FCC IC Test Report

Report No.:	FCC_IC_RF_SL20111601-JAD-010
FCC ID:	QV5IZAR
IC:	5407A-IZAR
Test Model:	IZAR
Received Date:	06/02/2021
Test Date:	06/23/2021-12/01/2021
Issued Date:	12/08/2021
Applicant:	JADAK, a business unit of Novanta Corporation
Address:	125 Middlesex Turnpike, Bedford, MA 01730
Manufacturer:	JADAK, a business unit of Novanta Corporation
Address:	125 Middlesex Turnpike, Bedford, MA 01730
Issued By:	Bureau Veritas Consumer Products Services, Inc.
Lab Address:	775 Montague Expressway, Milpitas, CA 95035
Test Location (1):	775 Montague Expressway, Milpitas, CA 95035
FCC Registration / Designation Number:	540430
ISED# / CAB identifier:	4842D

ACCREDITED
TESTING CERT # 2742-01

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Release Control Record

Issue No.	Description	Date Issued
FCC_IC_RF_SL20111601-JAD-010	Orignal Release	07/07/2021
FCC_IC_RF_SL20111601-JAD-010 Rev.01	Report updated per TCB comments.	12/8/2021

1 Certificate of Conformity

Product:	UHF Reader
Brand:	JADAK, a business unit of Novanta Corporation
Test Model:	IZAR
Sample Status:	Engineering sample
Applicant:	JADAK, a business unit of Novanta Corporation
Test Date:	06/23/2021-07/03/2021
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) RSS-247 Issue 2, February 2017 ANSI C63.10: 2013 RSS-Gen Issue 5, February 2021 KDB 558074 v05r02

The above equipment has been tested by **Bureau Veritas Consumer Products Services, Inc., Milpitas Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Deon , **Date:** 07/07/2021 / 12/8/2021

Deon Dai/Yu-Chien Ho / Test Engineer

Approved by : Gary Chou , **Date:** 12/8/2021

Gary Chou / Engineer Reviewer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (SECTION 15.247) RSS-247 Issue 5, February 2017			
FCC Clause	Test Item	Result	Remarks
15.207 / RSS-GEN 8.8	AC Power Conducted Emission	PASS	Meet the requirement of limit.
15.247(a)(1)(iii) / RSS-247 (5.1) (d)	Number of Hopping Frequency Used	N/A	
15.247(a)(1)(iii) / RSS-247 (5.1) (c)	Dwell Time on Each Channel	N/A	
15.247(a)(1) / RSS-247 (5.1) (a) (b) / RSS-GEN (6.7)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	N/A	
15.247(b) / RSS-247 (5.4) (a)	Maximum Peak Output Power	PASS	Meet the requirement of limit.
15.247(d) / RSS-247 (5.5)	Band Edge Measurement	PASS	Meet the requirement of limit.
15.205 & 209 / 15.247(d) / RSS-GEN (8.9) (8.10)	Radiated Emissions	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	The EUT antenna connector is RP-TNC not a standard connector. Professional installation is required.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	3.51dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	3.73dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	4.64dB
	6GHz ~ 18GHz	4.82dB
	18GHz ~ 40GHz	4.91dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	UHF Reader
Brand	JADAK, a business unit of Novanta Corporation
Test Model	IZAR
Identification No. of EUT	N/A
Status of EUT	Engineering sample
Power Supply Rating	24 Vdc power supply or 48V POE
Modulation Technology	FHSS
Operating Frequency	902.75-927.25MHz
Number of Channel	50
Output Power	29.95 dBm.
Antenna Info	ANT 1: Antenna type: circular antenna Gain: 6 dBi Brand: MTI Wireless Edge Ltd. Model No: MT-242043 12”x12” ANT2: Antenna Type: Dipole antenna Gain: 6 dBi Brand: Laird Technologies Model No: FG9026
Antenna Connector	RP-TNC

Note: Output power measurement were performed at the end of the antenna cables (18ft) and compared to applicable the limit.

3.2 Description of Test Modes

50 channels are provided to this EUT, 3 channels were test as follow:

Channel	Frequency (MHz)
Low	902.75
Mid	915.25
High	927.25

3.3 Description of Support Units

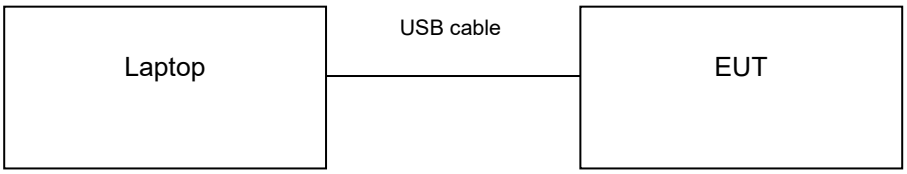
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	DC power supply	RIGOL	GTM96600-6024-T3	RoHS503681106/18	N/A	Provided by Customer
B.	Laptop	Thinkpad	EDGE	N/A	N/A	Provided by Customer

ID	Descriptions	Qty.	Length (ft)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	antenna cable	4	18	N	0	Provided by Customer

Note: The core(s) is(are) originally attached to the cable(s).

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

47 CFR FCC Part 15, Subpart C (Section 15.247)
RSS 247 Issue2, February 2017
ANSI C63.10: 2013
RSS Gen Issue5, March 2021
KDB 558074 v05r02

All test items have been performed and recorded as per the above standards.

4 Test Types and Results

4.1 Radiated Emission Measurement

4.1.1 Limits of Radiated Emission

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
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	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
EMI Test Receiver ROHDE & SCHWARZ	ESIB 40	100179	08/28/2020	08/28/2021
Spectrum Analyzer KEYSIGHT	N9030B	MY57140374	07/22/2020	07/22/2022
Hybrid Antenna SUNAR	JB6	A111717	03/09/2021	03/09/2022
DRG Horn Antenna ETS LINDGREN	3117	214309	11/22/2020	11/22/2021
Preamplifier RF-LAMBDA	RAMP00M50GA	17032300047	10/19/2020	10/19/2021
EMI Test Receiver Rohde & Schwarz	ESIB 40	100179	1/29/2021	1/29/2022
Transient Limiter Electro-Metrics	EM-7600-5	106	12/31/2020	12/31/2021
LISN ETS-Lindgren	3816/2NM	214372	1/29/2021	1/29/2022
Biconilog Antenna Sunol	JB6	A111717	9/4/2020	9/4/2021
SMA Fixed Attenuator(50ohm, 2w, 30dB, DC-6GHz)	VAT-03W2+	n/a	07/21/2021	07/21/2022
FSB Antenna Cable, 0.5m (Microwave Town)	FSB360PK-KMKM-00.50M	201906110002	10/1/2021	10/1/2022
FSB Antenna Cable, 4m (Microwave Town)	FSB360PK-KMKM-400M	202103270001	10/1/2021	10/1/2022
10m Semi-Anechoic Chamber (ETS-Lindgren)	S2010BL8X8	1462	07/21/2020	07/21/2022

*All testing was performed prior to 7/7/2021 with the exception of Conducted Band-edge and Conducted Spurious. The test equipment used for these specific tests were the VAT-03W2+ attenuator, FSB360PK-KMKM-00.50M, and N9030B.

4.1.3 Test Procedures

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

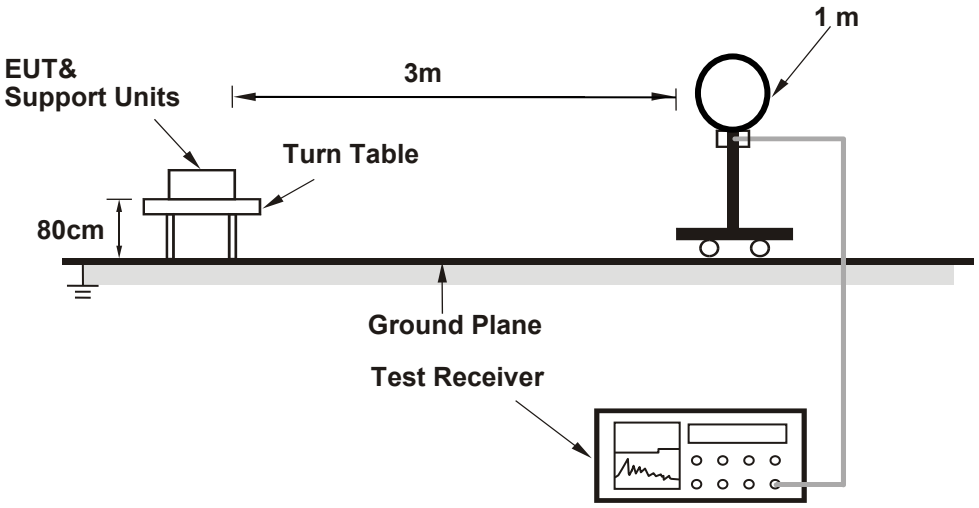
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

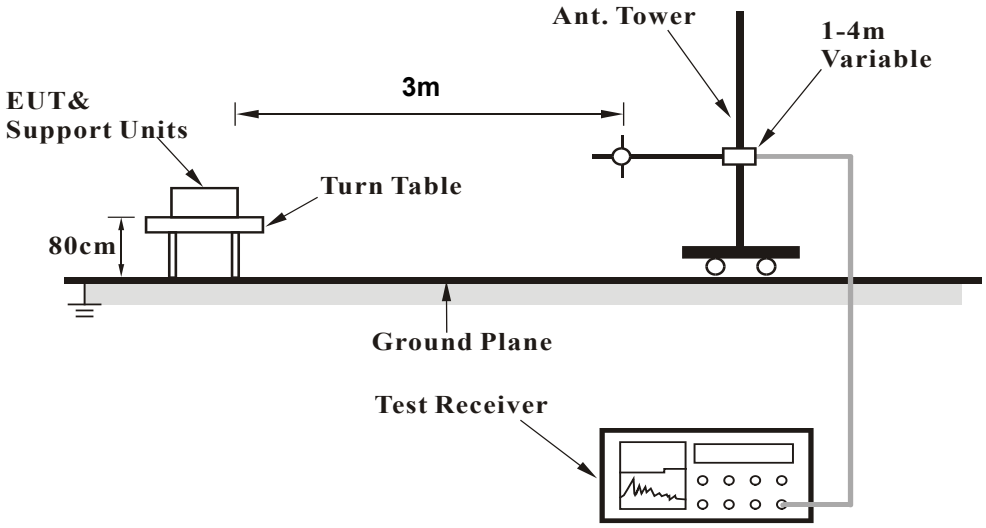
No deviation.

4.1.5 Test Setup

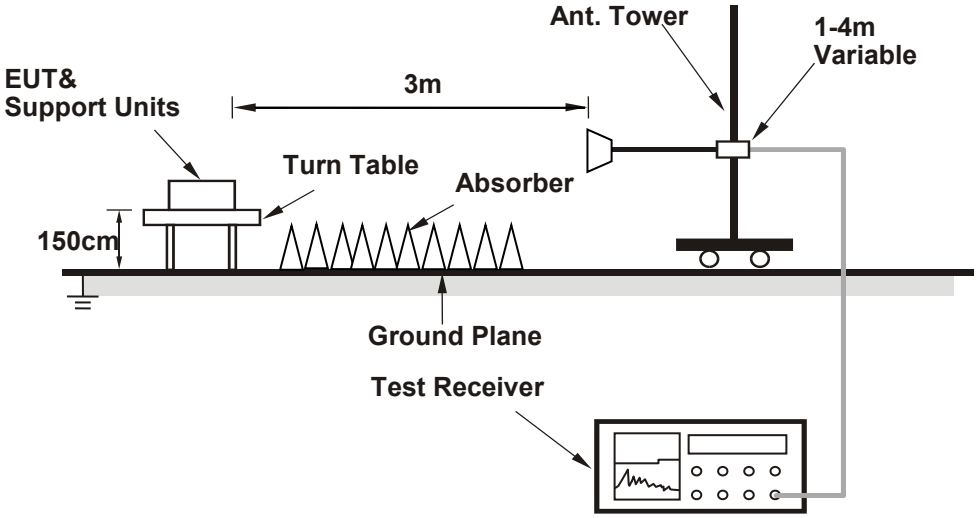
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.6 EUT Operating Conditions

a. Connected the EUT with the Notebook Computer which is placed on remote site.
b. Controlling software was used for changing power settings, types of operation (continuous / pulse operation).

4.1.7 Test Results

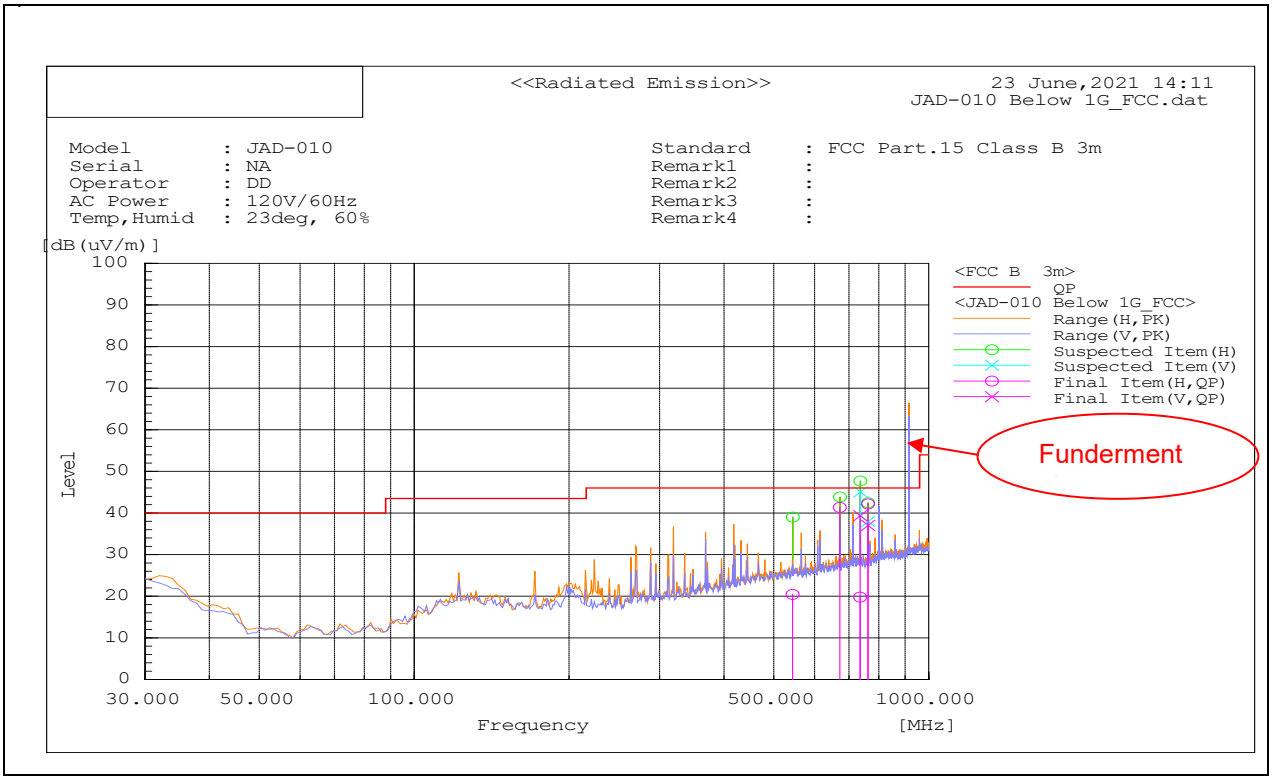
BELOW 1GHz WORST-CASE DATA:

CHANNEL	Middle Channel	**DETECTOR FUNCTION**	Quasi Peak
FREQUENCY RANGE	30MHz – 1GHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m										
No.	**Frequency (MHz)**	**Polarization (H/V)**	**Reading QP [dB(uV)]**	**Factor [dB(1/m)]**	**Level QP [dB(uV/m)]**	**Limit\QP dB(uV/m)**	**Margin QP [dB]**	**Height (cm)**	**Angle (Deg)**	**Pass/ Fail**
1	544.002	H	-5.2	25.6	20.4	46	-25.6	353	82	Pass
2	672.044	H	13.3	28	41.3	46	-4.7	131	216	Pass
3	735.843	H	-8.8	28.6	19.8	46	-26.2	304	4.2	Pass
4	736.017	V	11.3	28.1	39.4	46	-6.6	100	288	Pass
5	761.852	V	8.9	28.1	37	46	-9	100	171	Pass
6	761.851	H	13.5	28.7	42.2	46	-3.8	100	224	Pass

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss (dB) + AF (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.



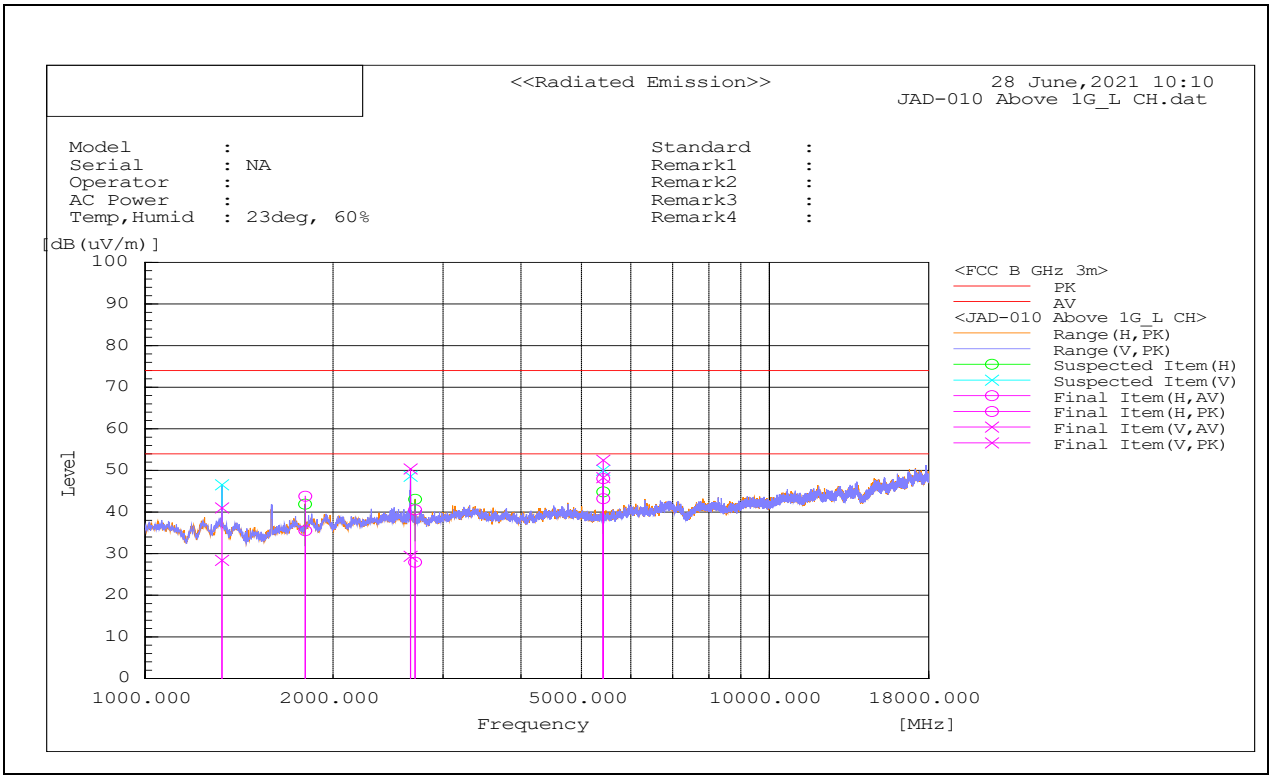
ABOVE 1GHz TEST DATA:

CHANNEL	Low Channel	DETECTOR FUNCTION	Peak Average
FREQUENCY RANGE	1GHz ~ 10GHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No.	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK dB(uV/m)	Limit AV dB(uV/m)	Limit PK [dB(uV/m)	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/ Fail
1	1327.565	V	44.7	57.3	-16.3	28.4	41	54	74	-25.6	-33	110.8	284.2	Pass
2	1805.54	H	49.5	57.8	-14	35.5	43.8	54	74	-18.5	-30.2	239.7	326.5	Pass
3	2661.347	V	39.9	60.9	-10.5	29.4	50.4	54	74	-24.6	-23.6	100	180.5	Pass
4	2706.483	H	38.3	50.9	-10.4	27.9	40.5	54	74	-26.1	-33.5	281	219.4	Pass
5	5416.469	V	53.2	57.4	-4.9	48.3	52.5	54	74	-5.7	-21.5	116.3	294.3	Pass
6	5416.389	H	48.1	52.9	-4.9	43.2	48	54	74	-10.8	-26	292.5	342.7	Pass

REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. Margin value = Emission level – Limit value.

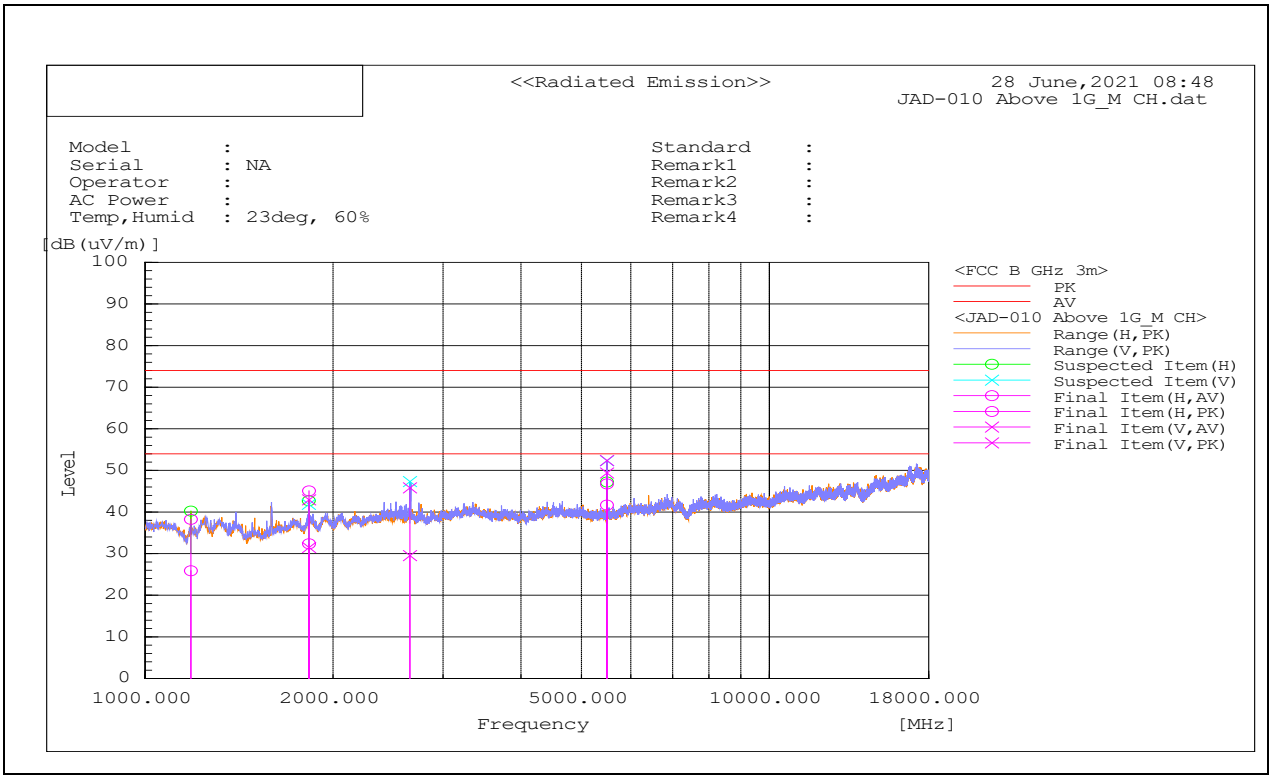


CHANNEL	Middle Channel	**DETECTOR FUNCTION**	Peak Average
FREQUENCY RANGE	1GHz ~ 10GHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No.	**Frequency (MHz)**	**Polarization (H/V)**	**Reading AV [dB(uV)]**	**Reading PK [dB(uV)]**	**Factor [dB(1/m)]**	**Level AV [dB(uV/m)]**	**Level PK dB(uV/m)**	**Limit AV dB(uV/m)**	**Limit PK [dB(uV/m)**	**Margin AV [dB]**	**Margin PK [dB]**	**Height (cm)**	**Angle (Deg)**	**Pass/ Fail**
1	1183.982	H	43.1	55.4	-17.2	25.9	38.2	54	74	-28.1	-35.8	185.1	224.3	Pass
2	1830.511	V	45.2	56.6	-13.7	31.5	42.9	54	74	-22.5	-31.1	227.8	38.4	Pass
3	1830.413	H	46.1	58.8	-13.7	32.4	45.1	54	74	-21.6	-28.9	395.4	359.4	Pass
4	2656.654	V	40.1	56.3	-10.5	29.6	45.8	54	74	-24.4	-28.2	239.5	355.8	Pass
5	5491.43	H	46.6	51.7	-4.9	41.7	46.8	54	74	-12.3	-27.2	100.5	263.4	Pass
6	5491.466	V	54.3	57.3	-4.9	49.4	52.4	54	74	-4.6	-21.6	100.5	279	Pass

REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. Margin value = Emission level – Limit value.

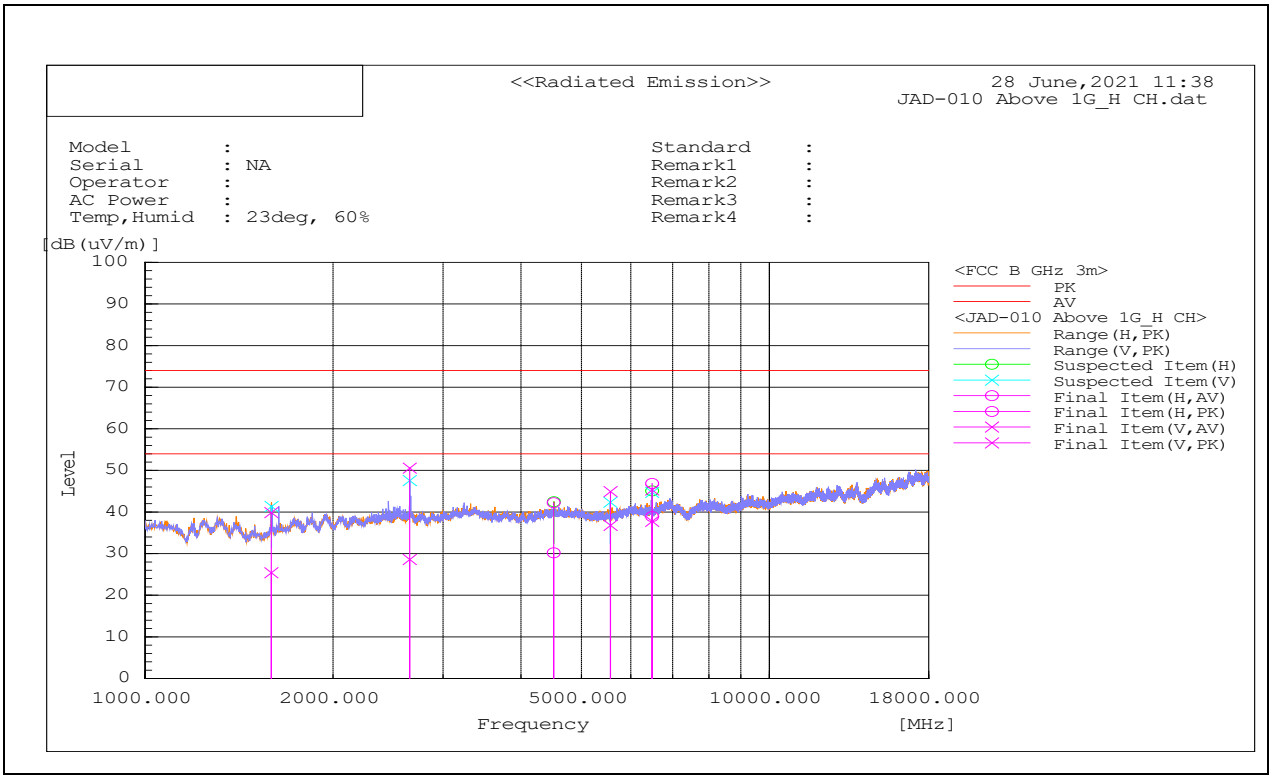


CHANNEL	High Channel	DETECTOR FUNCTION	Peak Average
FREQUENCY RANGE	1GHz ~ 10GHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 3m														
No.	Frequency (MHz)	Polarization (H/V)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK dB(uV/m)	Limit AV dB(uV/m)	Limit PK [dB(uV/m)	Margin AV [dB]	Margin PK [dB]	Height (cm)	Angle (Deg)	Pass/Fail
1	1593.213	V	42	56.5	-16.6	25.4	39.9	54	74	-28.6	-34.1	144	338	Pass
2	2653.949	V	39.1	61.1	-10.5	28.6	50.6	54	74	-25.4	-23.4	136.1	0	Pass
3	4515.108	H	36.7	48.7	-6.5	30.2	42.2	54	74	-23.8	-31.8	348.4	26.4	Pass
4	5563.464	V	41.6	49.7	-4.8	36.8	44.9	54	74	-17.2	-29.1	107.4	256.4	Pass
5	6490.698	V	40	47.5	-2.2	37.8	45.3	54	74	-16.2	-28.7	228.8	271.4	Pass
6	6490.69	H	41.1	49.1	-2.2	38.9	46.9	54	74	-15.1	-27.1	226.6	269.9	Pass

REMARKS:

1. Emission level (dBuV/m) = Reading Value (dBuV) + Factor (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. Margin value = Emission level – Limit value.



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Procedures

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

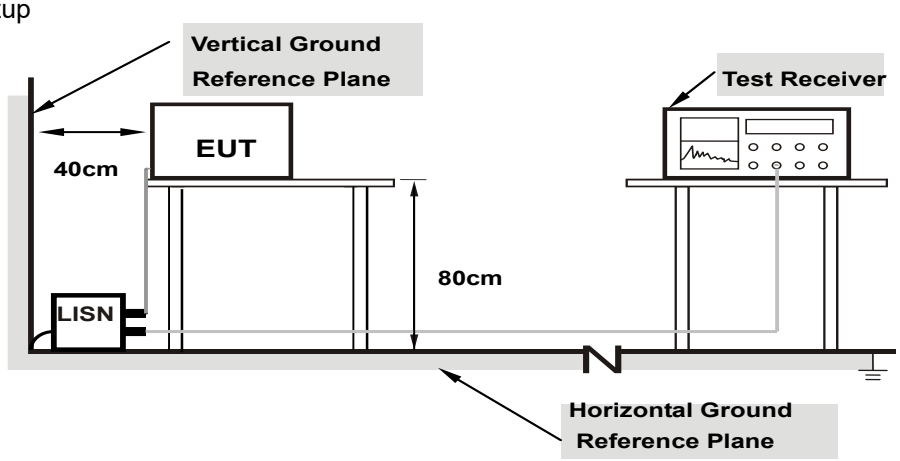
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.2.3 Deviation from Test Standard

No deviation.

4.2.4 Test Setup



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.5 EUT Operating Conditions

Same as 4.1.6.

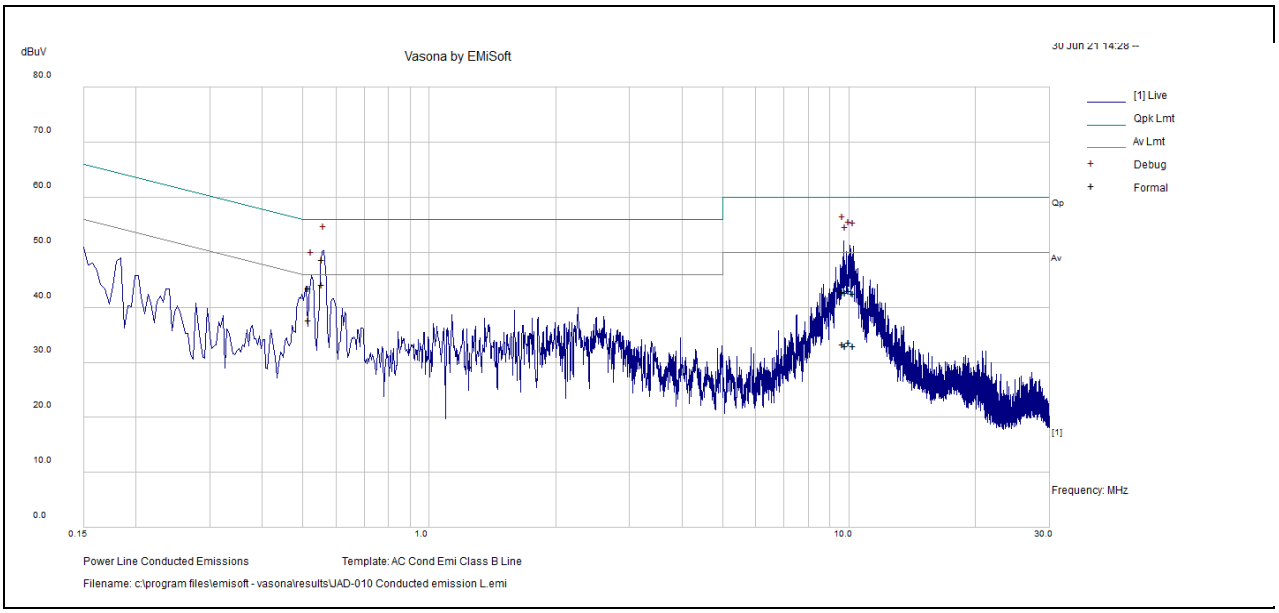
4.2.6 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak / Average

No	Freq.	Raw	Cale Loss	Factors	Level	Measurement Type	Line	Limit	Margin	Pass /Fail
	[MHz]	(dBuV)	(dB)	(dB)	(dBuV)			(dBuV)	(dB)	
1	0.557483	39.15	9.45	0.04	48.65	Quasi Peak	Live	56	-7.35	Pass
2	9.716148	32.97	9.63	0.23	42.83	Quasi Peak	Live	60	-17.17	Pass
3	10.05337	33.16	9.62	0.24	43.02	Quasi Peak	Live	60	-16.98	Pass
4	10.27653	32.68	9.63	0.24	42.56	Quasi Peak	Live	60	-17.44	Pass
5	9.853174	32.91	9.62	0.24	42.77	Quasi Peak	Live	60	-17.23	Pass
6	0.517347	34	9.45	0.04	43.49	Quasi Peak	Live	56	-12.51	Pass
7	0.557483	34.65	9.45	0.04	44.15	Average	Live	46	-1.85	Pass
8	9.716148	23.4	9.63	0.23	33.25	Average	Live	50	-16.75	Pass
9	10.05337	23.75	9.62	0.24	33.61	Average	Live	50	-16.39	Pass
10	10.27653	23.08	9.63	0.24	32.96	Average	Live	50	-17.04	Pass
11	9.853174	23.12	9.62	0.24	32.98	Average	Live	50	-17.02	Pass
12	0.517347	28.21	9.45	0.04	37.7	Average	Live	46	-8.3	Pass

REMARKS:

1. The emission levels of other frequencies were very low against the limit.
2. Margin value = Emission level - Limit value
3. Emission Level = Correction Factor + Raw Value + Factors Value.



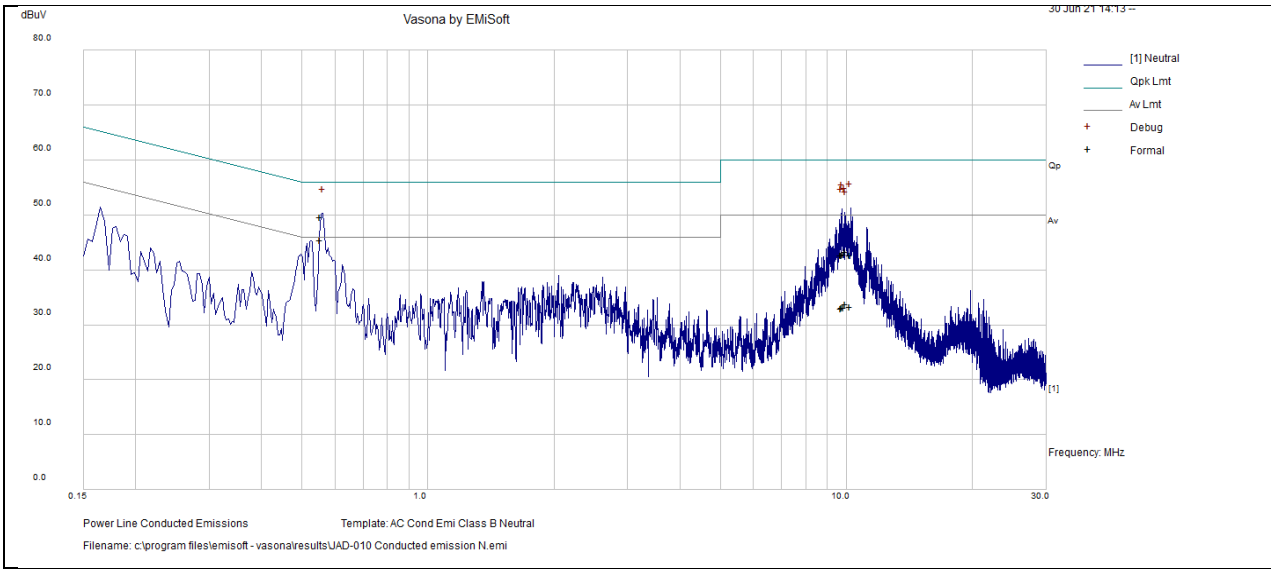
125 kHz transmit

Phase	Neutral (N)	Detector Function	Quasi-Peak / Average

No	Freq.	Raw	Cale Loss	Factors	Level	Measurement Type	Line	Limit	Margin	Pass /Fail
	[MHz]	(dBuV)	(dB)	(dB)	(dBuV)			(dBuV)	(dB)	
1	0.55503	40.1	9.45	0.03	49.58	Quasi Peak	Neutral	56	-6.42	Pass
2	10.22916	32.86	9.63	0.28	42.77	Quasi Peak	Neutral	60	-17.23	Pass
3	9.776593	32.8	9.62	0.26	42.69	Quasi Peak	Neutral	60	-17.31	Pass
4	9.904998	32.96	9.62	0.27	42.85	Quasi Peak	Neutral	60	-17.15	Pass
5	9.742505	32.78	9.62	0.26	42.67	Quasi Peak	Neutral	60	-17.33	Pass
6	9.963748	33.4	9.62	0.27	43.29	Quasi Peak	Neutral	60	-16.71	Pass
7	0.55503	35.92	9.45	0.03	45.41	Average	Neutral	46	-0.59	Pass
8	10.22916	23.42	9.63	0.28	33.33	Average	Neutral	50	-16.67	Pass
9	9.776593	23.26	9.62	0.26	33.15	Average	Neutral	50	-16.85	Pass
10	9.904998	23.2	9.62	0.27	33.09	Average	Neutral	50	-16.91	Pass
11	9.742505	23.07	9.62	0.26	32.96	Average	Neutral	50	-17.04	Pass
12	9.963748	23.9	9.62	0.27	33.79	Average	Neutral	50	-16.21	Pass

REMARKS:

1. The emission levels of other frequencies were very low against the limit.
2. Margin value = Emission level - Limit value
3. Emission Level = Correction Factor + Raw Value + Factors Value.

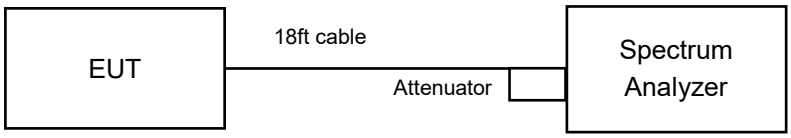


4.3 Conducted Output Power Measurement

4.3.1 Limits of Conducted Output Power Measurement

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedures

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

c. The center frequency of the spectrum analyzer is set to the fundamental frequency and using 3MHz RBW and 10 MHz VBW.

d. Measure the captured power within the band and recording the plot.

e. Repeat above procedures until all frequencies required were complete.

4.3.5 Deviation from Test Standard

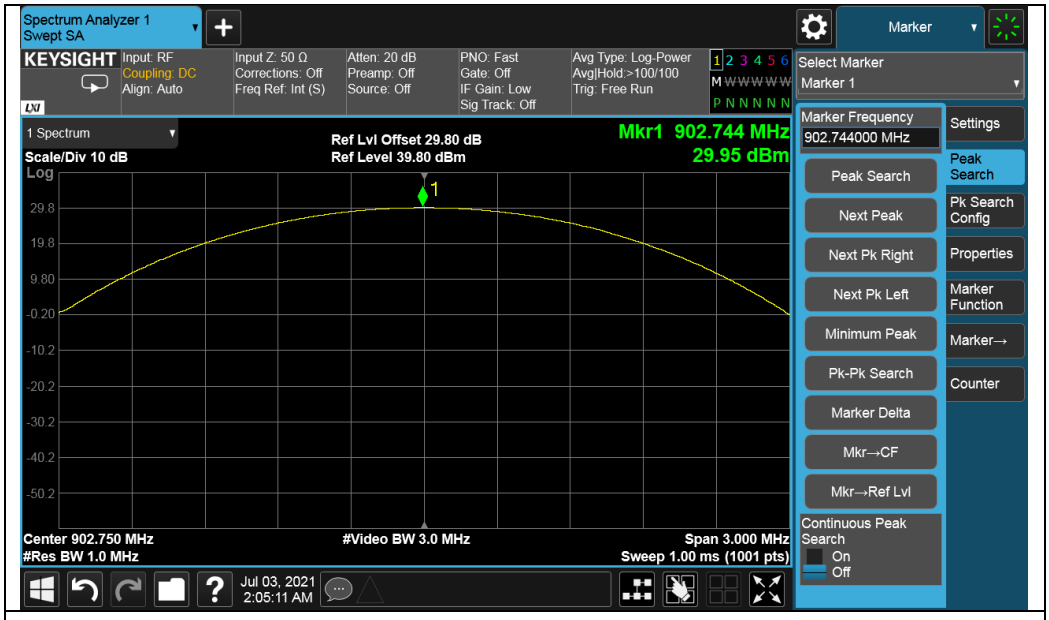
No deviation.

4.3.6 Test Results

Channel	Frequency (MHz)	Conducted Power at the end of the cable (dBm)	Limit (dBm)	Pass/Fail
Low	902.75	29.95	30	Pass
Mid	915.25	29.65	30	Pass
High	927.25	28.68	30	Pass

Note: Output power measurement were performed at the end of the antenna cables (18ft) and compared to applicable the limit.

Test Plots:



Low Channel

Middle Channel

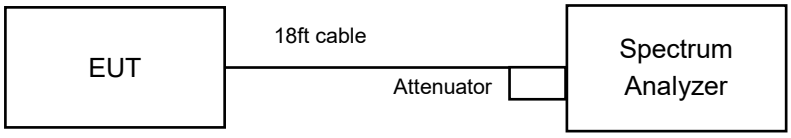
High Channel

4.4 BAND EDGE MEASUREMENT

4.4.1 Limits of Band Edge Measurement

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.

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
c. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
d. Set instrument center frequency to the frequency of the emission to be measured.
e. Set span to 30 MHz to 10 times the operating frequency in GHz.
f. RBW = 100 KHz.
g. VBW = 300 KHz.
h. Detector = Peak.
i. Sweep time = coupled sweep.
j. Trace mode = max hold
k. Allow sweep to continue until the trace stabilizes.
l. Repeat above procedures until all frequencies required were complete.

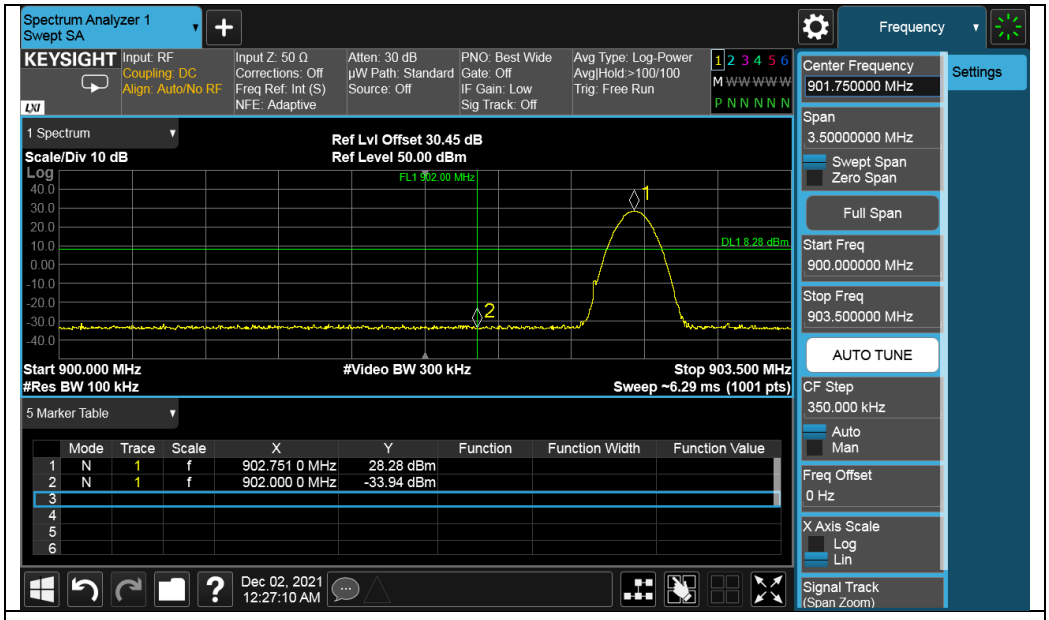
4.4.5 Deviation from Test Standard

No deviation.

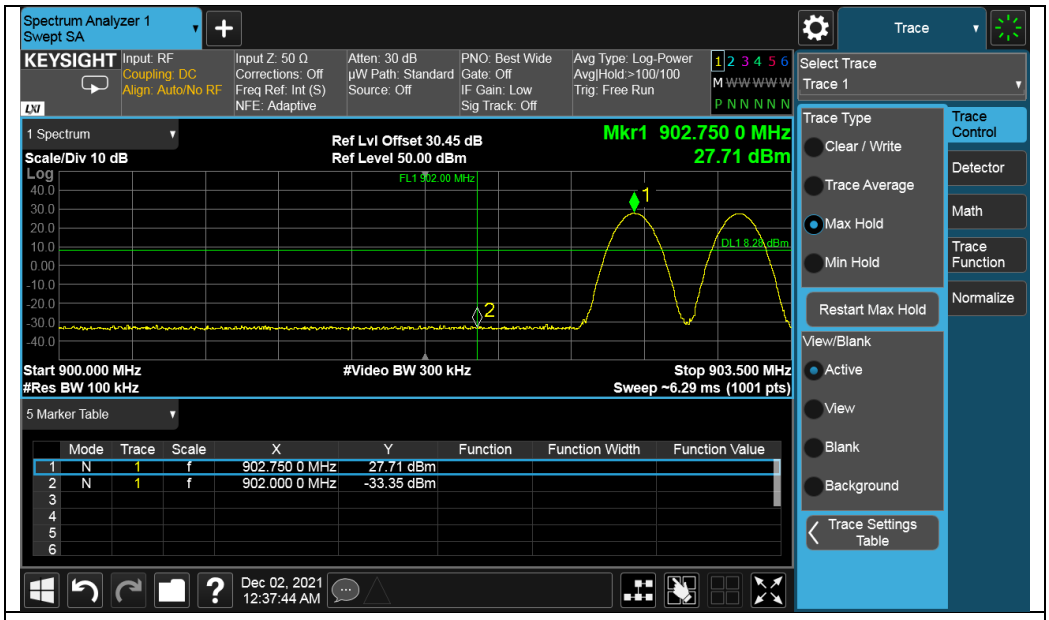
4.4.6 TEST RESULTS

Channel	Frequency (MHz)	Pass/Fail
Low	902.75	Pass
Mid	915.25	Pass
High	927.25	Pass

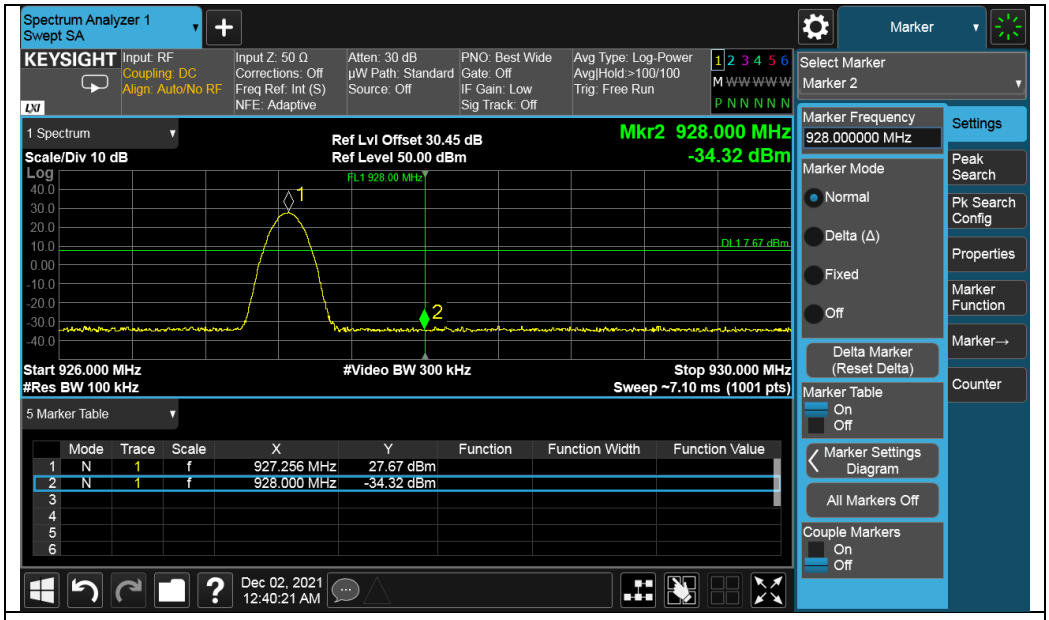
Test Plots:



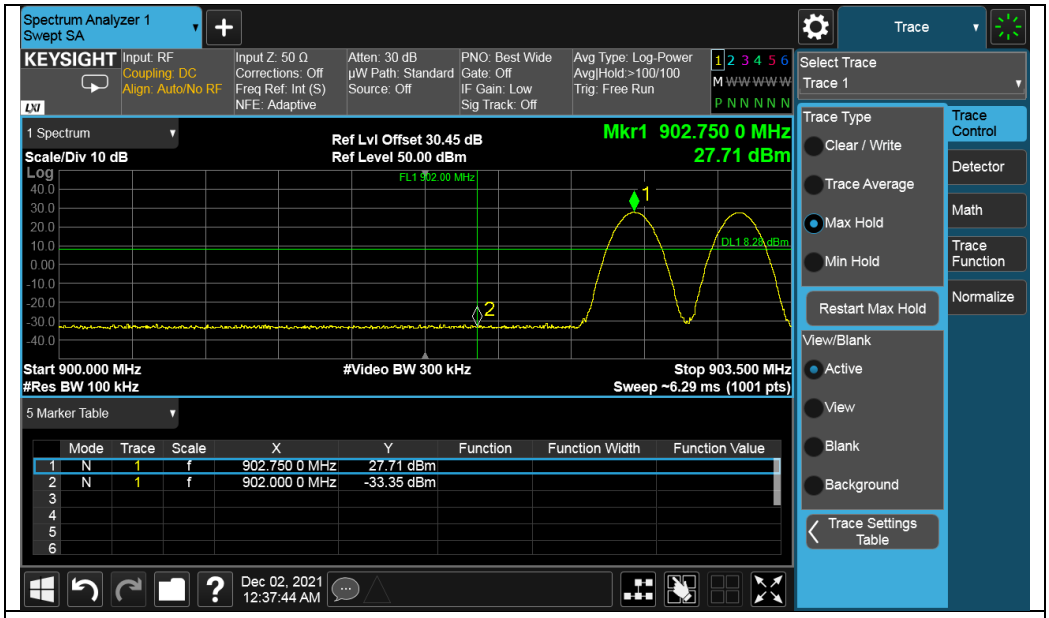
Band EdgeLow Channel



Band Edge Low Channel Hopping



Band Edge High Channel



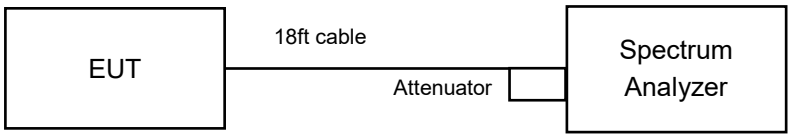
Band Egge High Channel Hopping

4.5 CONDUCTED SPURIOUS EMISSIONS MEASUREMENT

4.5.1 Limits of Conducted Spurious Emissions Measurement

For frequency hopping systems operating in the 902-928 MHz band: Other emissions shall be at least 20dB below the highest level of the desired power.

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedures

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

c. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

d. Set the center frequency and span to encompass frequency range to be measured.

e. RBW = 100 kHz.

f. VBW ≥ [3 × RBW].

g. Detector = Peak.

h. Sweep time = auto couple.

i. Trace mode = max hold

j. Allow trace to fully stabilize.

k. Use the peak marker function to determine the maximum amplitude level.

l. Repeat above procedures until all frequencies required were complete.

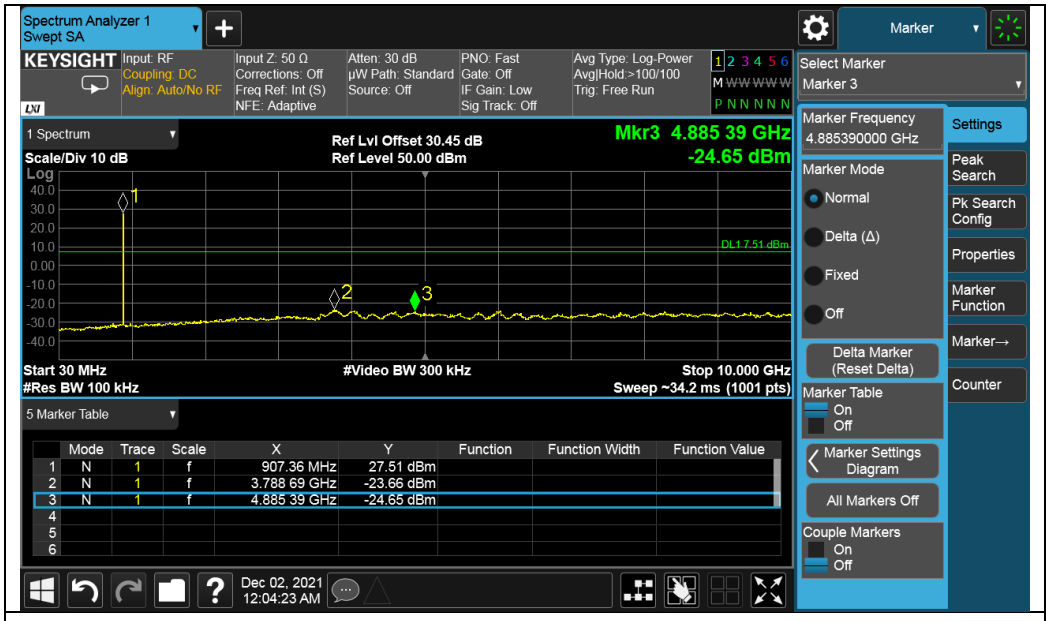
4.5.5 Deviation from Test Standard

No deviation.

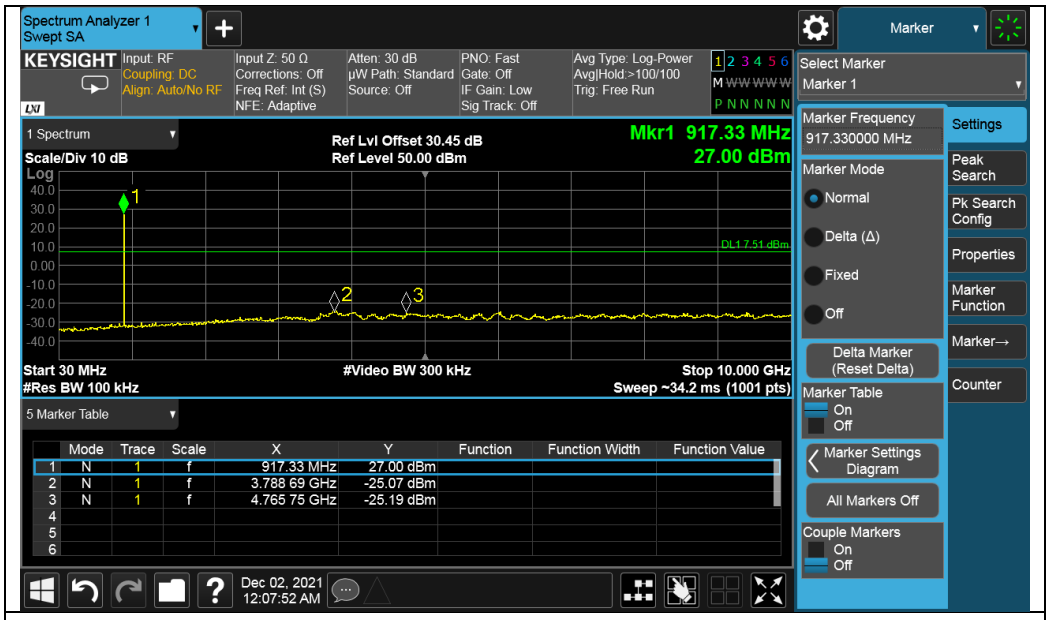
4.5.6 TEST RESULTS

Channel	Frequency (MHz)	Pass/Fail
Low	902.75	Pass
Mid	915.25	Pass
High	927.25	Pass

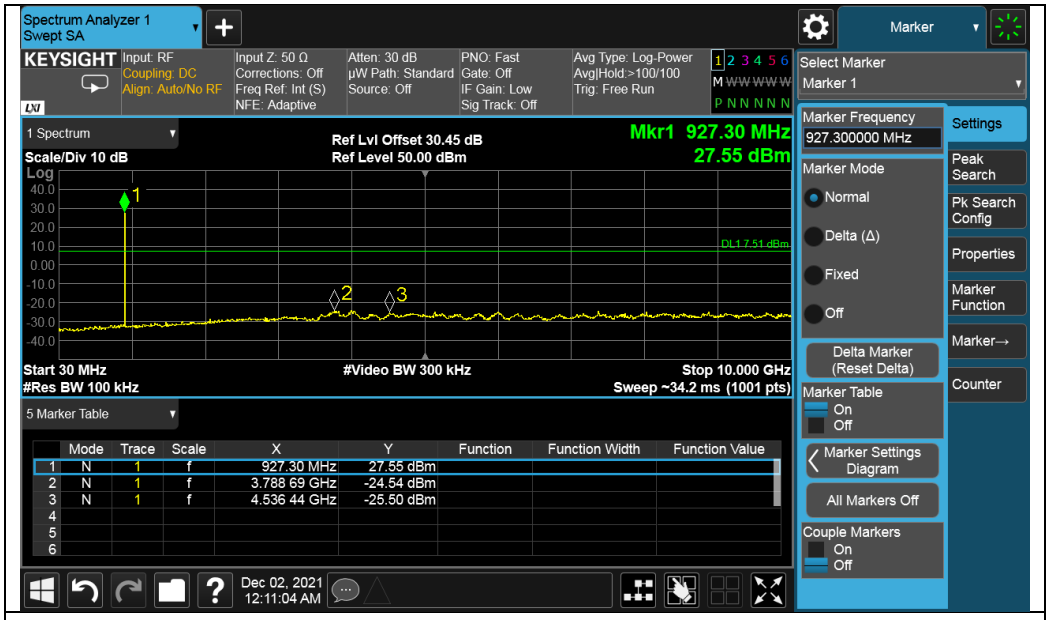
Test Plots:



Conducted Spurious Emissions Low Channel



Conducted Spurious Emissions Mid Channel



Conducted Spurious Emissions High Channel

Appendix – Information on the Testing Laboratories

Bureau Veritas is a global leader in testing, inspection and certification (TIC) services. We help businesses improve safety, sustainability and productivity; and our clients include the majority of leading brands in retail, manufacturing and other industries. With a presence in every major country around the world, our quality assurance and compliance solutions are vital in helping our customers enhance product quality and concept-to-consumer journeys. We also assist with increasing speed to market, profitability and brand equity throughout the supply chain. Bureau Veritas is a leading wireless/IoT testing, inspection, audit and certification provider, with a global network of test laboratories to support the IoT industry in areas of connectivity, security, interoperability as well as quality, health & safety, and environmental/chemical requirements.

If you have any comments, please feel free to contact us at the following:

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Web Site: www.cpsusa-bureauveritas.com

The address and road map of all our labs can be found in our web site also.

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