximum Output Power – FSK 250 Kbps:

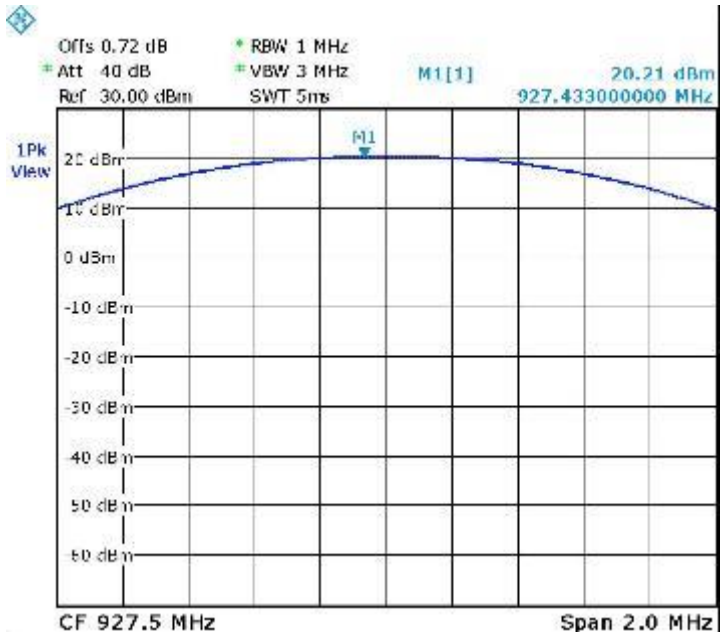
Low Channel:



Middle Channel:



High Channel:



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

SPECIFICATION:

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.

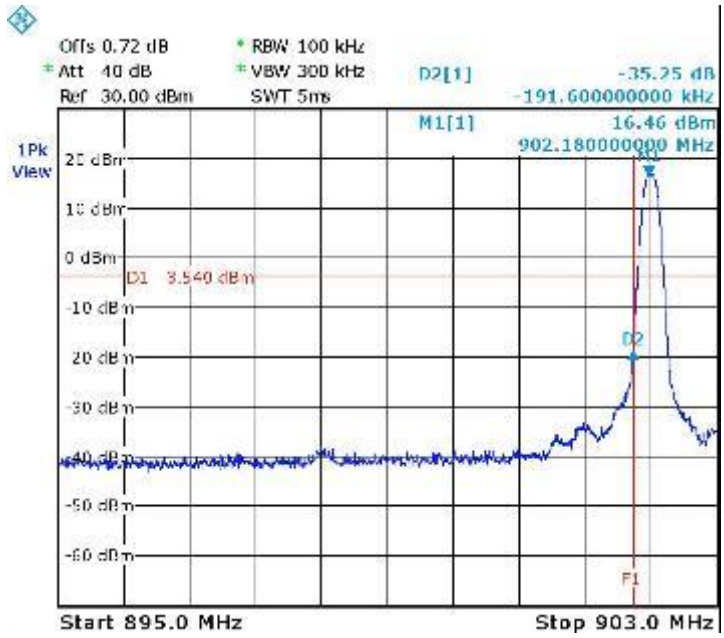
RESULTS:

The attenuation of highest emissions at the band-edge is more than 20 dB respect to the highest level of the desired power.

- **FSK 50 Kbps:**

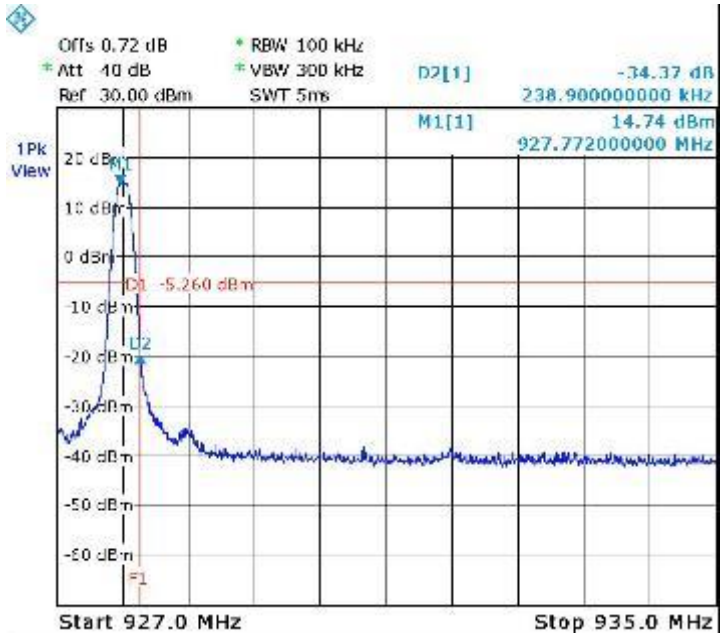
- HOPPING OFF:

  - LOW FREQUENCY SECTION:



Verdict: PASS

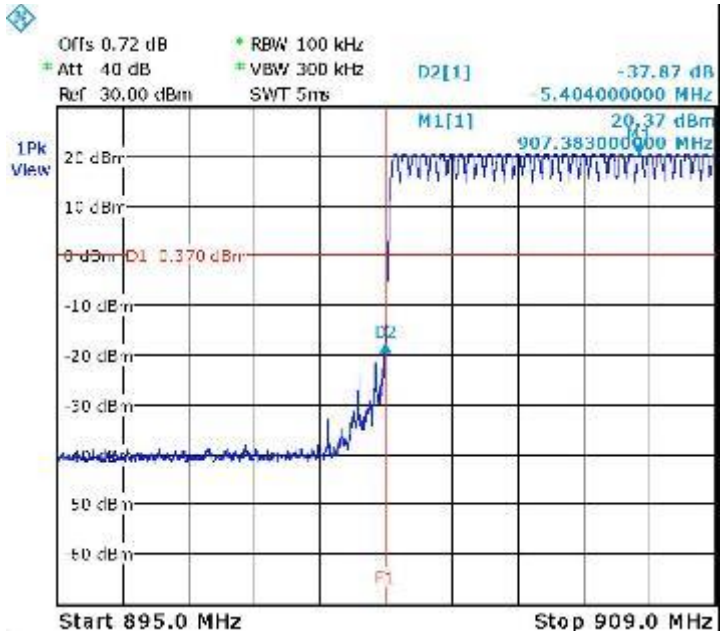
- HIGH FREQUENCY SECTION:



Verdict: PASS

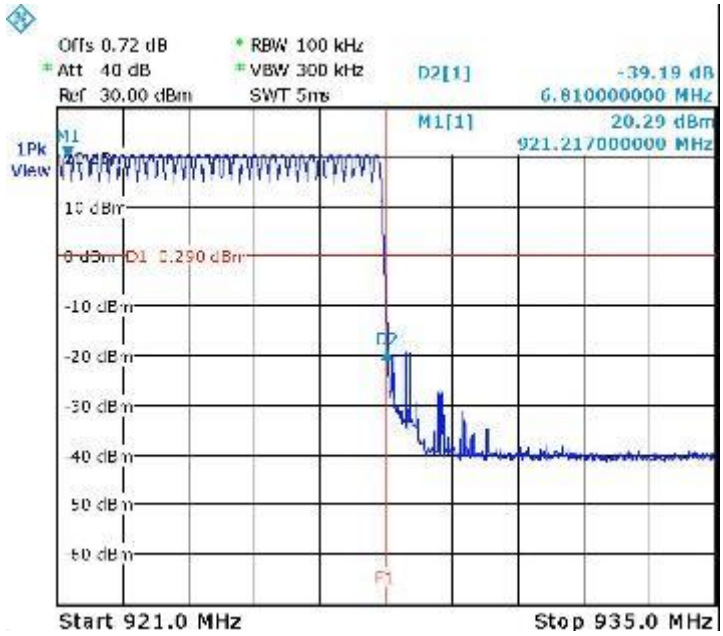
- HOPPING ON:

  - LOW FREQUENCY SECTION:



Verdict: PASS

- HIGH FREQUENCY SECTION:



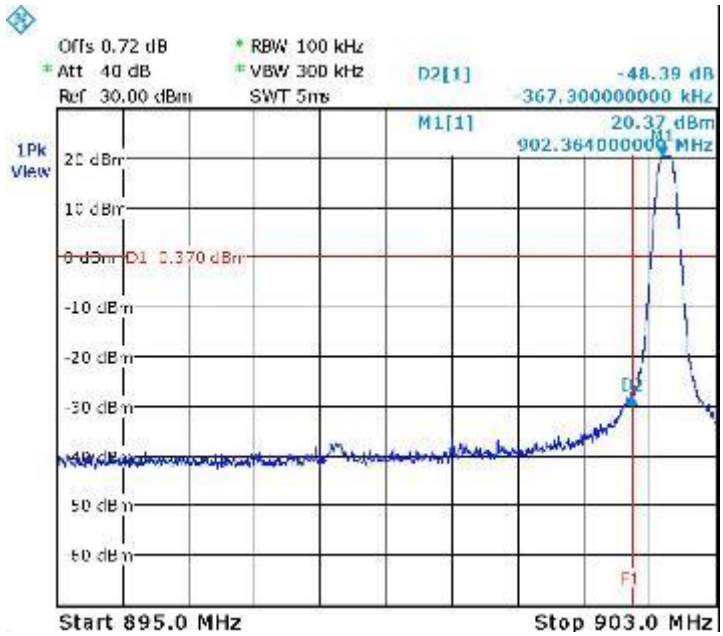
Verdict: PASS

Measurement uncertainty (dB)	<±2.57

- **FSK 150 Kbps:**

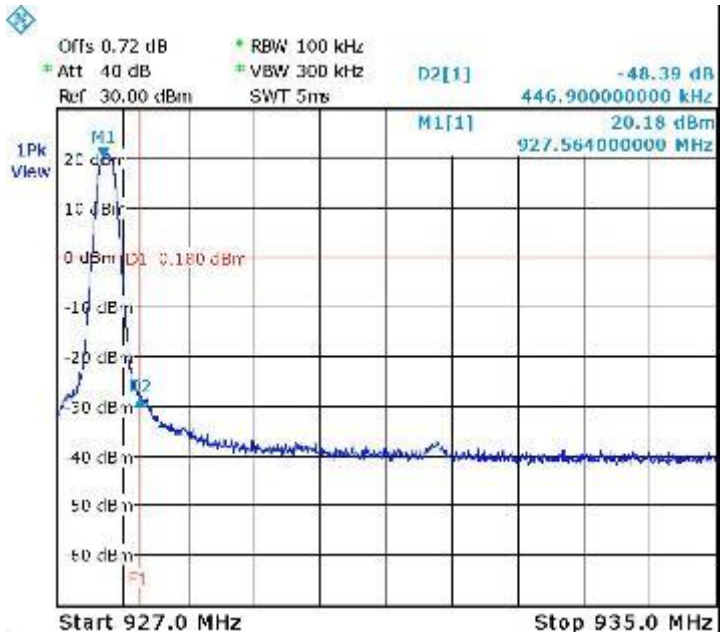
- HOPPING OFF:

  - LOW FREQUENCY SECTION:



Verdict: PASS

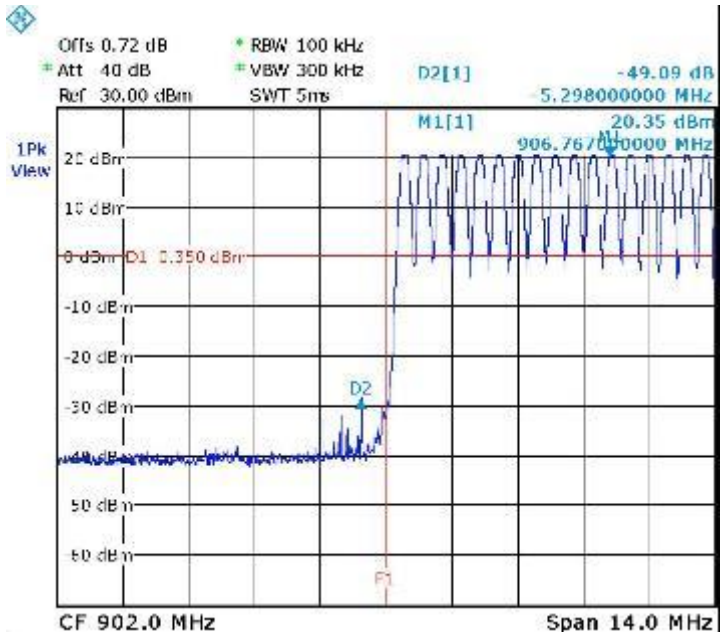
  - HIGH FREQUENCY SECTION:



Verdict: PASS

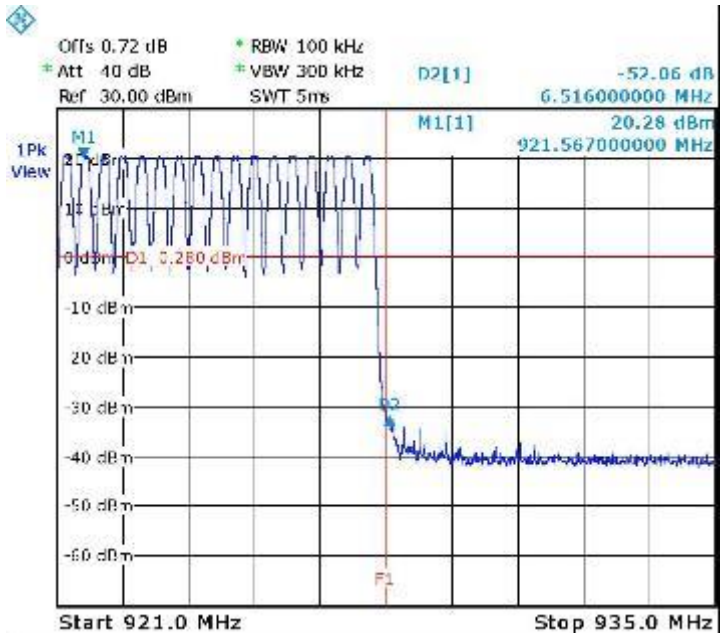
- HOPPING ON:

  - LOW FREQUENCY SECTION:



Verdict: PASS

  - HIGH FREQUENCY SECTION:



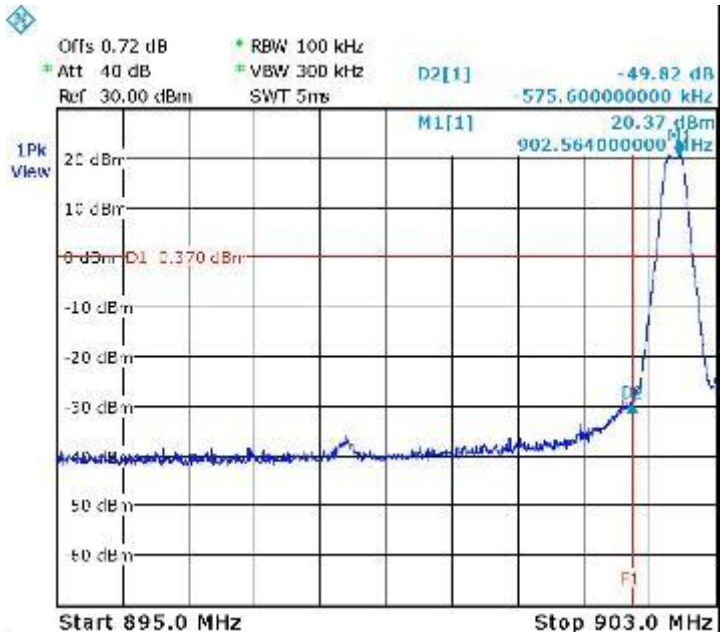
Verdict: PASS

Measurement uncertainty (dB)	<±2.57

- **FSK 250 Kbps:**

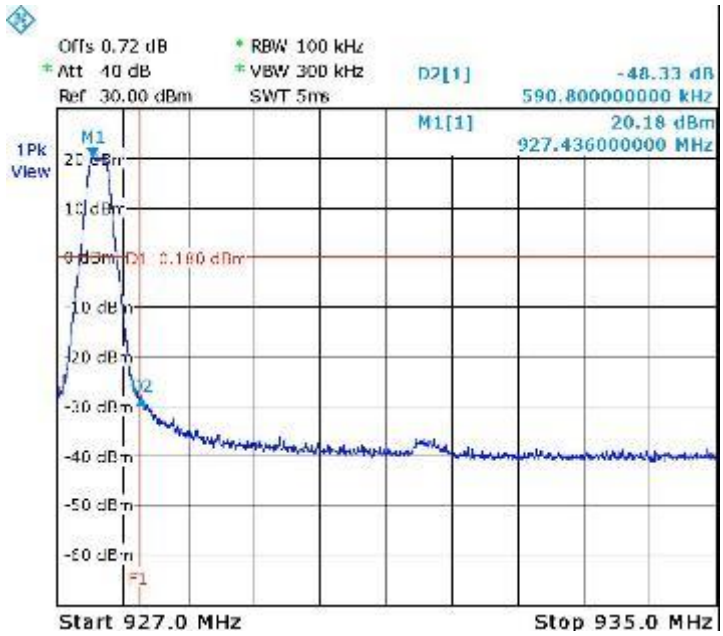
- HOPPING OFF:

  - LOW FREQUENCY SECTION:



Verdict: PASS

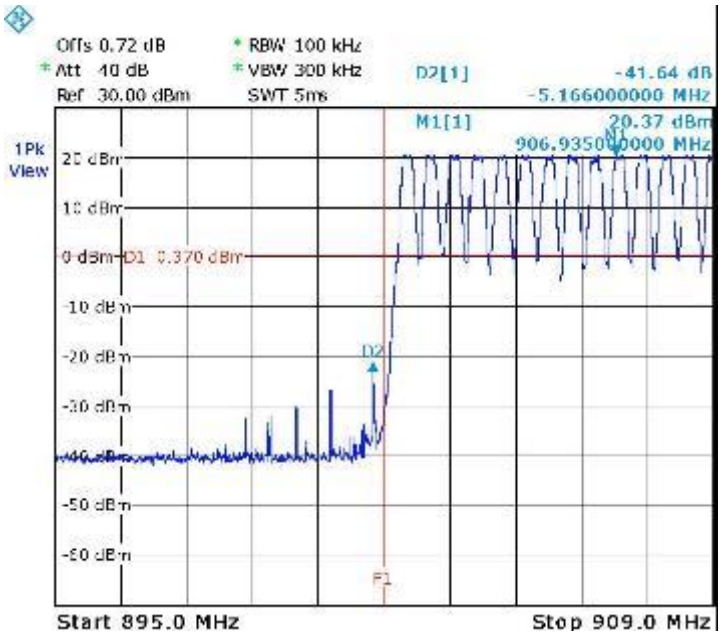
  - HIGH FREQUENCY SECTION:



Verdict: PASS

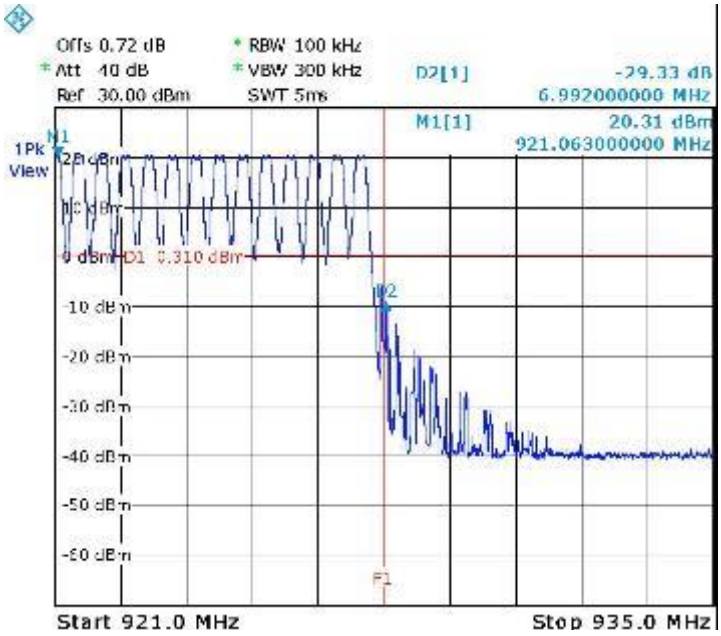
- HOPPING ON:

  - LOW FREQUENCY SECTION:



Verdict: PASS

  - HIGH FREQUENCY SECTION:



Verdict: PASS

Measurement uncertainty (dB)	<±2.57

FCC 15.247 (d) / RSS-247 5.5. Emission limitations radiated (Transmitter)

SPECIFICATION:

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 - 10000	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:

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.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-10 GHz.

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.

RADIATED:

Frequency range 30 MHz - 1 GHz:

- **FSK 50 Kbps, FSK 150 Kbps and FSK 250 Kbps:**

The spurious frequencies do not depend on the data rate.

LOW CHANNEL:

Spurious frequencies closest to the limit:

Spurious Frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
96.251000	27.34	H	Quasi-Peak
102.168000	27.37	H	Quasi-Peak
108.279000	24.41	H	Quasi-Peak
249.996000	34.02	H	Quasi-Peak
761.283000	36.98	V	Quasi-Peak
806.242500	44.49	V	Quasi-Peak
854.209000	40.25	V	Quasi-Peak
906.540500	28.07	V	Quasi-Peak
950.239000	32.08	V	Quasi-Peak
998.205500	38.85	V	Quasi-Peak

Measurement Uncertainty (dB) <± 5.1

MIDDLE CHANNEL:

Spurious frequencies closest to the limit:

Spurious Frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
95.960000	25.67	H	Quasi-Peak
102.459000	27.09	H	Quasi-Peak
249.996000	34.56	H	Quasi-Peak
771.904500	33.04	V	Quasi-Peak
818.852500	44.54	V	Quasi-Peak
866.819000	41.86	V	Quasi-Peak
900.672000	36.28	V	Quasi-Peak
918.859500	45.49	V	Quasi-Peak

Measurement Uncertainty (dB) <± 5.1

HIGH CHANNEL:

Spurious frequencies closest to the limit:

Spurious Frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
96.202500	25.62	H	Quasi-Peak
102.071000	26.68	H	Quasi-Peak
249.996000	34.25	H	Quasi-Peak
782.526000	36.10	V	Quasi-Peak
831.414000	44.68	V	Quasi-Peak
879.477500	42.03	V	Quasi-Peak
975.459000	38.31	V	Quasi-Peak

Measurement Uncertainty (dB) <± 5.1

Frequency range 1 - 10 GHz:

FSK 50 Kbps:

The results in the next tables show the maximum measured levels in the 1-10 GHz range (see next plots).

Applied a duty cycle correction to the Peak measurement to obtain the Average measurement.

* *Duty Cycle Correction (dB): 8.54.*

- LOW CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
2706.400000	58.63	V	Peak
	50.09		Average(*)
3608.800000	56.35	V	Peak
	47.81		Average(*)
4510.600000	55.37	V	Peak
	46.83		Average(*)

(*) NOTE: Calculated value.

- MIDDLE CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
2744.800000	60.67	V	Peak
	52.13		Average(*)
3660.100000	58.54	V	Peak
	50.00		Average(*)
4575.100000	55.71	V	Peak
	47.17		Average(*)
7319.800000	60.29	V	Peak
	51.75		Average(*)

(*) NOTE: Calculated value.

- HIGH CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
2783.200000	61.01	V	Peak
	52.47		Average(*)
3710.800000	56.23	V	Peak
	47.29		Average(*)
4638.700000	57.27	V	Peak
	48.73		Average(*)
7423.000000	59.10	V	Peak
	50.56		Average(*)

(*) NOTE: Calculated value.

Measurement Uncertainty (dB) <± 4.6

Verdict: PASS

FSK 150 Kbps:

The results in the next tables show the maximum measured levels in the 1-10 GHz range (see next plots).

Applied a duty cycle correction to the Peak measurement to obtain the Average measurement.

* *Duty Cycle Correction (dB): 18.13.*

- LOW CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
2707.000000	65.28	V	Peak
	47.15		Average(*)
3609.700000	59.44	V	Peak
	41.31		Average(*)
4512.100000	57.28	V	Peak
	39.15		Average(*)
5414.500000	59.62	V	Peak
	41.49		Average(*)

(*) NOTE: Calculated value.

- MIDDLE CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
2744.200000	64.11	V	Peak
	45.98		Average(*)
3659.200000	58.66	V	Peak
	40.53		Average(*)
4574.200000	56.60	V	Peak
	38.47		Average(*)
7318.000000	63.88	V	Peak
	45.75		Average(*)

(*) NOTE: Calculated value.

- HIGH CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
2782.600000	64.08	V	Peak
	45.95		Average(*)
3710.200000	58.20	V	Peak
	40.07		Average(*)
4637.800000	56.72	V	Peak
	38.59		Average(*)
7420.300000	62.10	V	Peak
	43.97		Average(*)

(*) NOTE: Calculated value.

Measurement Uncertainty (dB) <± 4.6

Verdict: PASS

FSK 250 Kbps:

The results in the next tables show the maximum measured levels in the 1-10 GHz range (see next plots).

Applied a duty cycle correction to the Peak measurement to obtain the Average measurement.

** Duty Cycle Correction (dB): 22.62.*

- LOW CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
2707.300000	65.14	V	Peak
	42.52		Average(*)
3610.000000	59.24	V	Peak
	36.62		Average(*)
4512.400000	57.09	V	Peak
	34.47		Average(*)
5415.400000	59.46	V	Peak
	36.84		Average(*)

(*) NOTE: Calculated value.

- MIDDLE CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
2745.100000	63.88	V	Peak
	41.26		Average(*)
3659.800000	58.74	V	Peak
	36.21		Average(*)
4574.800000	57.42	V	Peak
	34.80		Average(*)
7319.500000	65.63	V	Peak
	43.01		Average(*)

(*) NOTE: Calculated value.

- HIGH CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
2782.600000	62.31	V	Peak
	39.69		Average(*)
3710.200000	59.18	V	Peak
	36.56		Average(*)
4637.200000	57.40	V	Peak
	34.78		Average(*)
7420.600000	59.63	V	Peak
	37.01		Average(*)

(*) NOTE: Calculated value.

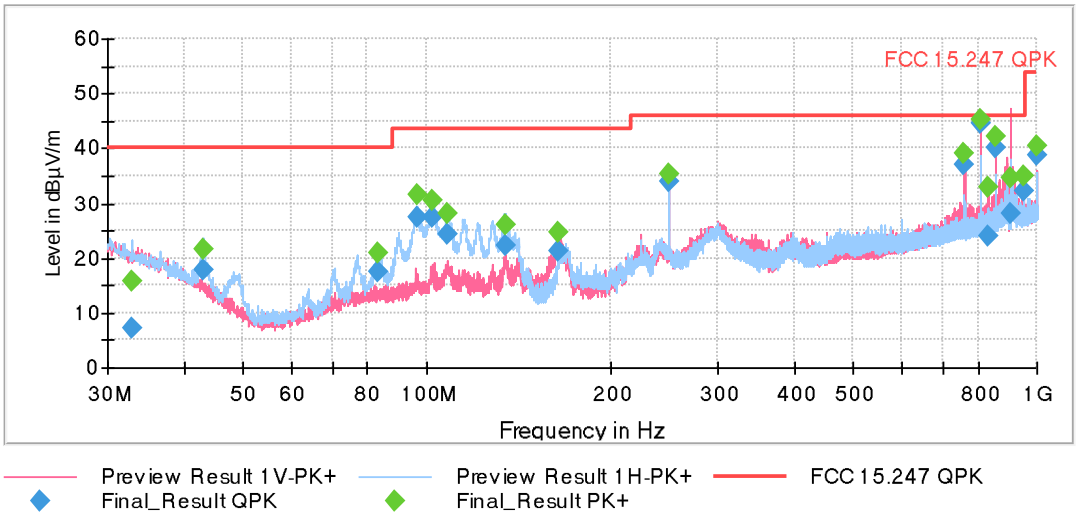
Measurement Uncertainty (dB) <± 4.6

Verdict: PASS

- **FSK 50 Kbps, FSK 150Kbps and FSK 250Kbps:**

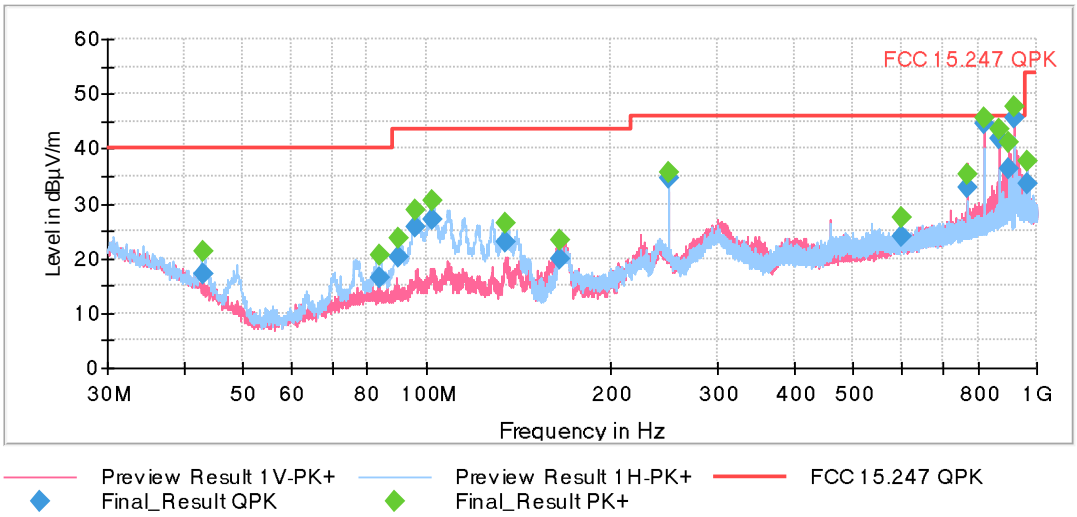
FREQUENCY RANGE 30 MHz - 1 GHz:

LOW CHANNEL:



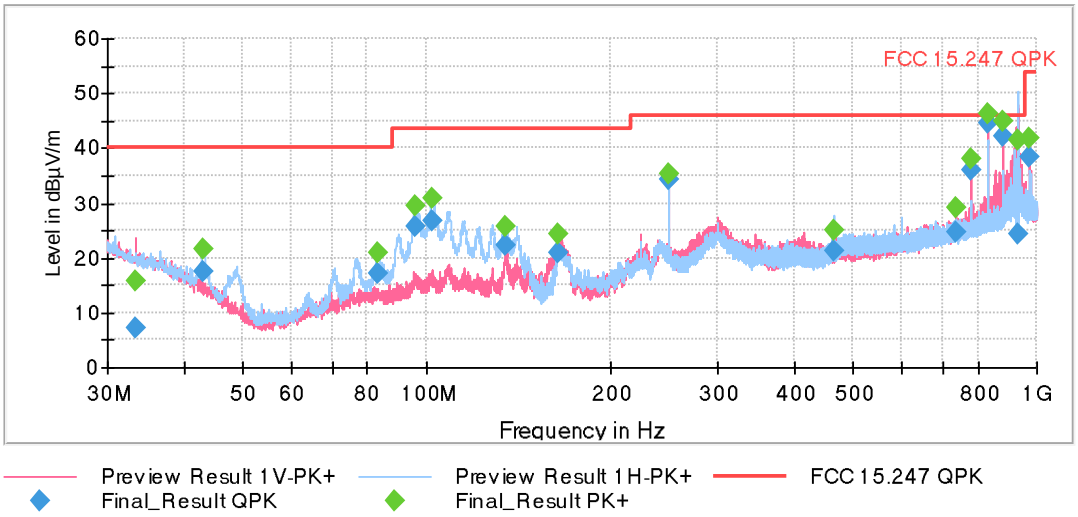
Note: The carrier was attenuated using a Notch filter.

MIDDLE CHANNEL:



Note: The carrier was attenuated using a Notch filter.

HIGH CHANNEL:

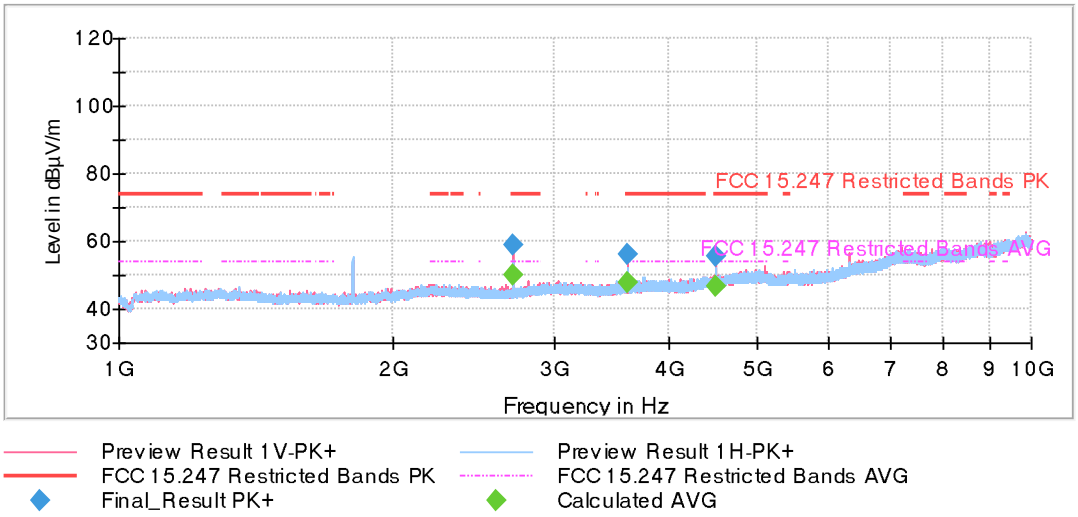


Note: The carrier was attenuated using a Notch filter.

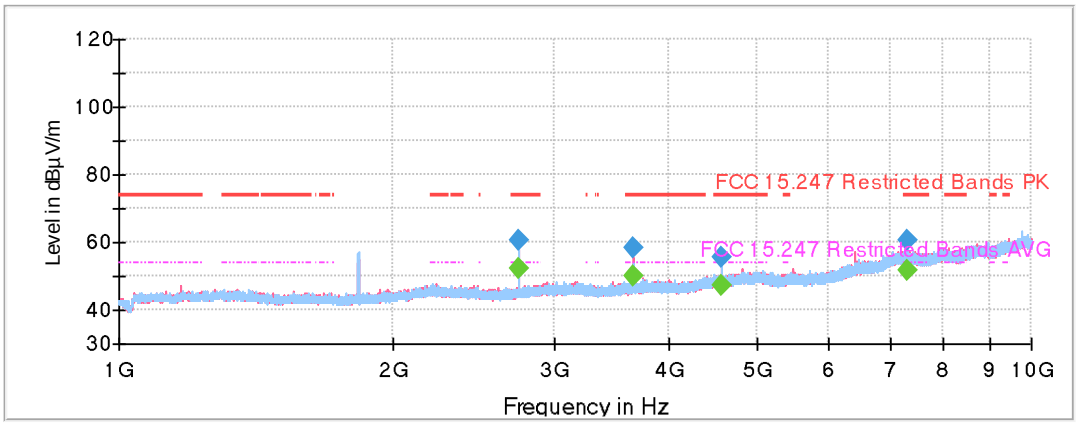
FREQUENCY RANGE 1 - 10 GHz:

FSK 50 Kbps:

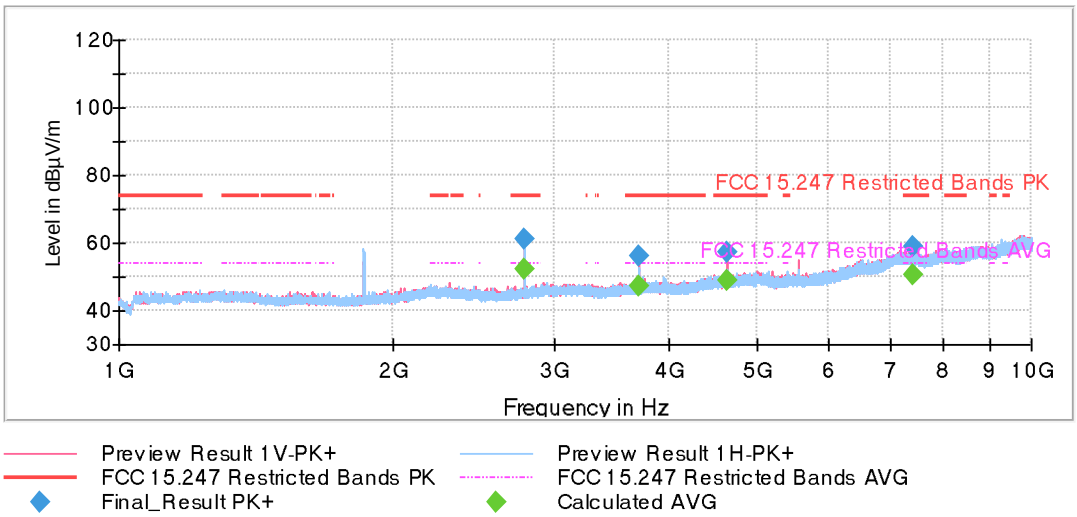
- Low Channel:



- Middle Channel:

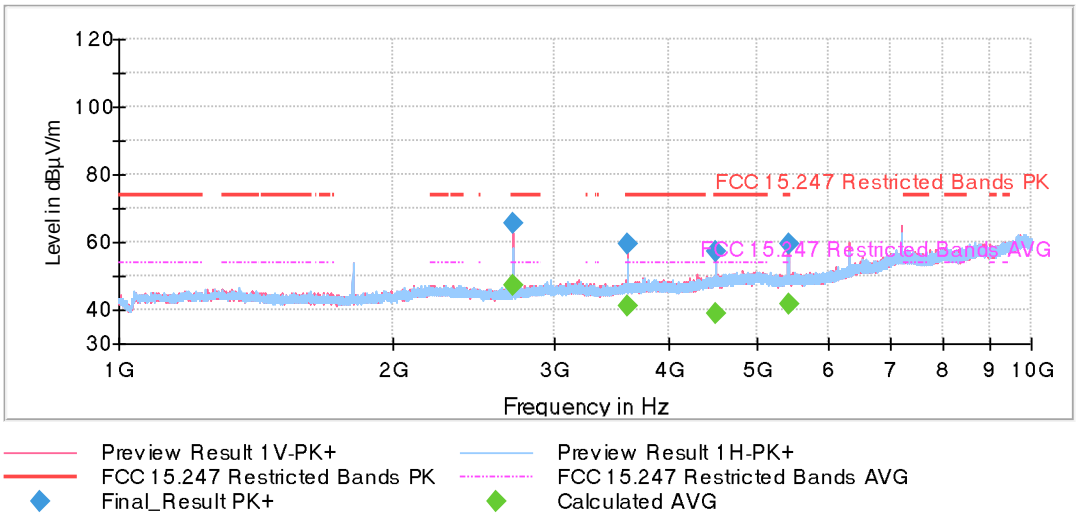


- High Channel:

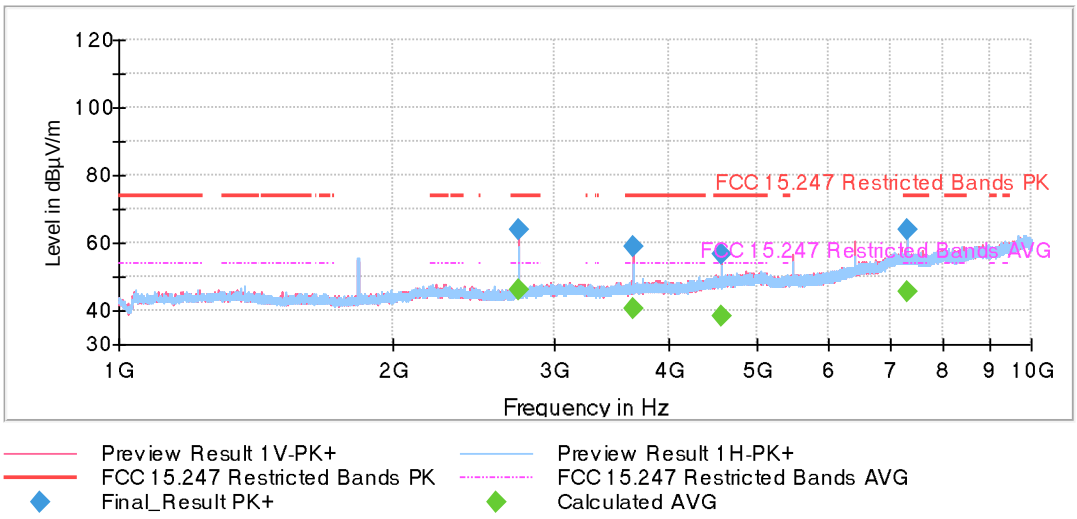


FSK 150 Kbps:

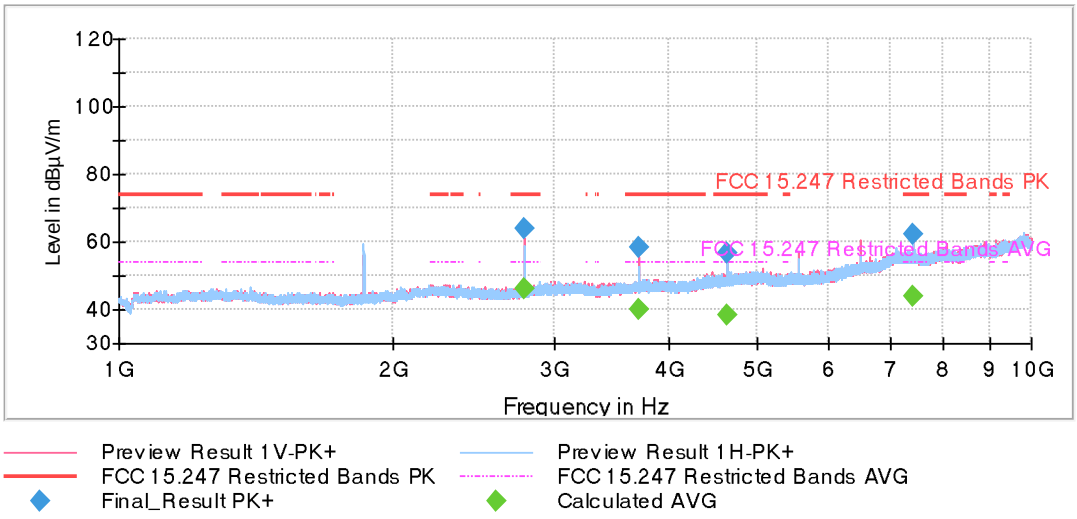
- Low Channel:



- Middle Channel:



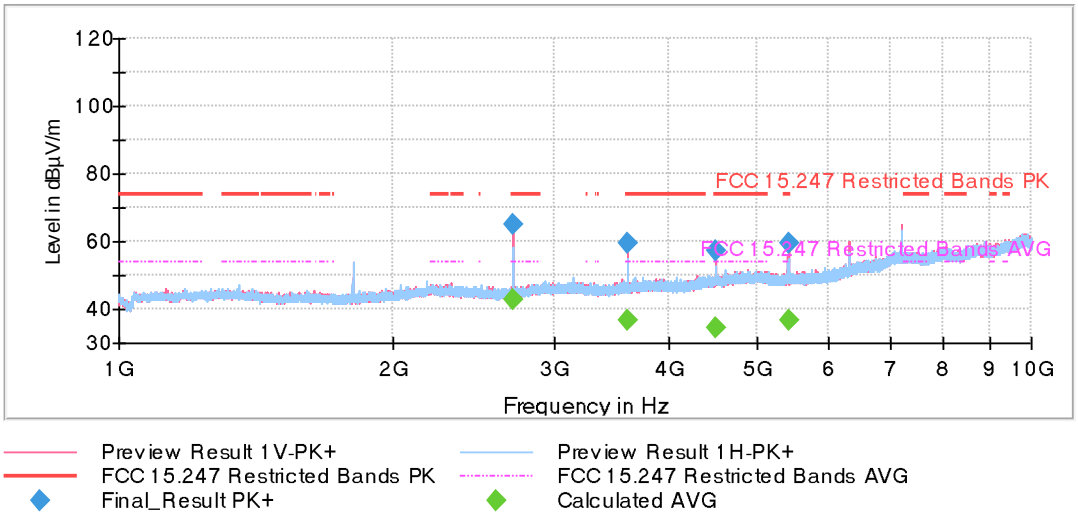
- High Channel:



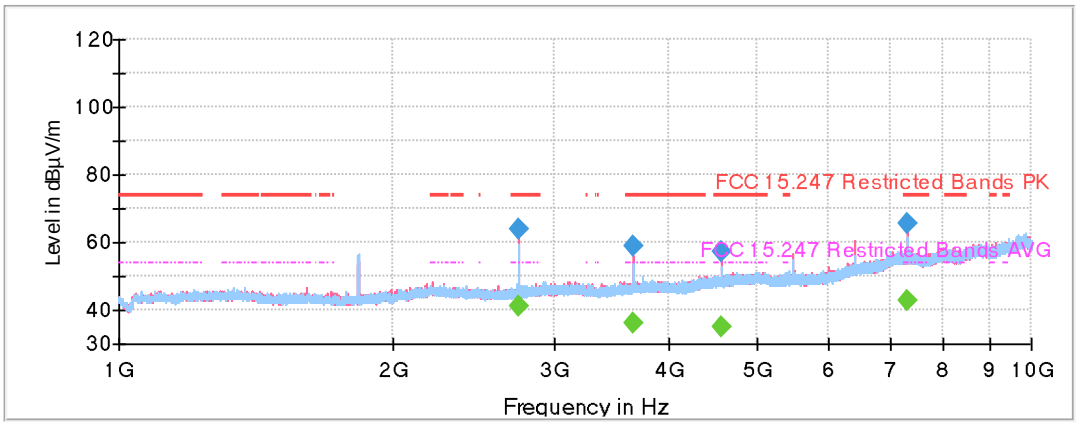
- **FSK 250 Kbps:**

FREQUENCY RANGE 1 - 10 GHz:

- Low Channel:



- Middle Channel:



- High Channel: