

FCC Test Report

Product Name	Plug-In Expander
Model No.	AL-IME2-PIE
FCC ID.	AD8-ALPIE

Applicant	Napco Security Technologies, Inc. (NSSC)
Address	333 Bayview Avenue, Amityville, NY 11701

Date of Receipt	Mar. 19, 2018
Issued Date	Apr. 20, 2018
Report No.	1830266R-RFUSP23V00
Report Version	V1.0



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.

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Test Report

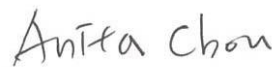
Issued Date: Apr. 20, 2018

Report No.: 1830266R-RFUSP23V00



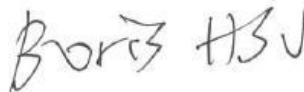
Product Name	Plug-In Expander
Applicant	Napco Security Technologies, Inc. (NSSC)
Address	333 Bayview Avenue, Amityville, NY 11701
Manufacturer	Napco DR SA
Model No.	AL-IME2-PIE
FCC ID.	AD8-ALPIE
EUT Rated Voltage	120VAC @ 60 Hz
EUT Test Voltage	AC 120V / 60Hz
Trade Name	NAPCO
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2017 ANSI C63.4: 2014, ANSI C63.10: 2013 KDB 558074 D01 DTS Meas Guidance v04
Test Result	Complied

Documented By :



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Tested By :



(Engineer / Boris Hsu)

Approved By :



(Director / Vincent Lin)

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1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Plug-In Expander
Trade Name	NAPCO
Model No.	AL-IME2-PIE
FCC ID.	AD8-ALPIE
Frequency Range	905.359034 - 922.971398 MHz
Channel Number	50
Type of Modulation	FSK
Antenna Type	Monopole Antenna
Antenna Gain	Refer to the table “Antenna List”

Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	NAPCO	AL-IME2-PIE	Monopole Antenna	-0.14 dBi

Note: The antenna of EUT is conforming to FCC 15.203.

Center Frequency of Each Channel:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 01: 905.359034 MHz		Channel 14: 910.031702 MHz		Channel 27: 914.704370MHz		Channel 40: 919.377038 MHz	
Channel 02: 905.718470 MHz		Channel 15: 910.391138 MHz		Channel 28: 915.063806MHz		Channel 41: 919.736474MHz	
Channel 03: 906.077906 MHz		Channel 16: 910.750574 MHz		Channel 29: 915.423242MHz		Channel 42: 920.095910MHz	
Channel 04: 906.437342 MHz		Channel 17: 911.110010 MHz		Channel 30: 915.782678MHz		Channel 43: 920.455346MHz	
Channel 05: 906.796778 MHz		Channel 18: 911.469446 MHz		Channel 31: 916.142114MHz		Channel 44: 920.814782MHz	
Channel 06: 907.156214 MHz		Channel 19: 911.828882 MHz		Channel 32: 916.501550MHz		Channel 45: 921.174218MHz	
Channel 07: 907.515650 MHz		Channel 20: 912.188318 MHz		Channel 33: 916.860986MHz		Channel 46: 921.533654MHz	
Channel 08: 907.875086 MHz		Channel 21: 912.547754 MHz		Channel 34: 917.220422MHz		Channel 47: 921.893090MHz	
Channel 09: 908.234522 MHz		Channel 22: 912.907190 MHz		Channel 35: 917.579858MHz		Channel 48: 922.252526 MHz	
Channel 10: 908.593958 MHz		Channel 23: 913.266626 MHz		Channel 36: 917.939294MHz		Channel 49: 922.611962MHz	
Channel 11: 908.953394 MHz		Channel 24: 913.626062 MHz		Channel 37: 918.298730MHz		Channel 50: 922.971398MHz	
Channel 12: 909.312830 MHz		Channel 25: 913.985498 MHz		Channel 38: 918.658166MHz			
Channel 13: 909.672266 MHz		Channel 26: 914.344934 MHz		Channel 39: 919.017602MHz			

Note:

1. The EUT is a Plug-In Expander with a built-in 905.359034 - 922.971398 MHz transceiver.
2. These tests were conducted on a sample for the purpose of demonstrating compliance of 905.359034 - 922.971398 MHz transmitter with Part 15 Subpart C Paragraph 15.247 for spread spectrum devices.
3. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.
4. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.

Test Mode	Mode 1: Transmit
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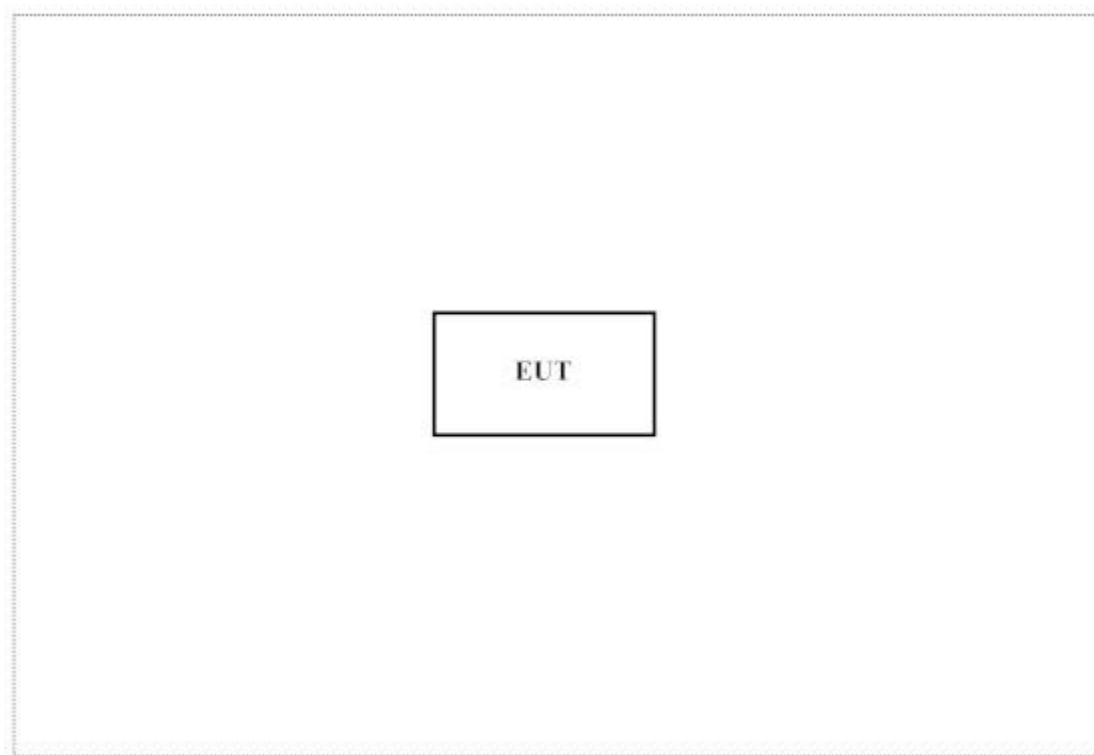
1.3. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
N/A				

Signal Cable Type	Signal cable Description
N/A	

1.4. Configuration of Tested System



1.5. EUT Exercise Software

- (1) Setup the EUT as shown in Section 1.4.
- (2) Press the button of the EUT.
- (3) Start the continuous transmit.
- (4) Verify that the EUT works properly.

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	50-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from DEKRA Testing and Certification Co., Ltd. Web Site:

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FCC Accreditation Number: TW3023

1.7. List of Test Equipment

For Conducted measurements /CB3/SR8

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Date	Due. Date
	Temperature Chamber	WIT GROUP	TH-1S-B	EQ-201-00146	2018/2/12	2019/2/11
X	Spectrum Analyzer	Agilent	N9010A	MY48030495	2017/10/13	2018/10/12
X	Power Meter	Anritsu	ML2495A	6K00003357	2017/8/7	2018/8/6
X	Pulse power sensor	Anritsu	MA2411B	0846193	2017/8/7	2018/8/6
X	EMI Test Receiver	R&S	ESCS 30	100369	2017/11/7	2018/11/6
X	LISN	R&S	ESH3-Z5	836679/017	2018/2/9	2019/2/8
X	LISN	R&S	ENV216	100097	2018/2/9	2019/2/8
X	Coaxial Cable	DEKRA	RG 400	LC018-RG	2017/6/22	2018/6/21

For Radiated measurements /Site3/CB8

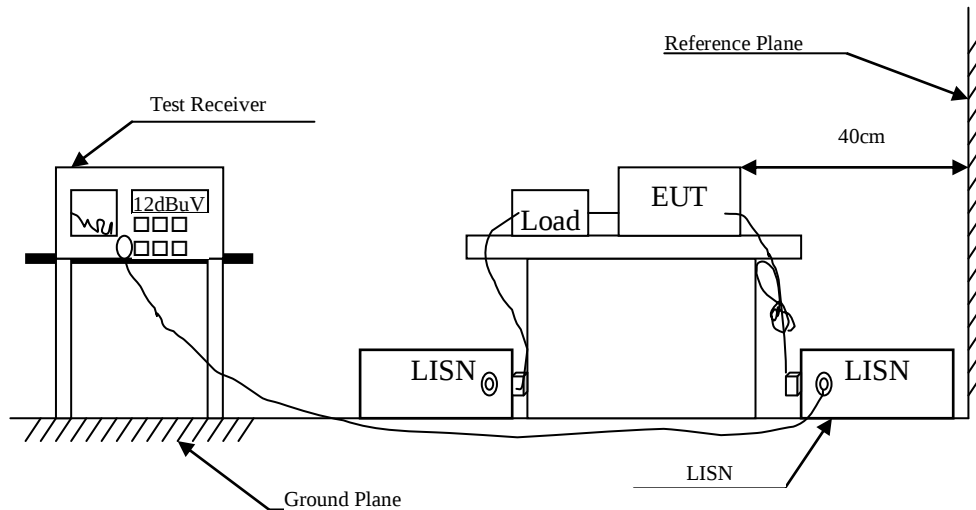
	Equipment	Manufacturer	Model No.	Serial No.	Cali. Date	Due. Date
X	Spectrum Analyzer	R&S	FSP40	100170	2018/3/12	2019/3/11
	Loop Antenna	Teseq	HLA6121	37133	2017/10/13	2018/10/12
X	Bilog Antenna	Schaffner Chase	CBL6112B	2707	2017/06/25	2018/06/24
X	Coaxial Cable	DEKRA	RG 214	LC003-RG	2017/06/15	2018/06/14
X	Pre-Amplifier	Jet-Power	JPA-10M1G33	170101000330010	2017/07/19	2018/07/18
X	Horn Antenna	ETS-Lindgren	3117	00135205	2017/04/28	2018/04/27
X	Pre-Amplifier	EMCI	EMC012630SE	980210	2018/02/24	2019/02/23
X	Coaxial Cable	QuiTek	SF-106	LC035/37/41-SF LC038-SF , LC037-SF	2017/6/21	2018/6/20
X	Horn Antenna	ETS-Lindgren	3117	00135205	2017/04/28	2018/04/27
X	Pre-Amplifier	EMCI	EMC012630SE	980210	2018/02/24	2019/02/23
	Amplifier + Cable	EMCI	EMC184045SE	980370	2018/03/21	2019/03/20
X	Horn Antenna	Com-Power	AH-840	101043	2018/01/09	2019/01/08
X	Filter	MicroTRON	BRM50701	019	2017/11/21	2018/11/20
	Filter	Microwave Circuits	N0257881	36681	2018/1/22	2019/1/21

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version :QuiTek EMI 2.0 V2.1.113.

2. Conducted Emission

2.1. Test Setup



2.2. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dBuV) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56	56-46
0.50-5.0	56	46
5.0 - 30	60	50

Remarks: In the above table, the tighter limit applies at the band edges.

2.3. Test Procedure

The EUT and Peripherals are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

The EUT was setup to ANSI C63.4, 2014; tested to DTS test procedure of FCC KDB-558074 for compliance to FCC 47CFR Subpart C requirements.

2.4. Uncertainty

± 2.26 dB

2.5. Test Result of Conducted Emission

Product : Plug-In Expander
 Test Item : Conducted Emission Test
 Power Line : Line 1
 Test Date : 2018/04/18
 Test Mode : Mode 1: Transmit

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dB μ V	dB μ V	dB	dB μ V
LINE 1					
Quasi-Peak					
0.271	9.677	7.380	17.057	-45.486	62.543
0.548	9.694	15.820	25.514	-30.486	56.000
0.908	9.727	0.360	10.087	-45.913	56.000
1.103	9.740	0.700	10.440	-45.560	56.000
1.533	9.767	4.420	14.187	-41.813	56.000
5.334	9.903	-0.020	9.883	-50.117	60.000
Average					
0.271	9.677	2.680	12.357	-40.186	52.543
0.548	9.694	10.030	19.724	-26.276	46.000
0.908	9.727	-4.840	4.887	-41.113	46.000
1.103	9.740	-4.240	5.500	-40.500	46.000
1.533	9.767	-2.530	7.237	-38.763	46.000
5.334	9.903	-5.400	4.503	-45.497	50.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. " " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : Plug-In Expander
 Test Item : Conducted Emission Test
 Power Line : Line 2
 Test Date : 2018/04/18
 Test Mode : Mode 1: Transmit

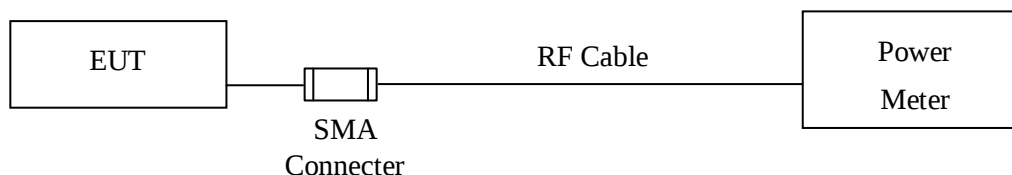
Frequency	Correct	Reading	Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dB μ V	dB μ V	dB	dB μ V
LINE 2					
Quasi-Peak					
0.162	9.670	2.840	12.510	-53.147	65.657
0.283	9.676	8.560	18.236	-43.964	62.200
0.502	9.681	6.040	15.721	-40.279	56.000
1.529	9.767	4.820	14.587	-41.413	56.000
8.752	9.979	0.360	10.339	-49.661	60.000
15.064	10.137	0.680	10.817	-49.183	60.000
Average					
0.162	9.670	-3.470	6.200	-49.457	55.657
0.283	9.676	1.340	11.016	-41.184	52.200
0.502	9.681	-2.590	7.091	-38.909	46.000
1.529	9.767	-1.960	7.807	-38.193	46.000
8.752	9.979	-4.910	5.069	-44.931	50.000
15.064	10.137	-4.680	5.457	-44.543	50.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. "■" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

3. Peak Power Output

3.1. Test Setup



3.2. Limit

The maximum peak power shall be less 1Watt.

3.3. Test Procedure

Tested according to DTS test procedure of KDB 558074 for compliance to FCC 47CFR 15.247 requirements. The maximum peak conducted output power using KDB 558074 section 9.1.3 PKPM1 Peak-reading power meter method

3.4. Uncertainty

± 0.86 dB

3.5. Test Result of Peak Power Output

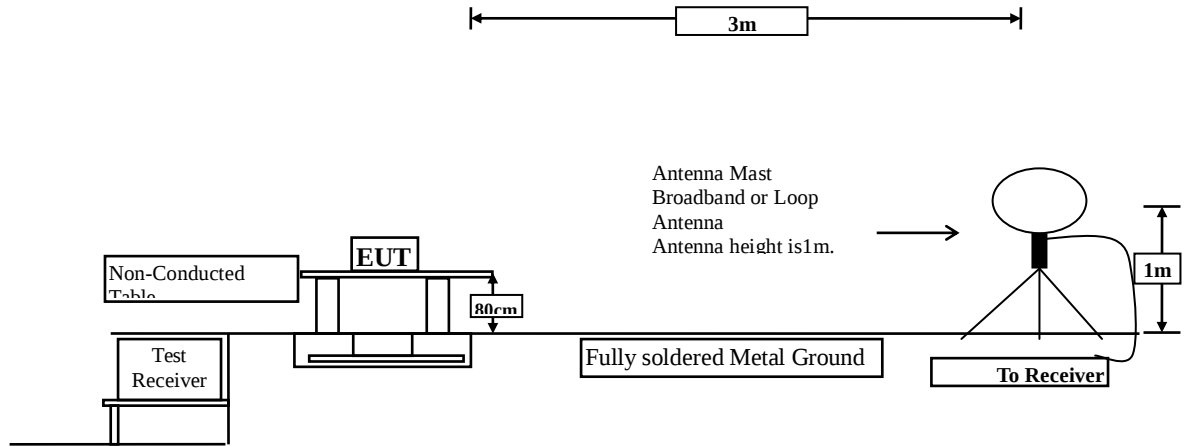
Product : Plug-In Expander
Test Item : Peak Power Output
Test Mode : Mode 1: Transmit
Test Date : 2018/04/19

Channel No.	Frequency (MHz)	Measurement (dBm)	Required Limit	Result
01	905.359034	11.29	<30dBm	Pass
26	914.344934	9.07	<30dBm	Pass
50	922.971398	8.08	<30dBm	Pass

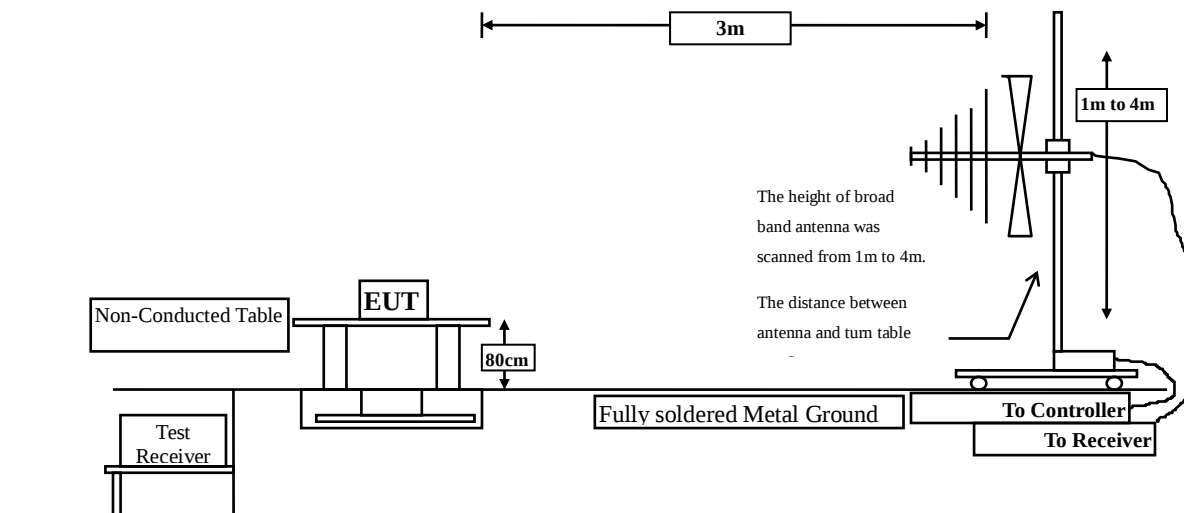
4. Radiated Emission

4.1. Test Setup

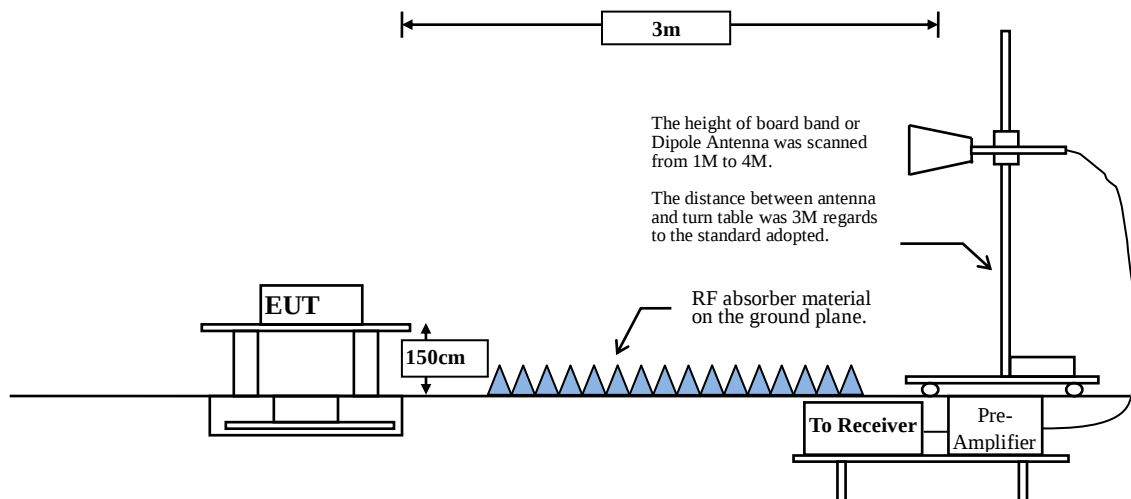
Radiated Emission Under 30MHz



Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



4.2. Limits

➤ General Radiated Emission Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209 Limits		
Frequency MHz	Field strength (microvolts/meter)	Measurement distance (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

- Remarks:
1. RF Voltage (dBuV) = 20 log RF Voltage (uV)
 2. In the Above Table, the tighter limit applies at the band edges.
 3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

4.3. Test Procedure

The EUT was setup according to ANSI C63.10: 2013 and tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Measuring the frequency range below 1GHz, the EUT is placed on a turn table which is 0.8 meter above ground, when measuring the frequency range above 1GHz, the EUT is placed on a turn table which is 1.5 meter above ground.

The turn table is rotated 360 degrees to determine the position of the maximum emission level.

The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned between 1 meter and 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10: 2013 on radiated measurement.

The resolution bandwidth below 30MHz setting on the field strength meter is 9kHz and 30MHz~1GHz is 120kHz and above 1GHz is 1MHz.

Radiated emission measurements below 30MHz are made using Loop Antenna and 30MHz~1GHz are made using broadband Bilog antenna and above 1GHz are made using Horn Antennas.

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna.

The measurement frequency range from 9kHz - 10th Harmonic of fundamental was investigated.

RBW and VBW Parameter setting:

According to KDB 558074 section 12.2.4. Peak power measurement procedure

RBW = as specified in Table 1.

$VBW \geq 3 \times RBW$.

Table 1 —RBW as a function of frequency

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

According to KDB 558074 section 12.2.5. Average power measurement procedure

RBW = 1MHz.

VBW = 10Hz, when duty cycle $\geq 98 \%$

$VBW \geq 1/T$, when duty cycle $< 98 \%$

(T refers to the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.)

band	Duty Cycle (%)	T (ms)	1/T (Hz)	VBW (Hz)
905.359034MHz	16.7	1.05	115 Hz	200Hz

Note: Duty Cycle Refer to Section 9

4.4. Uncertainty

± 4.08 dB above 1GHz

± 4.22 dB below 1GHz

4.5. Test Result of Radiated Emission

Product : Plug-In Expander
 Test Item : Harmonic Radiated Emission
 Test Mode : Mode 1: Transmit (905.35903MHz)
 Test Date : 2018/04/17

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Peak Detector:					
1810.718	-11.268	63.580	52.312	-21.688	74.000
2716.077	-7.262	62.050	54.788	-19.212	74.000
3621.436	-5.604	59.470	53.865	-20.135	74.000
4526.795	-3.078	51.730	48.653	-25.347	74.000
5432.154	-2.197	50.650	48.453	-25.547	74.000
6337.513	-0.547	47.170	46.624	-27.376	74.000
7242.872	0.071	50.980	51.051	-22.949	74.000
8148.231	0.914	46.740	47.653	-26.347	74.000
9053.590	1.318	49.750	51.069	-22.931	74.000
Average Detector:					
2716.077	-7.262	56.710	49.448	-4.552	54.000
Vertical					
Peak Detector:					
1810.718	-11.268	57.010	45.742	-28.258	74.000
2716.077	-7.262	61.480	54.218	-19.782	74.000
3621.436	-5.604	56.460	50.855	-23.145	74.000
4526.795	-3.078	49.020	45.943	-28.057	74.000
5432.154	-2.197	54.350	52.153	-21.847	74.000
6337.513	-0.547	46.550	46.004	-27.996	74.000
7242.872	0.071	51.220	51.291	-22.709	74.000
8148.231	0.914	48.570	49.483	-24.517	74.000
9053.590	1.318	49.790	51.109	-22.891	74.000
Average Detector:					
2716.077	-7.262	55.110	47.848	-6.152	54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Plug-In Expander
 Test Item : Harmonic Radiated Emission
 Test Mode : Mode 1: Transmit (914.34493MHz)
 Test Date : 2018/04/17

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Peak Detector:					
1828.689	-11.144	59.740	48.596	-25.404	74.000
2743.034	-7.209	56.750	49.541	-24.459	74.000
3657.379	-5.554	60.390	54.837	-19.163	74.000
4571.724	-3.057	46.700	43.643	-30.357	74.000
5486.069	-2.117	53.400	51.283	-22.717	74.000
6400.414	-0.427	47.440	47.013	-26.987	74.000
7314.759	0.100	50.390	50.490	-23.510	74.000
8229.104	0.878	46.970	47.848	-26.152	74.000
9143.449	1.404	47.910	49.313	-24.687	74.000
Average Detector:					
3657.379	-5.554	55.030	49.477	-4.523	54.000
Vertical					
Peak Detector:					
1828.689	-11.144	55.950	44.806	-29.194	74.000
2743.034	-7.209	54.420	47.211	-26.789	74.000
3657.379	-5.554	56.160	50.607	-23.393	74.000
4571.724	-3.057	48.780	45.723	-28.277	74.000
5486.069	-2.117	56.390	54.273	-19.727	74.000
6400.414	-0.427	47.450	47.023	-26.977	74.000
7314.759	0.100	54.450	54.550	-19.450	74.000
8229.104	0.878	48.410	49.288	-24.712	74.000
9143.449	1.404	50.200	51.603	-22.397	74.000
Average Detector:					
3657.379	-5.554	55.030	49.477	-4.523	54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Plug-In Expander
 Test Item : Harmonic Radiated Emission
 Test Mode : Mode 1: Transmit (922.971398MHz)
 Test Date : 2018/04/17

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Peak Detector:					
1845.942	-10.976	58.180	47.204	-26.796	74.000
2768.914	-7.131	59.990	52.858	-21.142	74.000
3691.885	-5.480	56.890	51.410	-22.590	74.000
4614.856	-2.980	49.810	46.829	-27.171	74.000
5537.828	-1.956	53.870	51.914	-22.086	74.000
6460.799	-0.326	47.890	47.565	-26.435	74.000
7383.771	0.071	52.130	52.201	-21.799	74.000
8306.742	0.952	48.080	49.032	-24.968	74.000
9229.713	1.547	50.470	52.017	-21.983	74.000
Average Detector:					
--	--	--	--	--	--
Vertical					
Peak Detector:					
1845.942	-10.976	54.280	43.304	-30.696	74.000
2768.914	-7.131	57.610	50.478	-23.522	74.000
3691.885	-5.480	54.550	49.070	-24.930	74.000
4614.856	-2.980	49.530	46.549	-27.451	74.000
5537.828	-1.956	52.730	50.774	-23.226	74.000
6460.799	-0.326	47.790	47.465	-26.535	74.000
7383.771	0.071	54.390	54.461	-19.539	74.000
8306.742	0.952	48.730	49.682	-24.318	74.000
9229.713	1.547	51.960	53.507	-20.493	74.000
Average Detector:					
7383.771	0.071	45.520	45.591	-8.409	54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Plug-In Expander
 Test Item : General Radiated Emission
 Test Mode : Mode 1: Transmit (905.359034MHz)
 Test Date : 2018/03/21

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
389.087	0.751	29.543	30.294	-15.706	46.000
435.721	1.797	29.404	31.201	-14.799	46.000
597.388	6.924	28.690	35.614	-10.386	46.000
696.875	5.953	28.915	34.868	-11.132	46.000
783.926	7.492	29.867	37.360	-8.640	46.000
847.660	7.764	28.840	36.605	-9.395	46.000
Vertical					
204.103	0.060	28.915	28.975	-14.525	43.500
448.157	0.912	28.044	28.956	-17.044	46.000
535.208	2.011	29.840	31.851	-14.149	46.000
727.965	4.722	27.711	32.432	-13.568	46.000
807.244	6.126	27.929	34.055	-11.945	46.000
875.641	8.163	27.677	35.840	-10.160	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
4. The emission levels of other frequencies are very lower than the limit and not show in test report.
5. No emission found between lowest internal used/generated frequency to 30MHz.

Product : Plug-In Expander
 Test Item : General Radiated Emission
 Test Mode : Mode 1: Transmit (914.344934MHz)
 Test Date : 2018/03/21

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
53.317	-10.930	43.055	32.125	-7.875	40.000
518.109	3.204	28.840	32.045	-13.955	46.000
659.567	6.371	29.446	35.817	-10.183	46.000
752.837	6.926	29.135	36.061	-9.939	46.000
869.423	7.738	28.207	35.945	-10.055	46.000
984.455	8.671	29.543	38.214	-15.786	54.000
Vertical					
421.731	0.804	28.044	28.848	-17.152	46.000
519.663	1.616	27.929	29.545	-16.455	46.000
631.587	3.866	29.933	33.799	-12.201	46.000
783.926	5.642	28.350	33.993	-12.007	46.000
832.115	6.867	26.759	33.626	-12.374	46.000
858.542	7.649	27.711	35.360	-10.640	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
4. The emission levels of other frequencies are very lower than the limit and not show in test report.
5. No emission found between lowest internal used/generated frequency to 30MHz.

Product : Plug-In Expander
 Test Item : General Radiated Emission
 Test Mode : Mode 1: Transmit (922.971398MHz)
 Test Date : 2018/03/21

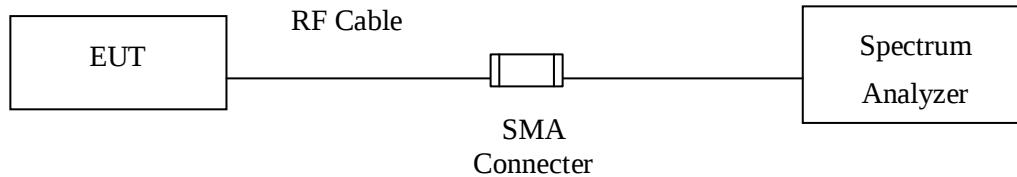
Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
508.782	2.768	29.263	32.032	-13.968	46.000
575.625	5.905	29.333	35.238	-10.762	46.000
611.378	6.915	30.064	36.978	-9.022	46.000
695.321	5.981	29.543	35.524	-10.476	46.000
759.054	7.033	28.397	35.430	-10.570	46.000
839.888	7.762	29.306	37.068	-8.932	46.000
Vertical					
213.429	-0.065	28.886	28.821	-14.679	43.500
435.721	0.854	28.428	29.283	-16.717	46.000
504.119	1.218	27.995	29.212	-16.788	46.000
617.596	3.785	26.372	30.157	-15.843	46.000
811.907	6.267	28.841	35.108	-10.892	46.000
863.205	7.784	28.506	36.290	-9.710	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
4. The emission levels of other frequencies are very lower than the limit and not show in test report.
5. No emission found between lowest internal used/generated frequency to 30MHz.

5. RF Antenna Conducted Test

5.1. Test Setup



5.2. Limits

According to FCC Section 15.247(d). In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or 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, based on either an RF conducted or 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.

5.3. Test Procedure

The EUT was tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 100 kHz, Set VBW > RBW, scan up through 10th harmonic.

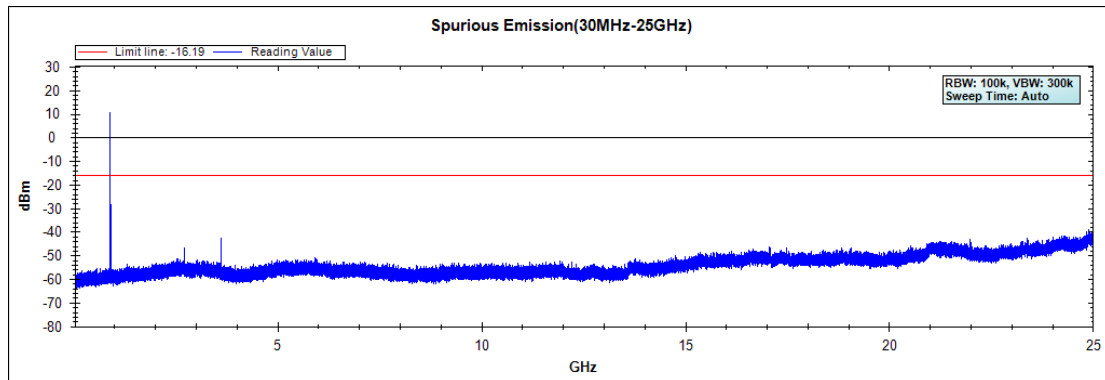
5.4. Uncertainty

±1.23dB

5.5. Test Result of RF Antenna Conducted Test

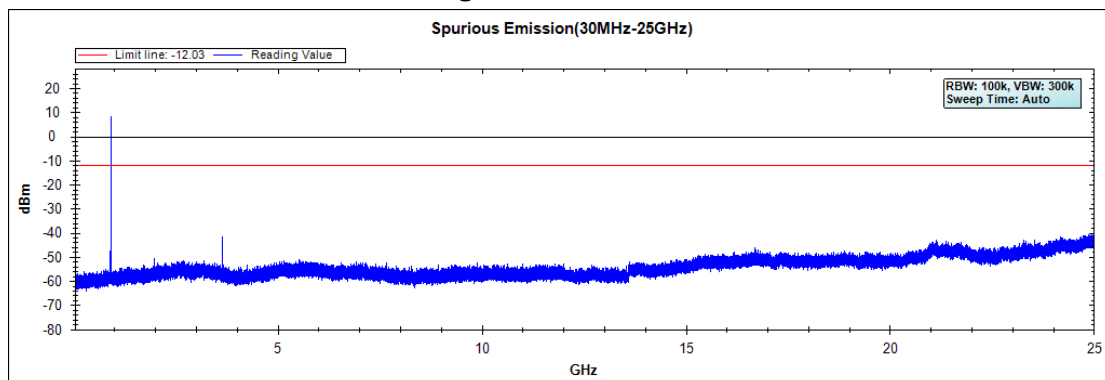
Product : Plug-In Expander
Test Item : RF Antenna Conducted Test
Test Mode : Mode 1: Transmit
Test Date : 2018/04/18

Figure Channel 01:



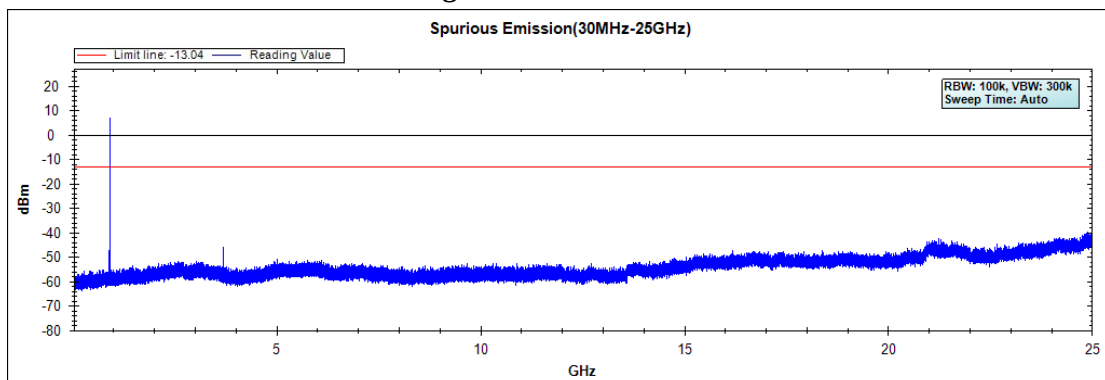
Note: The above test pattern is synthesized by multiple of the frequency range.

Figure Channel 26:



Note: The above test pattern is synthesized by multiple of the frequency range.

Figure Channel 50:

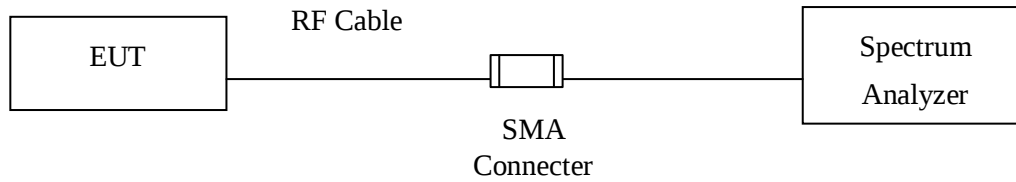


Note: The above test pattern is synthesized by multiple of the frequency range.

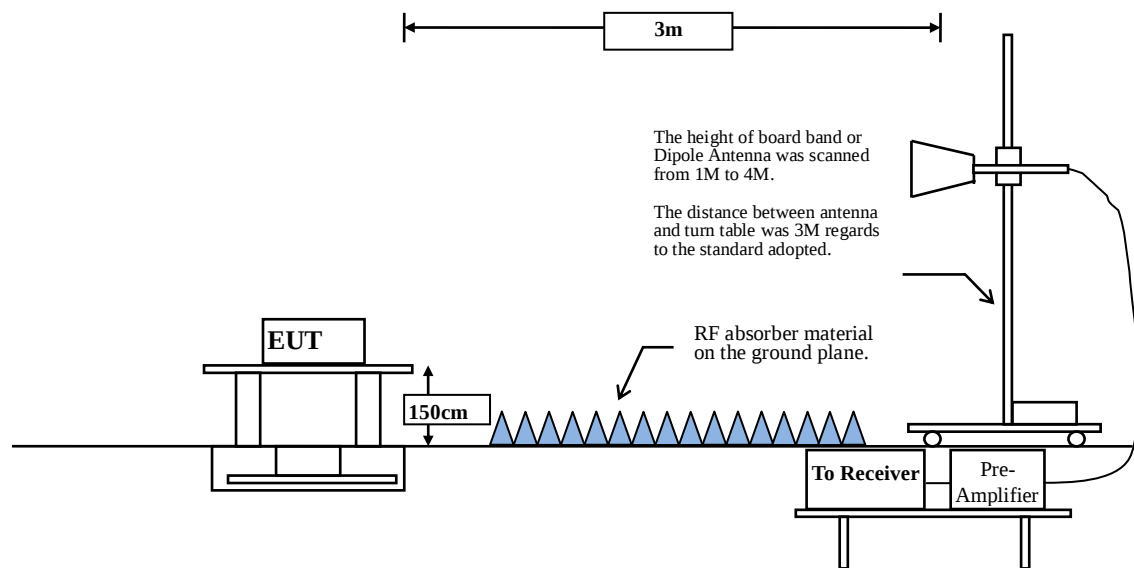
6. Band Edge

6.1. Test Setup

RF Conducted Measurement



RF Radiated Measurement:



6.2. Limit

According to FCC Section 15.247(d). In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or 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, based on either an RF conducted or 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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, 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)).

6.3. Test Procedure

The EUT was setup according to ANSI C63.10, 2013 and tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.

6.4. Uncertainty

Conducted: $\pm 1.20\text{dB}$

Radiated:

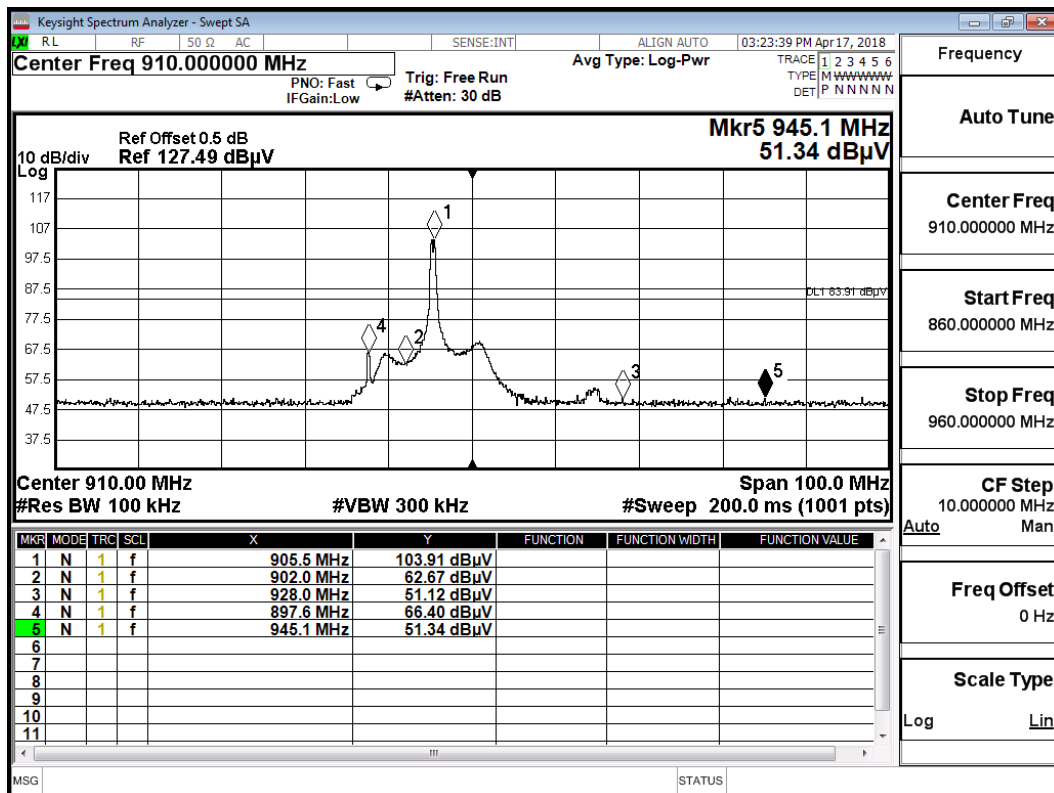
$\pm 4.08\text{ dB}$ above 1GHz

$\pm 4.22\text{ dB}$ below 1GHz

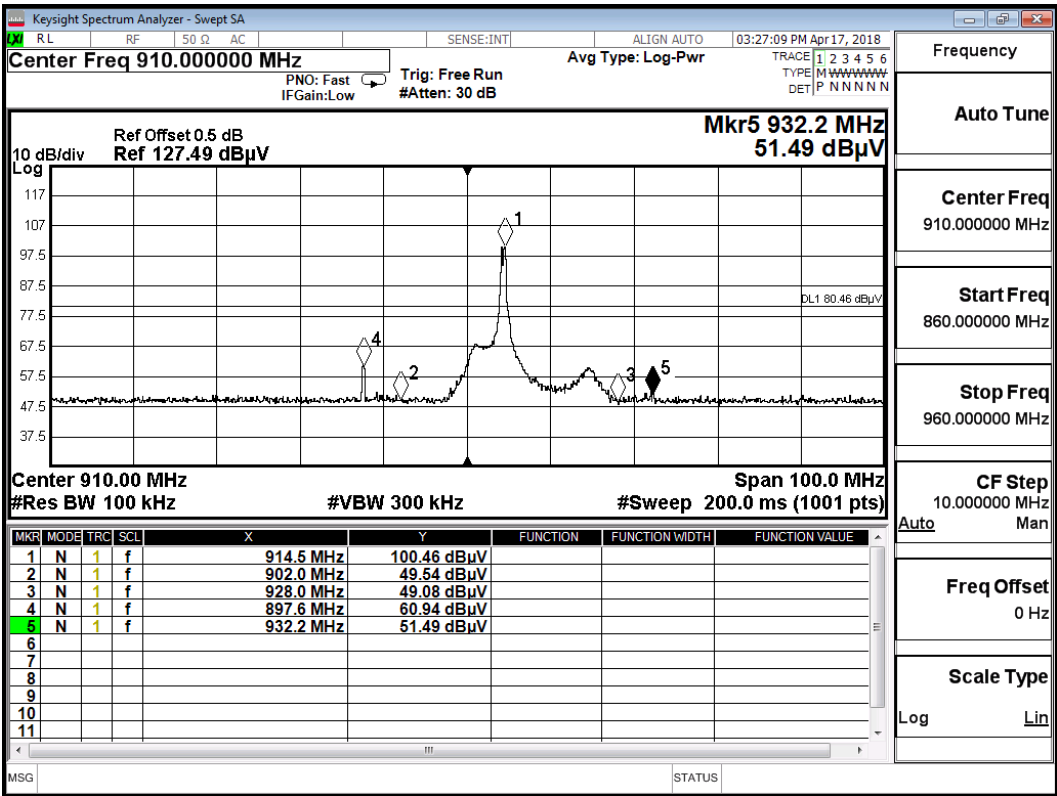
6.5. Test Result of Band Edge

Product : Plug-In Expander
 Test Item : Band Edge
 Test Mode : Mode 1: Transmit

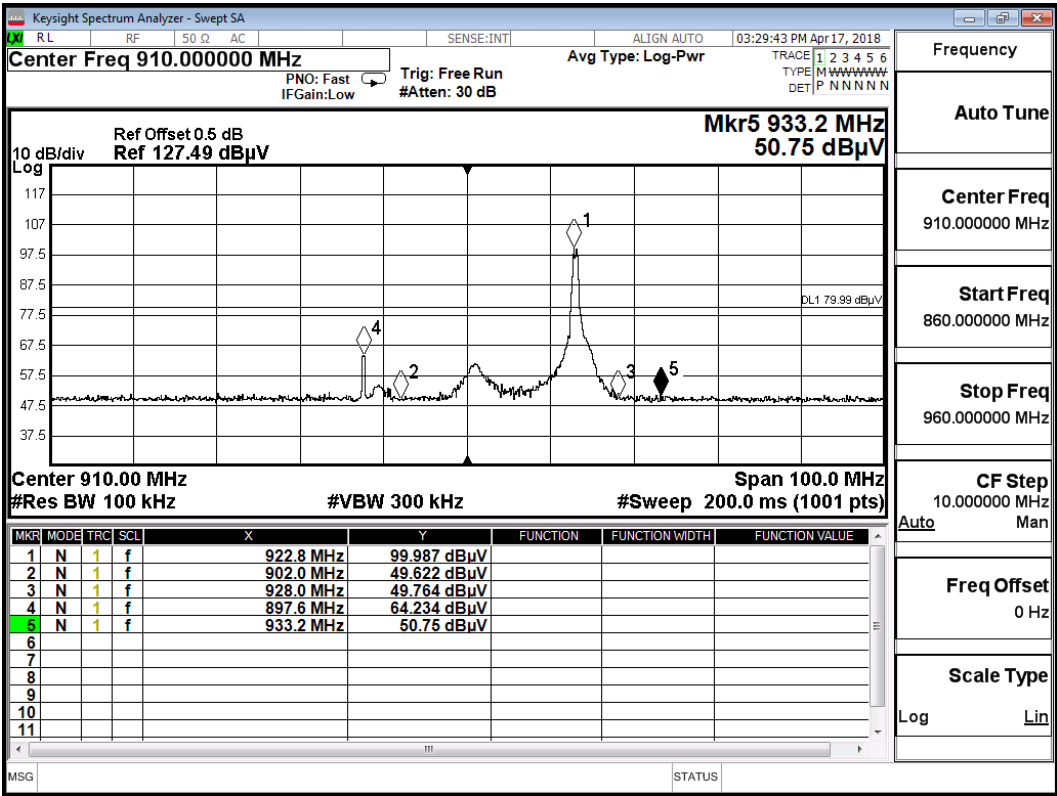
Measurement Level	Result
Δ (dB)	
> 20	PASS



Measurement Level	Result
Δ (dB)	
> 20	PASS

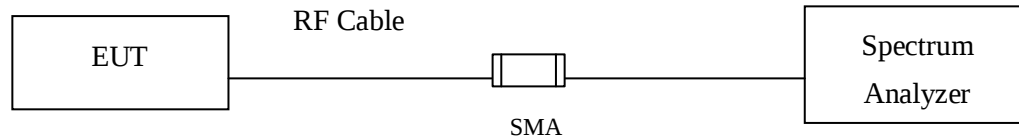


Measurement Level	Result
Δ (dB)	
> 20	PASS



7. 6dB Bandwidth

7.1. Test Setup



7.2. Limits

The minimum bandwidth shall be at least 500 kHz.

7.3. Test Procedure

The EUT was setup according to ANSI C63.10 2013; tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 1-5% of the emission bandwidth, $VBW \geq 3 * RBW$

7.4. Uncertainty

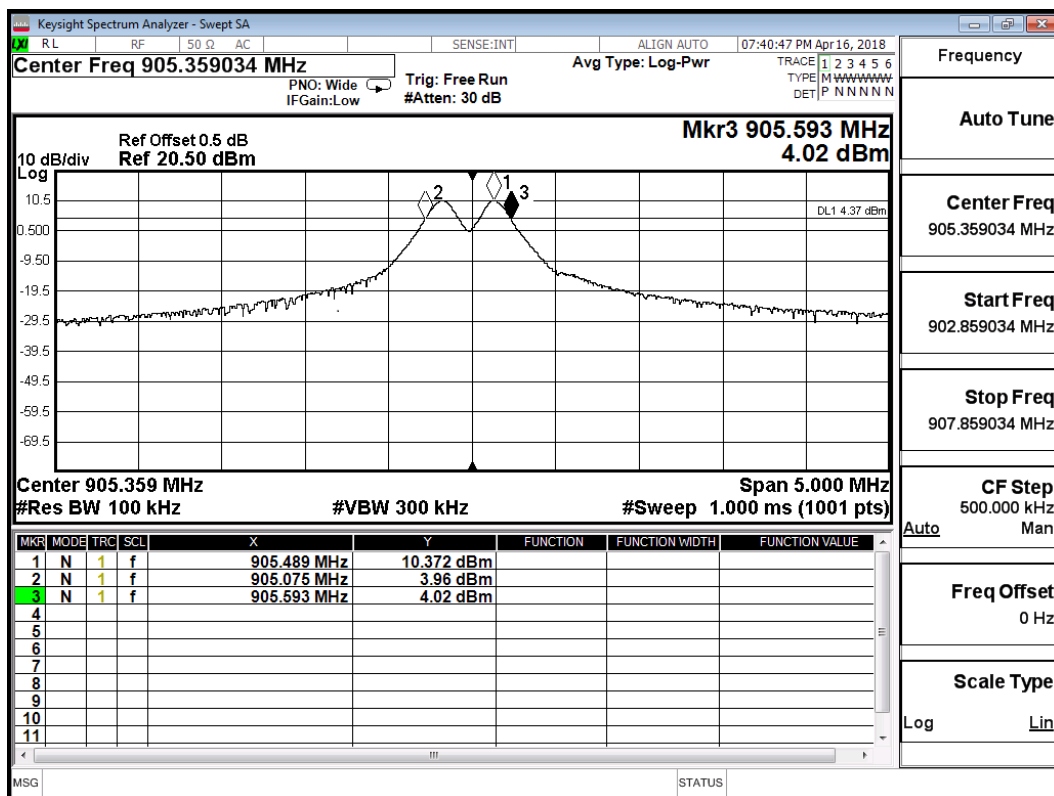
$\pm 279.2\text{Hz}$

7.5. Test Result of 6dB Bandwidth

Product : Plug-In Expander
 Test Item : 6dB Bandwidth Data
 Test Mode : Mode 1: Transmit

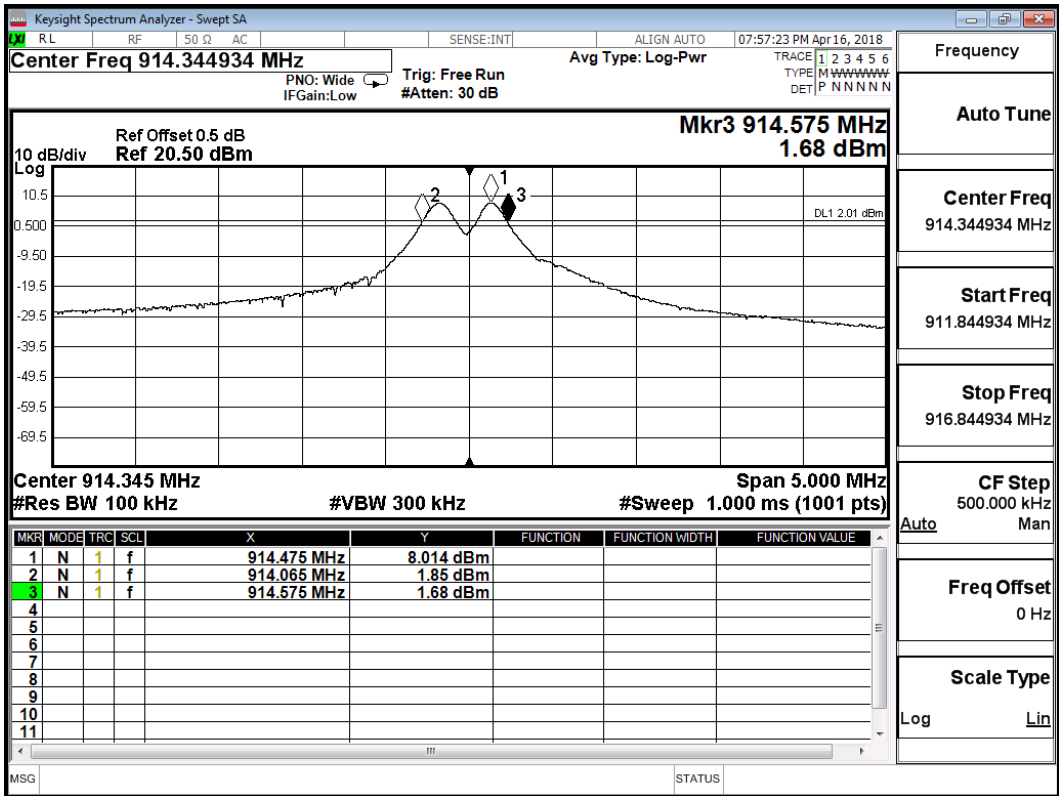
Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
01	905.359034	518	≥ 500	Pass

Figure Channel 01:



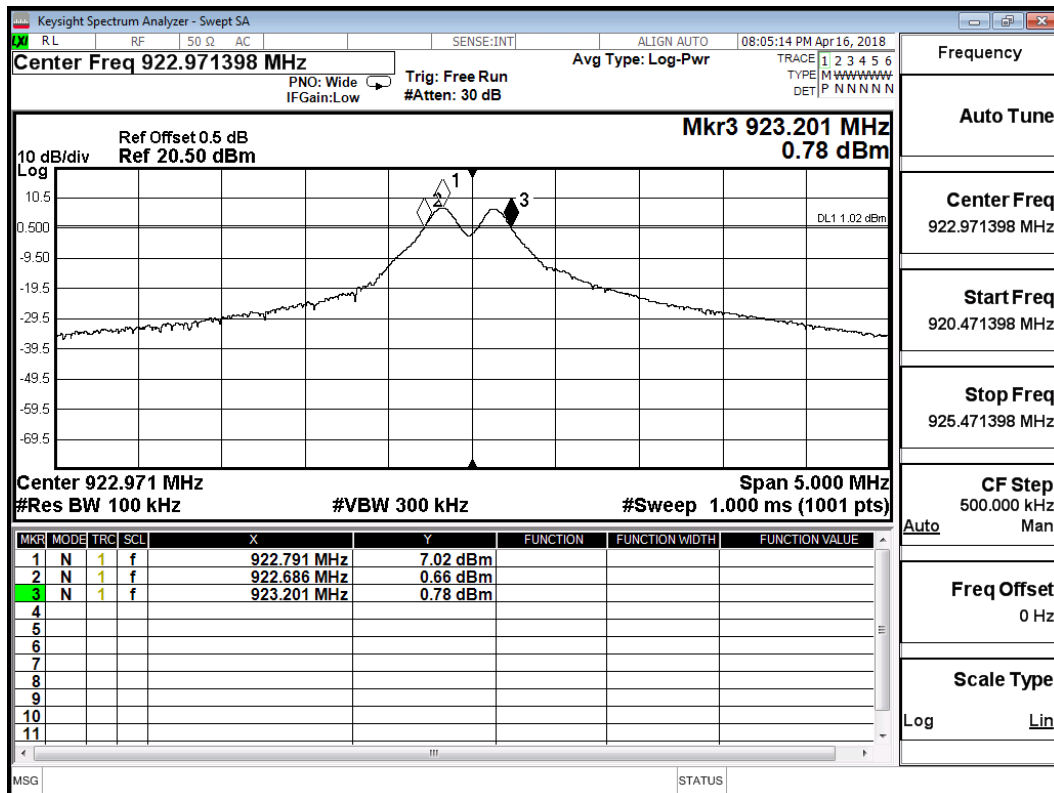
Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
26	914.344934	510	≥ 500	Pass

Figure Channel 26:



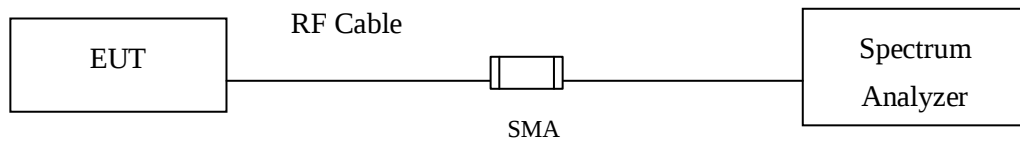
Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
50	922.971398	515	≥ 500	Pass

Figure Channel 50:



8. Power Density

8.1. Test Setup



8.2. Limits

The transmitted power density averaged over any 1 second interval shall not be greater +8dBm in any 3kHz bandwidth.

8.3. Test Procedure

The EUT was setup according to ANSI C63.10: 2013, the maximum power spectral density using KDB 558074 section 10.2 PKPSD (peak PSD) method.

8.4. Uncertainty

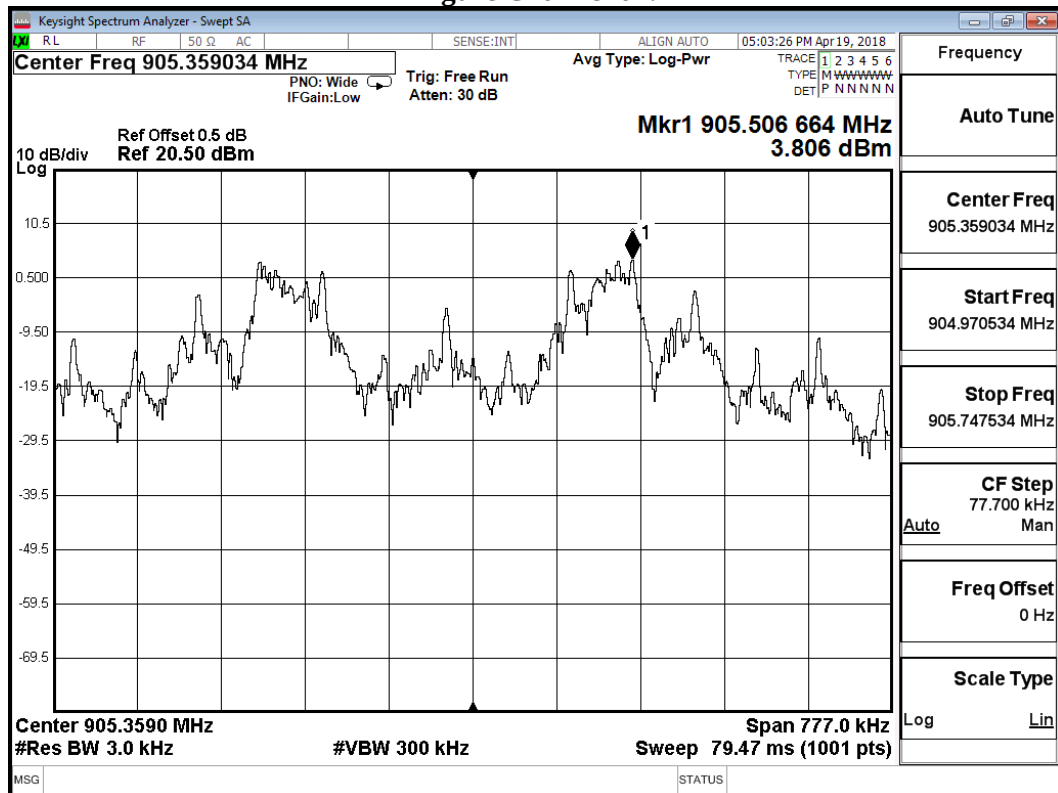
$\pm 1.23\text{dB}$

8.5. Test Result of Power Density

Product : Plug-In Expander
 Test Item : Power Density Data
 Test Mode : Mode 1: Transmit

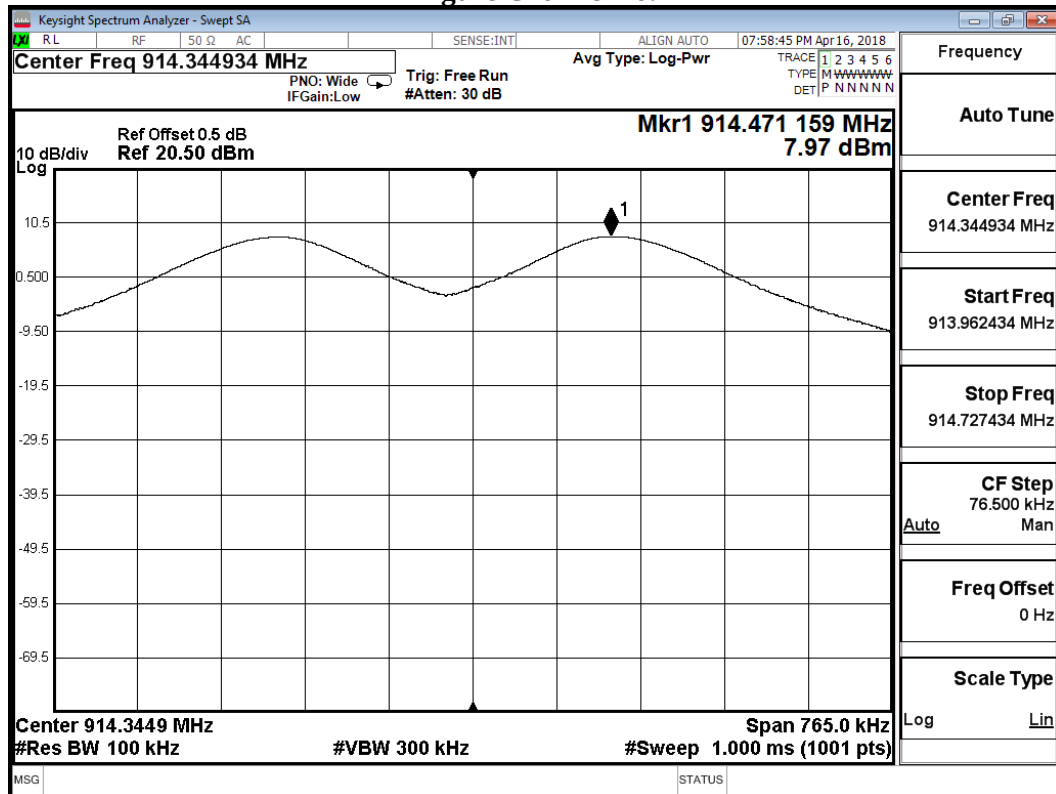
Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
01	905.359034	3.806	$\leq 8\text{dBm}$	Pass

Figure Channel 01:



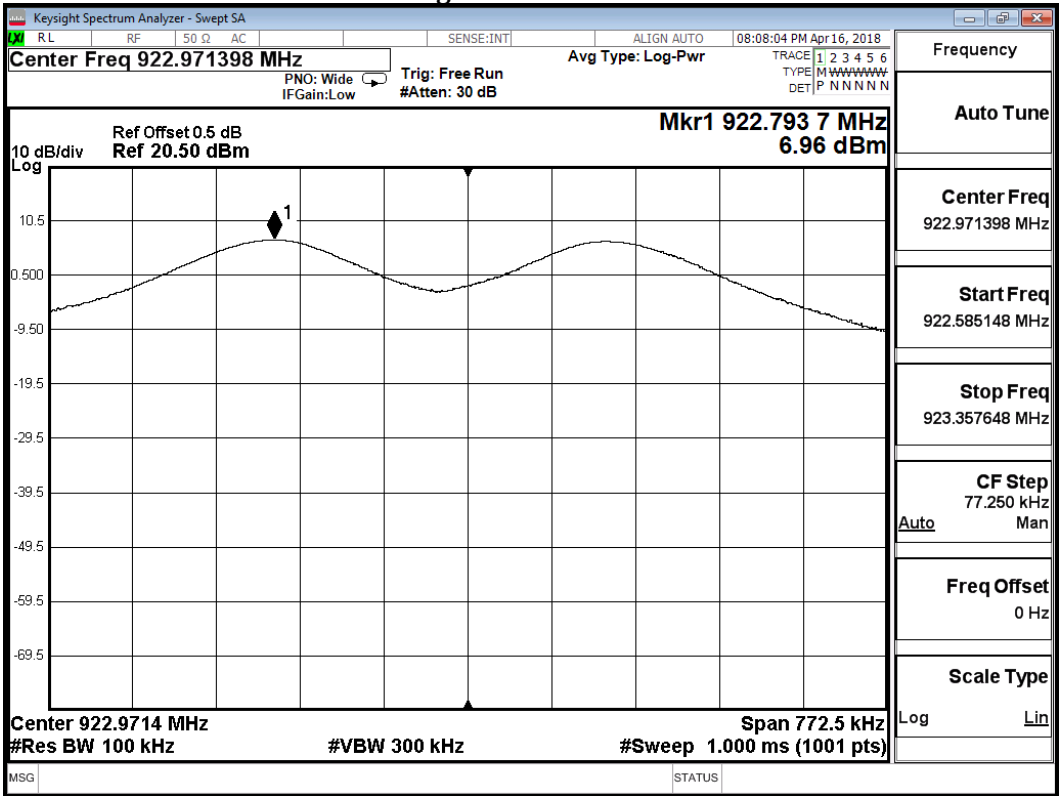
Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
26	914.344934	7.97	$\leq 8\text{dBm}$	Pass

Figure Channel 26:



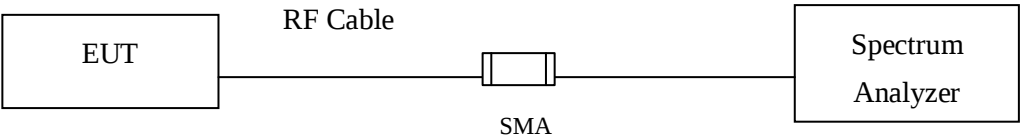
Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
50	922.971398	6.96	≤ 8dBm	Pass

Figure Channel 50:



9. Duty Cycle

9.1. Test Setup



9.2. Test Procedure

The EUT was setup according to ANSI C63.10 2013; tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

9.3. Uncertainty

$\pm 2.31\text{msec}$

band	Duty Cycle (%)	T (ms)	1/T (Hz)	VBW (Hz)
905.359034MHz	16.7	1.05	115 Hz	200Hz

9.4. Test Result of Duty Cycle

Product : Plug-In Expander
 Test Item : Duty Cycle
 Test Mode : Mode 1: Transmit

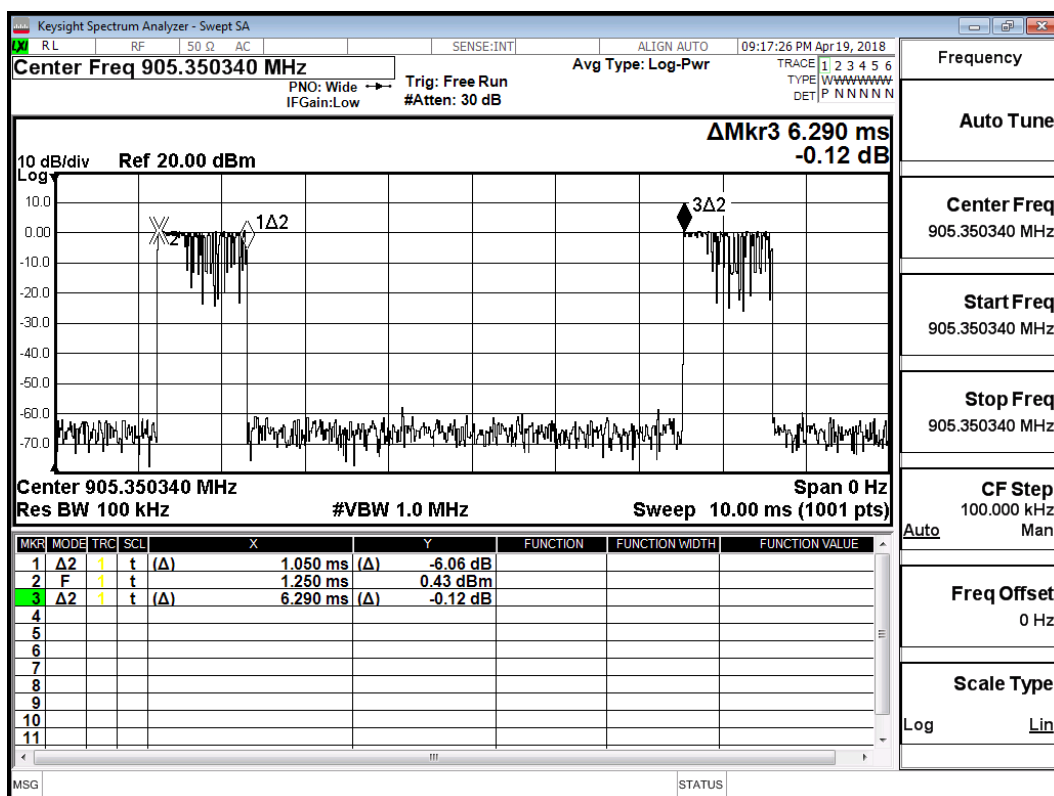
Duty Cycle Formula:

Duty Cycle = Ton / (Ton + Toff)

Duty Factor = 10 Log (1/Duty Cycle)

Results:

band	Ton (ms)	Ton + Toff (ms)	Duty Cycle (%)	Duty Factor (dB)
905.359034MHz	1.05	6.29	16.7	7.75



10. EMI Reduction Method During Compliance Testing

No modification was made during testing.