

FCC Test Report

Report No.: LGD-ESH-P22111124B-1

FCC ID: PII-31405

Product: RF Module with 902-928 MHz ISM frequency band

Model: ETII RF V2

Received Date: Nov.18, 2022

Test Date: Nov.18, 2022 to Dec.14, 2022

Issued Date: Dec.14, 2022

Applicant: Vantage Controls Inc.

Address: 2240 Campbell Creek Blvd Ste #110, Richardson, TX, United States 75082

Manufacturer: SHANGHAI LEGRAND ELECTRICAL CO., LTD

Address: 1&2/F, Building 1, No. 1358 Xiangyang Road, Minhang District
ShangHai, CHINA(201108)

Issued By: BUREAU VERITAS ADT (Shanghai) Corporation

Address: No. 829, Xinzhuang Road, Shanghai, P.R.China (201612)



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Release Control Record

Issue No.	Description	Date Issued
LGD-ESH-P22111124B-1	Original release	Dec.14, 2022



1 Certificate of Conformity

Product: RF Module with 902-928 MHz ISM frequency band

Brand: Vantage

Model: ETII RF V2

Applicant: Vantage Controls Inc.

Test Date: Nov.18, 2022 to Dec.14, 2022

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10:2020

The above equipment has been tested by **BUREAU VERITAS ADT (Shanghai) Corporation**, 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 :

, Date:

Dec.14, 2022

Yan ZHOU

Project Engineer

Approved by :

Sean YU

RF Supervisor

, Date:

Dec.14, 2022

2 Summary of Test Results

The EUT has been tested according to the following specifications:

47 CFR FCC Part 15, Subpart C (SECTION 15.247)			
FCC Clause	Test Item	Result	Remarks
15.203	Antenna Requirement	PASS	Meet the requirement of limit.
15.207 RSS GEN 8.8	AC Power Conducted Emission	PASS	Meet the requirement of limit.
15.247(a) (1) RSS 247 5.1	20dB Bandwidth	PASS	Meet the requirement of limit.
15.247(b) RSS 247 5.4	Conducted Output Power	PASS	Meet the requirement of limit.
15.247(a)(1) RSS 247 5.1	Carrier Frequency Separation	PASS	Meet the requirement of limit.
15.247(a)(1) (iii) RSS 247 5.1	Number of Hopping Frequencies	PASS	Meet the requirement of limit.
15.247(a)(1) (iii) RSS 247 5.1	Dwell Time	PASS	Meet the requirement of limit.
15.247(d) RSS 247 5.5	Conducted Spurious Emissions	PASS	Meet the requirement of limit.
15.247(d) RSS GEN 8.10	Emissions in restricted frequency bands	PASS	Meet the requirement of limit.
15.205 / 15.209 / 15.247(d) RSS GEN 8.9	Radiated Emissions	PASS	Meet the requirement of limit.

2.1 Test Facility

Laboratory Name: Bureau Veritas ADT (ShangHai) Corporation

Laboratory Address: No.829, Xin Zhuan Road, Song Jiang District, Shanghai, China

Test Location: No.829, Xin Zhuan Road, Song Jiang District, Shanghai, China

A2LA Lab Code: 2343.01

FCC-Recognized Accredited Testing Lab: CN1213

ISED Recognized Lab: 6392A

FCC Accredited Test Site Number: 176467

2.2 Test Instruments

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Hybrid Antenna(25MHz-1.5GHz)	Schwarzbeck	VULB9168	E1A1012	Jul.26, 21	Jul.25, 23
Horn Antenna(1GHz -18GHz)	Schwarzbeck	BBHA9120D	E1A1017	Jul.25, 22	Jul.24, 24
Double Ridge Horn Antenna(18G-40G)	COM-POWER	AH-840	E1A1040	Jul.25, 22	Jul.24, 24
Pre-Amplifier(100kHz-1.3GHz)	Agilent	8447D	E1A2001	Mar.03, 22	Mar.02, 23
Pre-Amplifier(0.5GHz-18GHz)	EMCI	EMC184045SE	E1A2009	Aug.04, 22	Aug.03, 23
Pre-Amplifier(18GHz-40GHz)	EMCI	EMC051845SE	E1A2008	Aug.04, 22	Aug.03, 23
EMI test receiver	R&S	ESR7	E1R1005	Mar.03, 22	Mar.02, 23
Spectrum Analyzer	Keysight	N9030B	E1S1003	Sep.14, 22	Sep.13, 23
Spectrum Analyzer	Keysight	N9020A	E1S1004	Mar.03, 22	Mar.02, 23
LISN	R&S	ENV216	E1L1011	Jun.20, 22	Jun.19, 23
RF Control Unit	Toscend	JS0806-2	E1C5003	N/A	N/A
Test Software	ADT	ADT_COND_V7 .3.1	N/A	N/A	N/A
Test Software	Toscend	JS32-RE	N/A	N/A	N/A
Test Software	Toscend	JS1120	N/A	N/A	N/A
Test Software	Toscend	JS1120-3	N/A	N/A	N/A

2.3 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

Measurement	Frequency	Expanded Uncertainty ($k=2$) ($\pm$)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.83 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	3.36 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	3.47 dB
	6GHz ~ 18GHz	3.75 dB
	18GHz ~ 40GHz	3.30 dB

2.4 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	RF Module with 902-928 MHz ISM frequency band
Brand	Vantage
Model	ETII RF V2
Difference	--
Power Rating	1.8Vdc- 3.6Vdc
Modulation Type	FSK
Modulation Technology	FHSS
Operating Frequency	907.3MHz-916.9MHz
Number of Channel	25
Output Power	15.136 dBm
Antenna Type	Monopole antenna
Antenna Connector	IPEX
Antenna Gain	1.58 dBi

3.2 Description of Support Unit

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.
Adaptor	SOMFY ACTIVITES SA	DSC090-130065S-3	NA

3.3 Description of Test Modes

25 channels

Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	907.3	16	913.7
1	907.7	17	914.1
2	908.1	18	914.5
3	908.5	19	914.9
4	908.9	20	915.3
5	909.3	21	915.7
6	909.7	22	916.1
7	910.1	23	916.5
8	910.5	24	916.9
9	910.9		
10	911.3		
11	911.7		
12	912.1		
13	912.5		
14	912.9		
15	913.3		

3.3.1 Test Mode Applicability:

EUT Configure Mode	Applicable to				Description
	RE ≥ 1G	RE < 1G	PLC	APCM	
-	√	√	√	√	-

Where **RE≥1G**: Radiated Emission above 1GHz

RE≤1G: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

APCM: Antenna Port Conducted Measurement

Radiated Emission Test (Above 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 24	0, 24	FHSS	FSK	-

Radiated Emission Test (Below 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 24	0, 24	FHSS	FSK	-

Power Line Conducted Emission Test:

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 24	0, 24	FHSS	FSK	-

Antenna Port Conducted Measurement

- ☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 24	0, 24	FHSS	FSK	-

3.3.2 Test Condition:

Applicable to	Normal Environmental Conditions	Normal Input Power
RE ≥ 1G	23deg. C, 58%RH	1.8Vdc- 3.6Vdc
RE < 1G	23deg. C, 58%RH	1.8Vdc- 3.6Vdc
PLC	23deg. C, 58%RH	1.8Vdc- 3.6Vdc
APCM	25deg. C, 60%RH	1.8Vdc- 3.6Vdc

3.4 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units.

3.5 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 standard:

47 CFR FCC Part 15, Subpart C (Section 15.247)

ANSI C63.10:2013

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

4 Test Procedure and Results

4.1 AC Power Conducted Emission Measurement

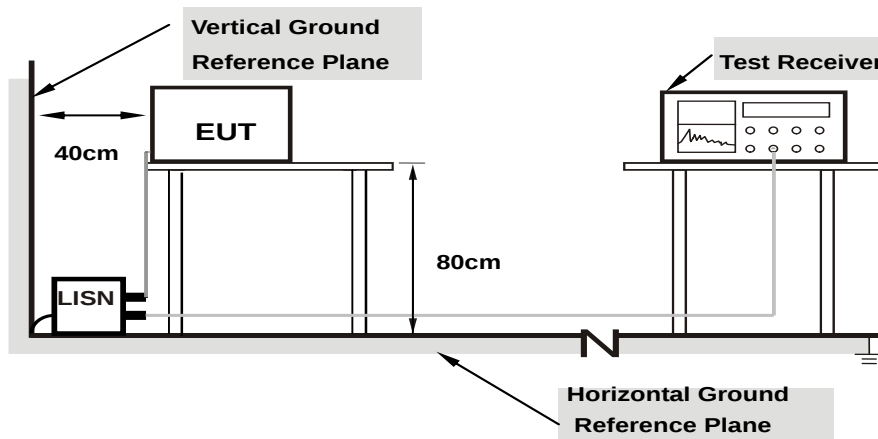
4.1.1 Limit

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.

4.1.2 Test Setup



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

4.1.3 Test Procedures

- 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.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

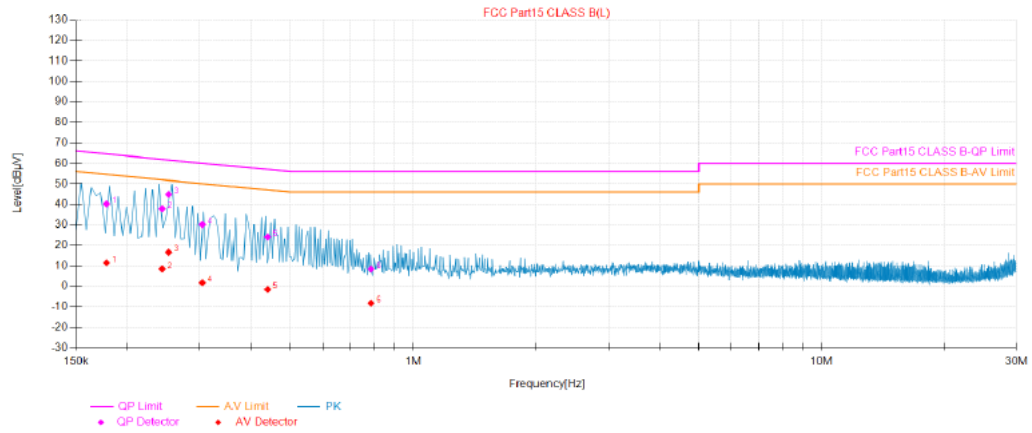
NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.1.4 Deviation of Test Standard

No deviation.

4.1.5 Test Results

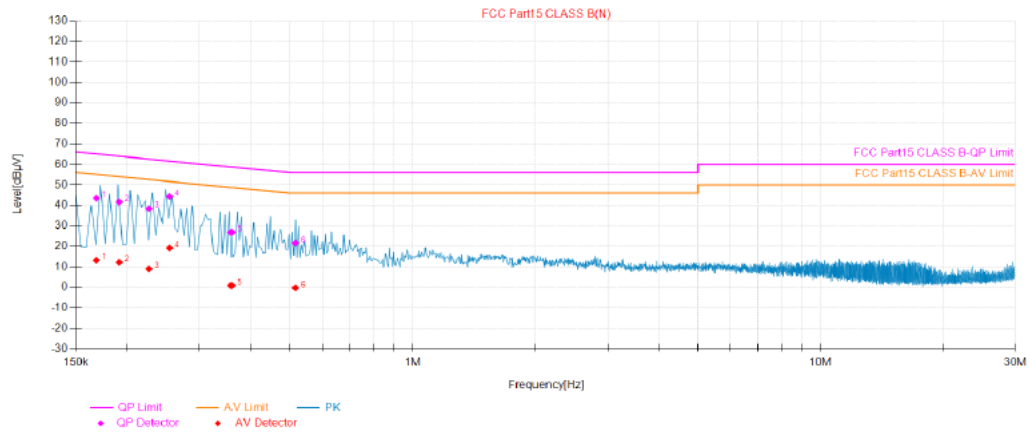
Test Graph



Final Data List

NO.	Freq. [MHz]	Factor [dB]	QP Reading Value	QP Value [dBμV]	QP Limit [dBμV]	QP Margin [dB]	AV Reading Value	AV Value [dBμV]	AV Limit [dBμV]	AV Margin [dB]	Type	Verdict
1	0.1782	9.78	30.43	40.21	64.57	24.36	1.67	11.45	54.57	43.12	L	PASS
2	0.2439	9.71	28.21	37.92	61.96	24.04	-1.31	8.40	51.96	43.56	L	PASS
3	0.2531	9.69	35.11	44.80	61.65	16.85	6.9	16.59	51.65	35.06	L	PASS
4	0.3060	9.60	20.49	30.09	60.08	29.99	-7.81	1.79	50.08	48.29	L	PASS
5	0.4390	9.59	14.52	24.11	57.08	32.97	-11.15	-1.56	47.08	46.64	L	PASS
6	0.7867	9.45	-1.12	8.33	56.00	47.67	-17.61	-8.16	46.00	54.16	L	PASS

Test Graph



Final Data List

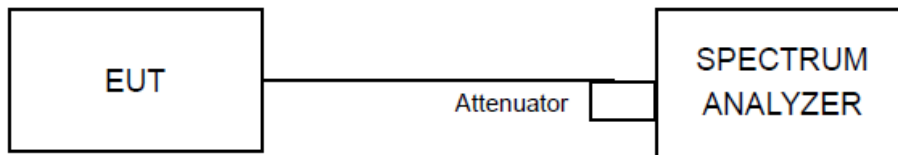
NO.	Freq. [MHz]	Factor [dB]	QP Reading Value	QP Value [dBμV]	QP Limit [dBμV]	QP Margin [dB]	AV Reading Value	AV Value [dBμV]	AV Limit [dBμV]	AV Margin [dB]	Type	Verdict
1	0.1684	9.76	33.66	43.42	65.04	21.62	3.47	13.23	55.04	41.81	N	PASS
2	0.1917	9.76	31.8	41.56	63.96	22.40	2.47	12.23	53.96	41.73	N	PASS
3	0.2268	9.70	28.72	38.42	62.57	24.15	-0.81	8.89	52.57	43.68	N	PASS
4	0.2548	9.64	34.63	44.27	61.60	17.33	9.46	19.10	51.60	32.50	N	PASS
5	0.3598	9.56	17.37	26.93	58.73	31.80	-8.88	0.88	48.73	47.85	N	PASS
6	0.5145	9.58	11.97	21.55	56.00	34.45	-9.84	-0.26	46.00	46.26	N	PASS

4.2 20dB Bandwidth and 99% Bandwidth

4.2.1 Limit

The 20 dB bandwidth is less than 500 kHz and less than the channel spacing; therefore, the EUT complied with the requirements of the specification.

4.2.2 Test Setup



4.2.3 Test Procedures

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 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.
- Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
- Repeat above procedures until all frequencies measured were complete.

4.2.4 Deviation of Test Standard

No deviation.

4.2.5 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.2.6 Test Results

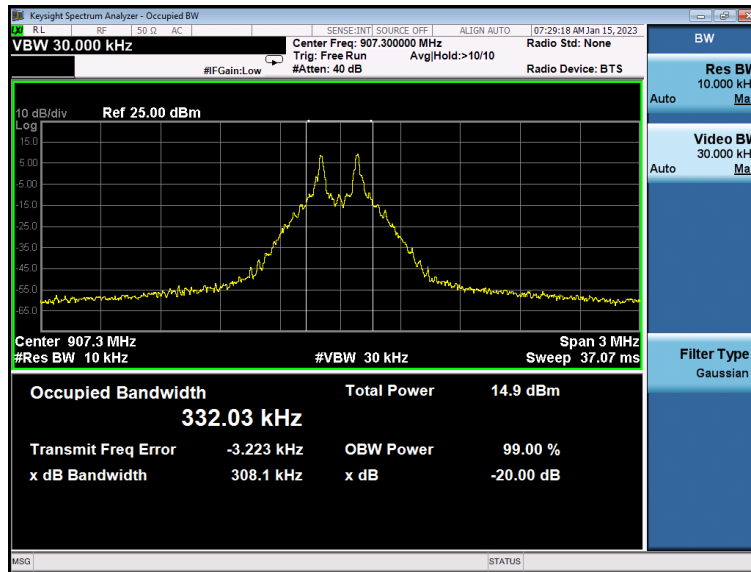
99% Bandwidth

Test Mode	Channel [MHz]	99% Bandwidth [MHz]	Limit [MHz]	Verdict
FSK	907.3	0.332	---	PASS
	912.1	0.332	---	PASS
	916.9	0.315	---	PASS

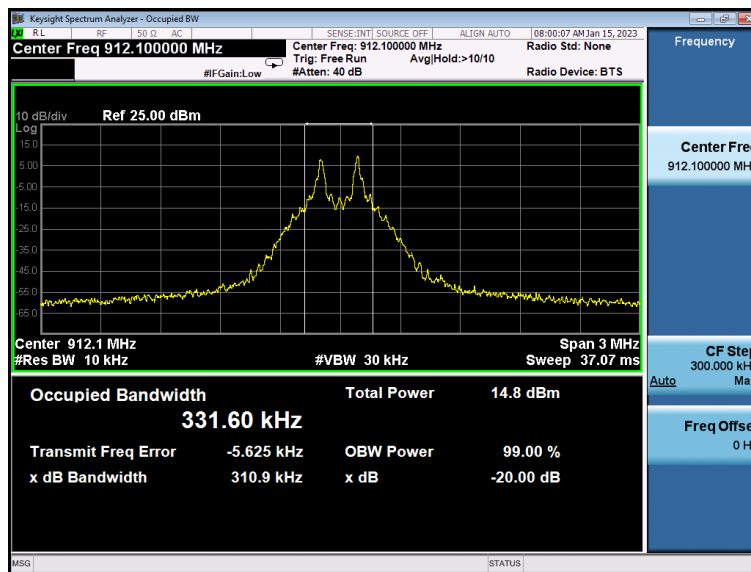
20dB Bandwidth

Test Mode	Channel [MHz]	20dB Bandwidth [MHz]	Limit [MHz]	Verdict
FSK	907.3	0.308	0.5	PASS
	912.1	0.311	0.5	PASS
	916.9	0.290	0.5	PASS

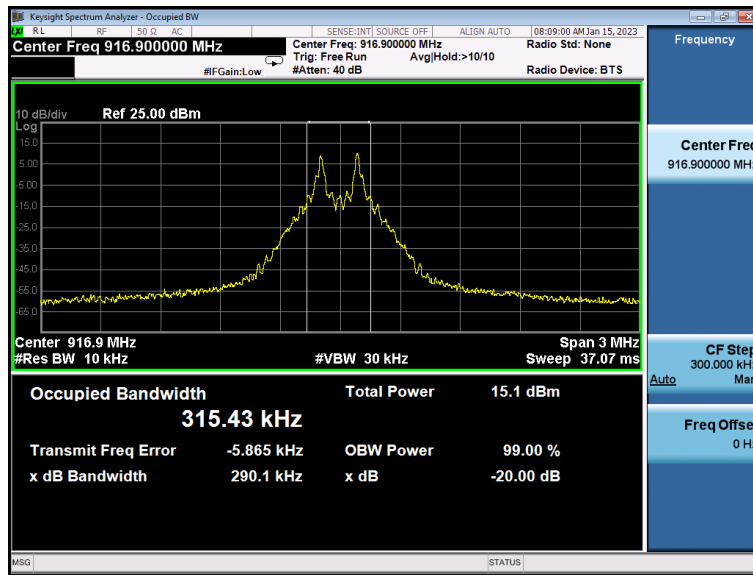
Low channel 907.3 MHz



Middle channel 912.1 MHz



High channel 916.9 MHz

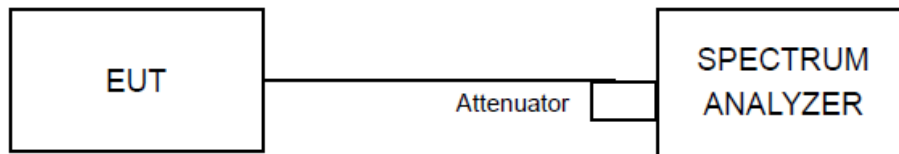


4.3 Conducted Peak Output Power

4.3.1 Limit

RF peak output power was less than 0.25 Watt.

4.3.2 Test Setup



4.3.3 Test Procedures

- 1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
- 2) RBW > 20 dB bandwidth of the emission being measured.
- 3) VBW $\geq$ RBW.
- 4) Sweep: Auto.
- 5) Detector function: Peak.
- 6) Trace: Max hold.
- b) Allow trace to stabilize.
- c) Use the marker-to-peak function to set the marker to the peak of the emission.
- d) The indicated level is the peak output power, after any corrections for external attenuators and cables.
- e) A plot of the test results and setup description shall be included in the test report.

4.3.4 Deviation of Test Standard

No deviation.

4.3.5 EUT Operating Condition

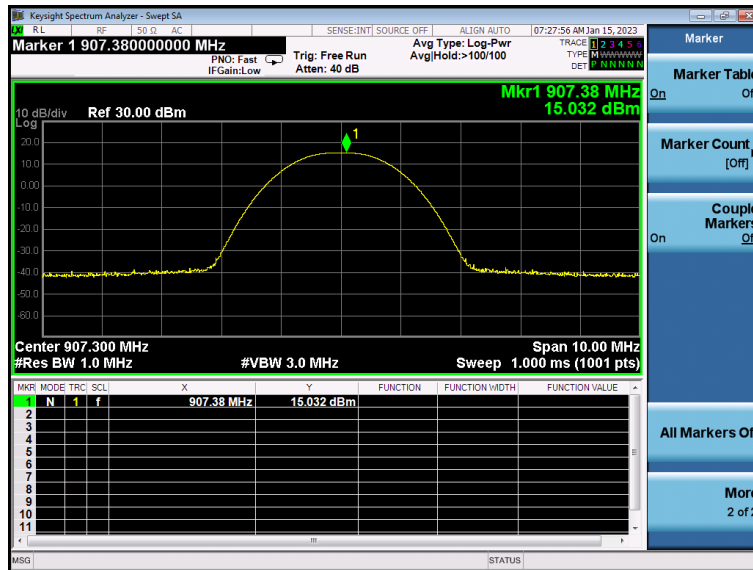
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.3.6 Test Results

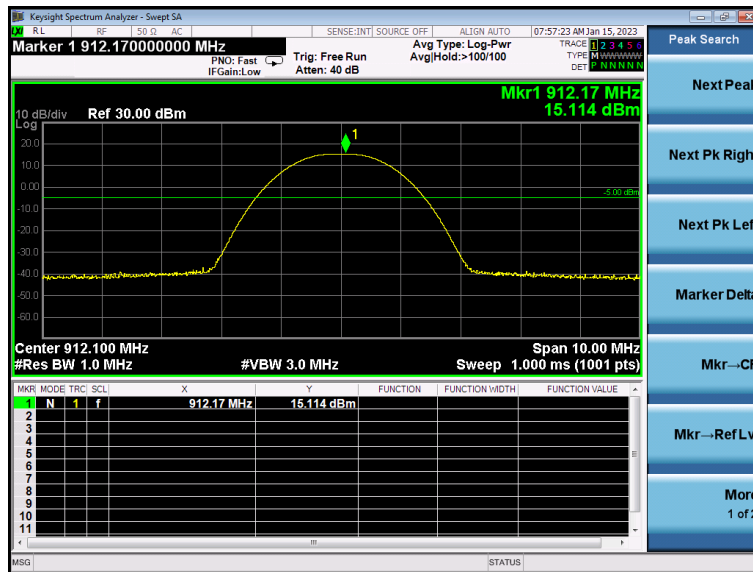
Test Conditions		Maximum Output Power Conducted		
		Low channel	Middle channel	High channel
Tnom	Vnom	15.032 dBm	15.114 dBm	15.136 dBm

	Maximum Output Power Conducted	Antenna Gain	E.I.R.P.
Low channel	15.032 dBm	1.58 dBi	16.612 dBm
Middle channel	15.114 dBm	1.58 dBi	16.694 dBm
High channel	15.136 dBm	1.58 dBi	16.716 dBm

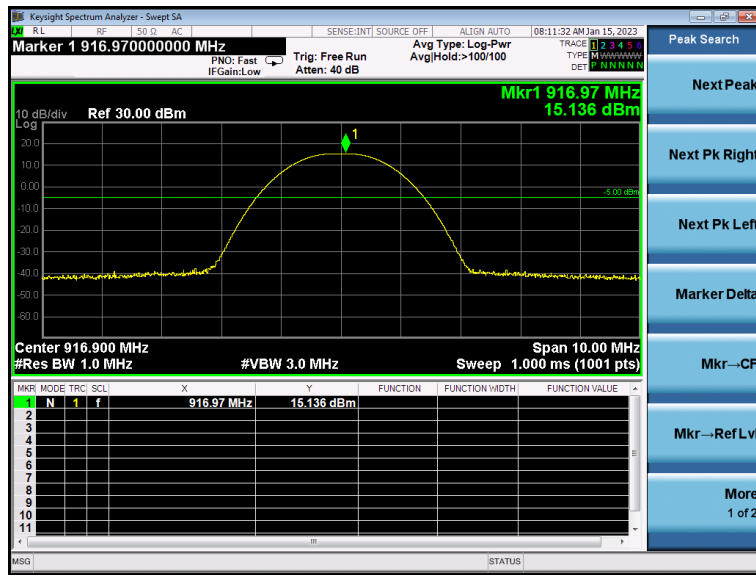
Low channel 907.3 MHz



Middle channel 912.1 MHz



High channel 916.9 MHz

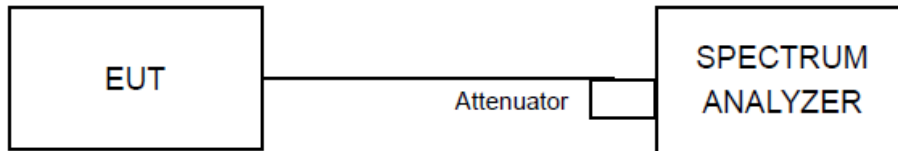


4.4 Carrier Frequency Separation

4.4.1 Limit

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.

4.4.2 Test Setup



4.4.3 Test Procedures

Measurement Procedure REF

- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
- By using the Max Hold function record the separation of two adjacent channels.
- Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.
- Repeat above procedures until all frequencies measured were complete.

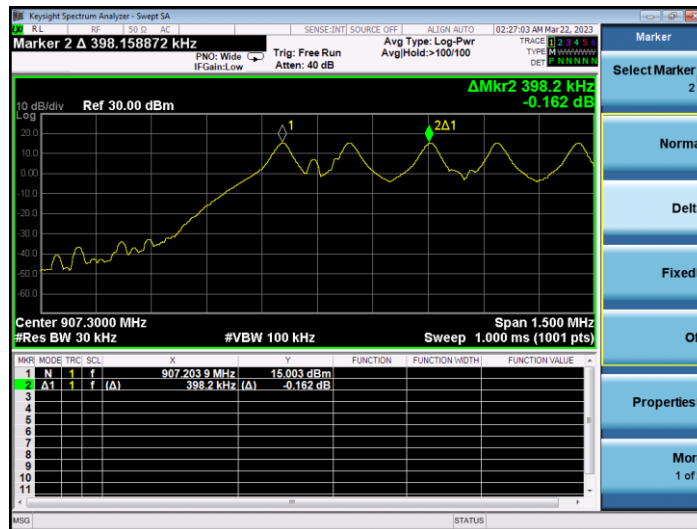
4.4.4 Deviation of Test Standard

No deviation.

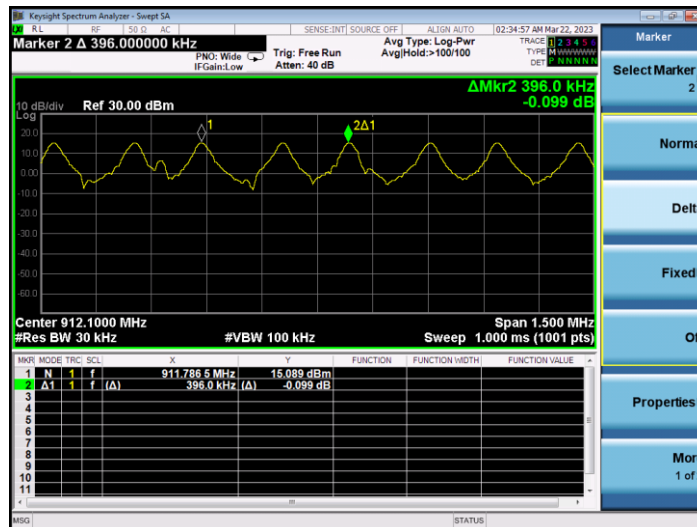
4.4.5 Test Results

Test Mode	Channel [MHz]	Channel Separation [kHz]	Limit [kHz]
FSK	907.3	398.2	308
FSK	912.1	396	311
FSK	916.9	406.5	290

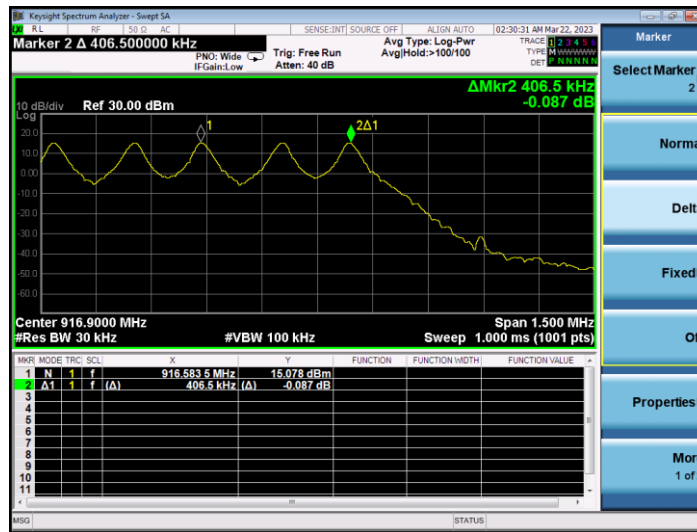
Low channel 907.3 MHz



Middle channel 912.1 MHz



High channel 916.9 MHz

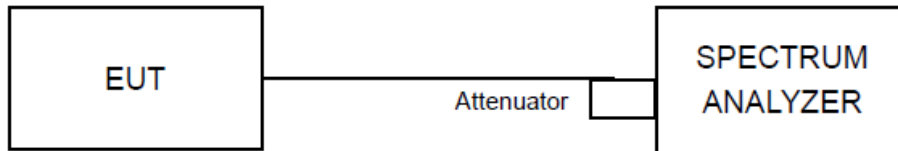


4.5 Number of Hopping Frequencies

4.5.1 Limit

At least 25 channels frequencies, and should be equally spaced.

4.5.2 Test Setup



4.5.3 Test Procedures

- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
- Set the SA on View mode and then plot the result on SA screen.
- Repeat above procedures until all frequencies measured were complete.

4.5.4 Deviation of Test Standard

No deviation.

4.5.5 Test Results

Test Mode	Number of Hopping Frequencies	Limit	Verdict
FSK	25	≥ 25	PASS

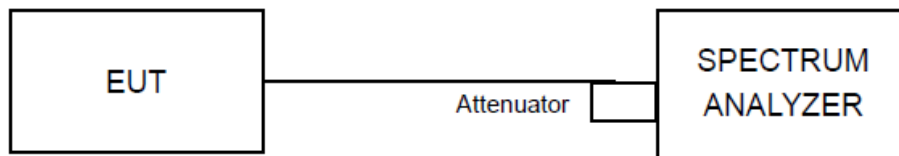


4.6 Dwell Time

4.6.1 Limit

The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

4.6.2 Test Setup



4.6.3 Test Procedures

- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
- Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
- Repeat above procedures until all different time-slot modes have been completed.

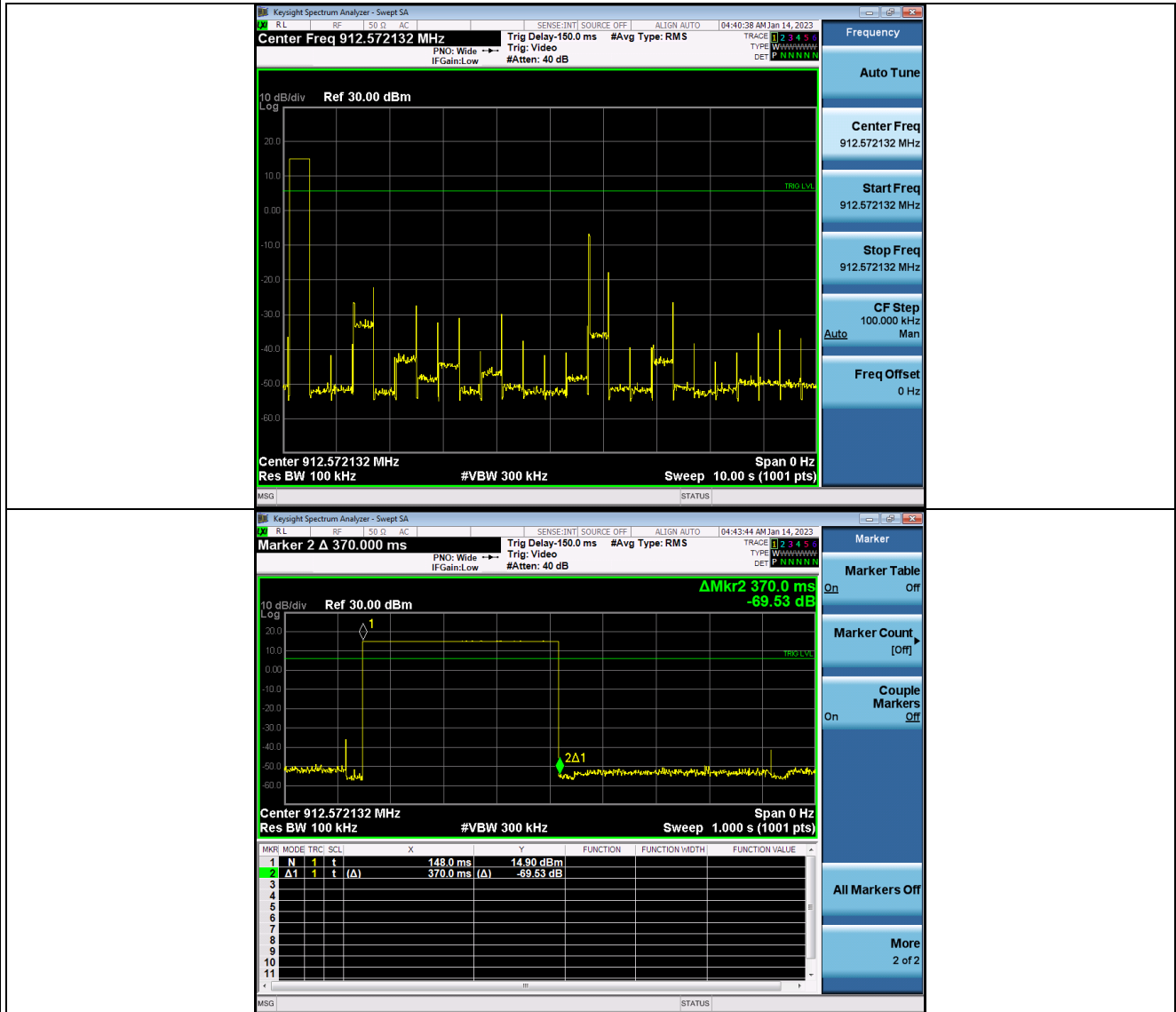
4.6.4 Deviation of Test Standard

No deviation.

4.6.5 Test Results

Test Mode	Channel [MHz]	Dwell Time [ms]	Time of occupancy on the Tx Channel in 10 sec(ms)	Limit [ms]
FSK	912.6	370	1	<=400

Note: Time of occupancy on the TX channel in 10 sec: 370ms *1=370ms<400ms

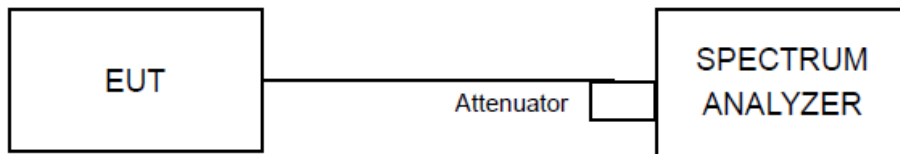


4.7 Conducted Spurious Emissions

4.7.1 Limit

Below -20dB of the highest emission level of operating band (in 100kHz RBW).

4.7.2 Test Setup



4.7.3 Test Procedures

The transmitter output was connected to the spectrum analyzer via a low loss cable. Set both RBW and VBW of spectrum analyzer to 100 kHz and 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. The band edges was measured and recorded.

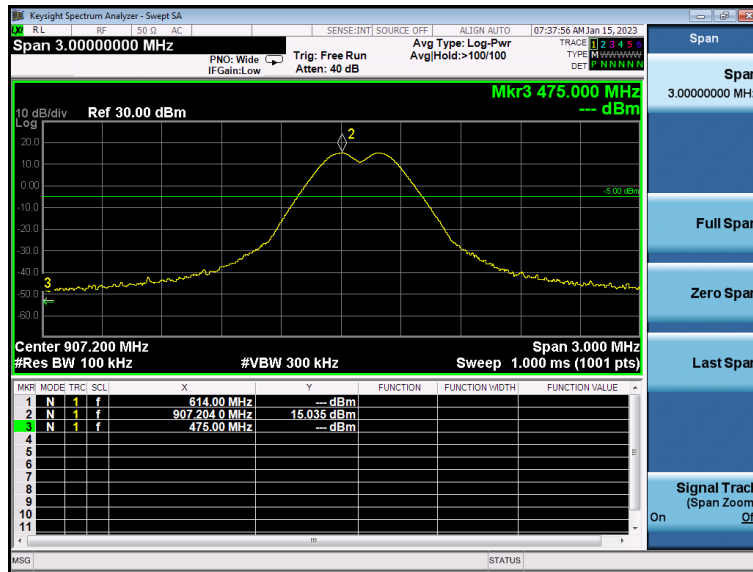
4.7.4 Deviation of Test Standard

No deviation.

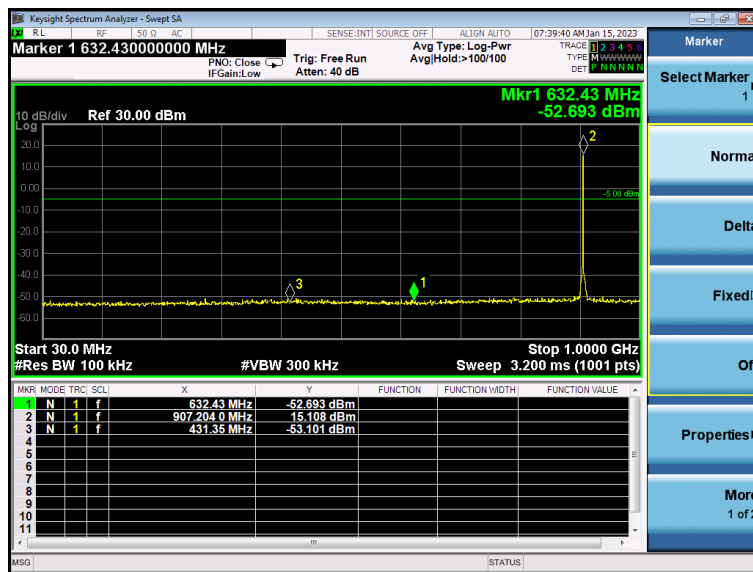
4.7.5 Test Result

Test Mode	Antenna	Channel [MHz]	FreqRange [MHz]	RefLevel [dBm]	Max. Level [dBm]	Limit [dBm]	Verdict
FSK	Ant1	907.3	Reference	15.035	-4.965	--	PASS
			30~1000	15.035	-53.101	<=-4.965	PASS
			1000~26500	15.035	-35.532	<=-4.965	PASS
		912.1	Reference	15.107	-4.893	--	PASS
			30~1000	15.107	-52.179	<=-4.893	PASS
			1000~26500	15.107	-37.004	<=-4.893	PASS
		916.9	Reference	15.129	-4.871	--	PASS
			30~1000	15.129	-52.623	<=-4.871	PASS
			1000~26500	15.129	-36.229	<=-4.871	PASS

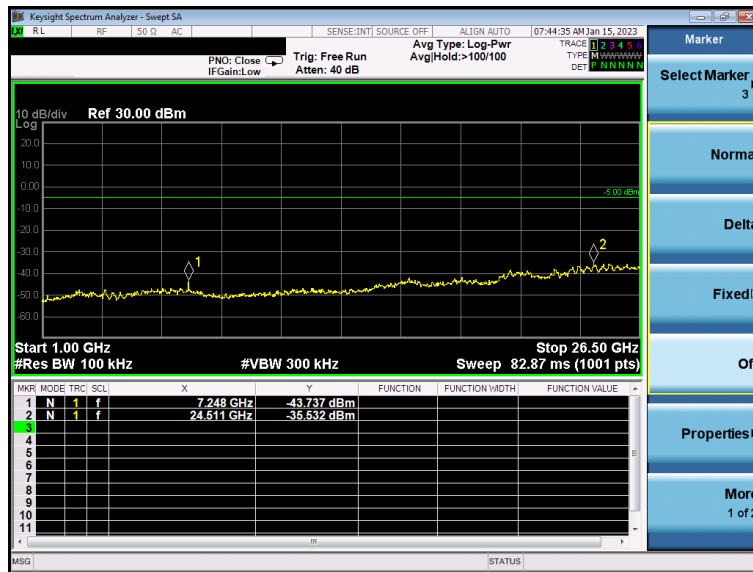
907.3 MHz_0~Reference



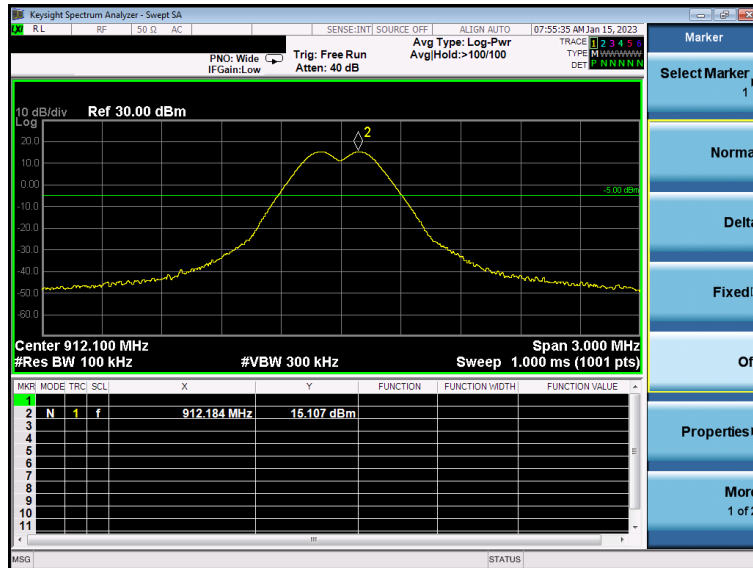
907.3 MHz_30~1000



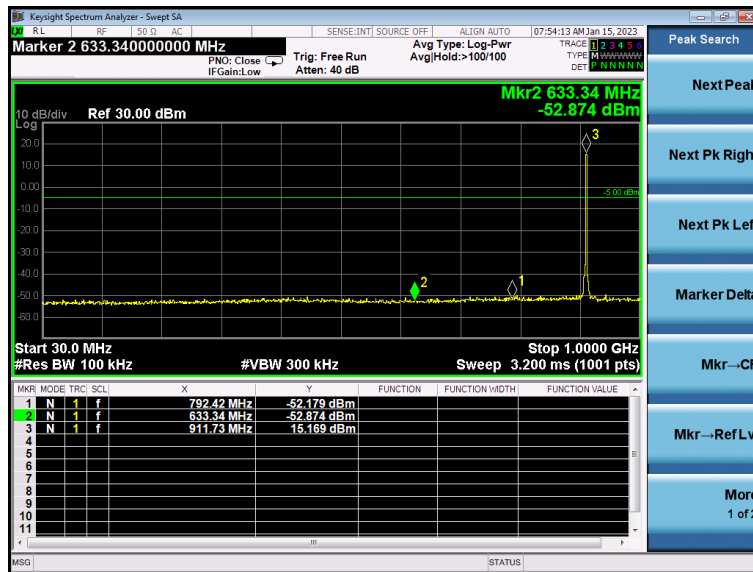
907.3 MHz_1000~26500



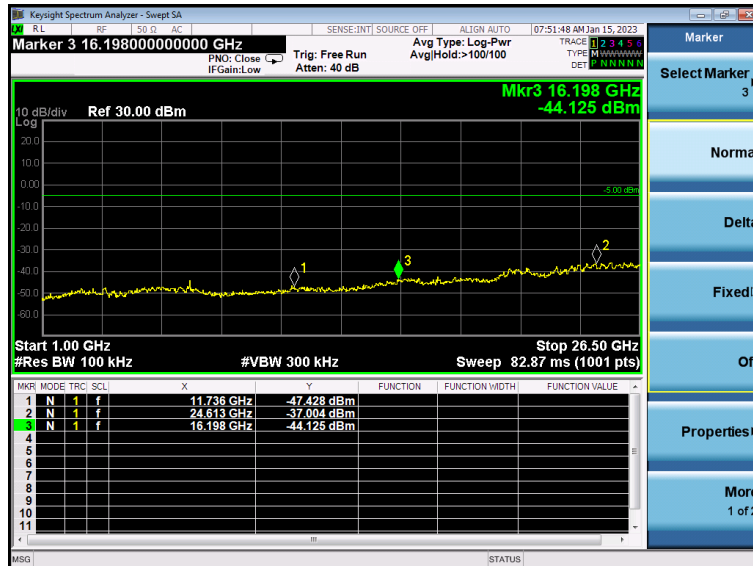
912.1 MHz_0~Reference



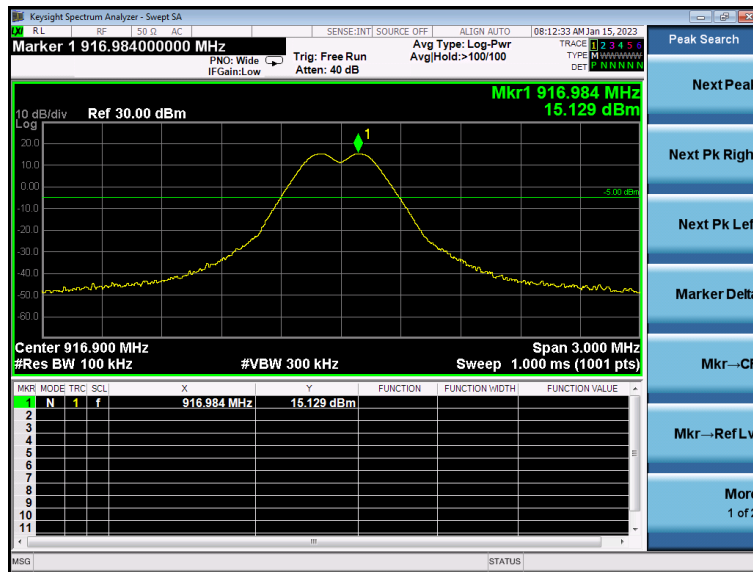
912.1 MHz_30~1000



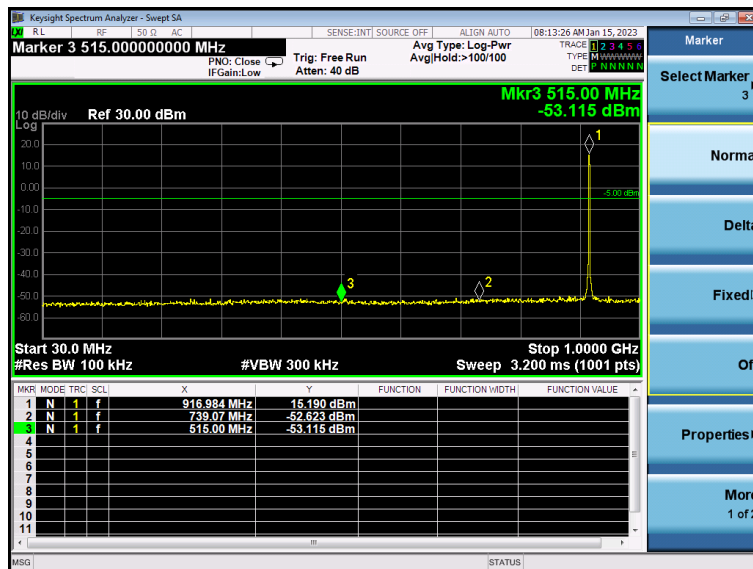
912.1 MHz_1000~26500



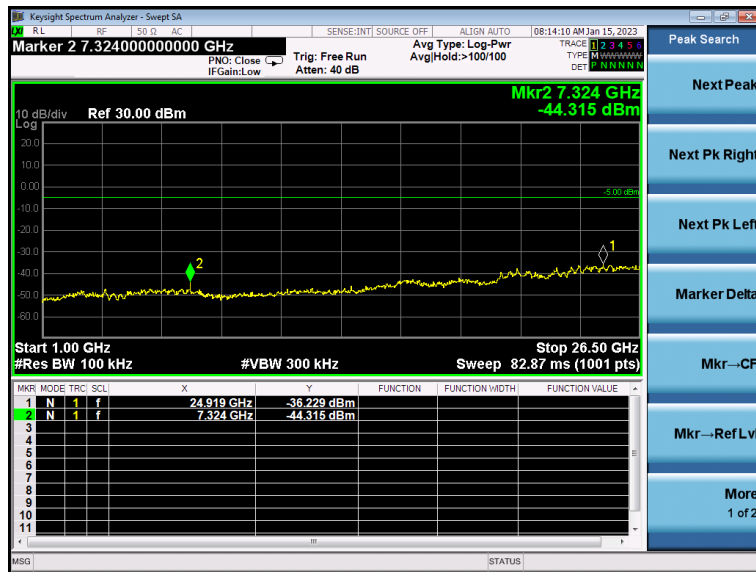
916.9 MHz_0~Reference



916.9 MHz_30~1000



916.9 MHz_1000~26500



4.8 Emissions in restricted frequency bands

4.8.1 Test Limit

For 15.205 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part15, must also comply with the radiated emission limits specified in Section 15.209(a).

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
1 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(2)
13.36 - 13.41	--	--	--

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [uV/m]	Measured Distance [Meters]
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

4.8.2 Test Procedure Reference

ANSI C63.10 Section 6.3 (General Requirements)

ANSI C63.10 Section 6.6 (Standard test method above 1GHz)

4.8.3 Test Procedures

Peak Field Strength Measurements

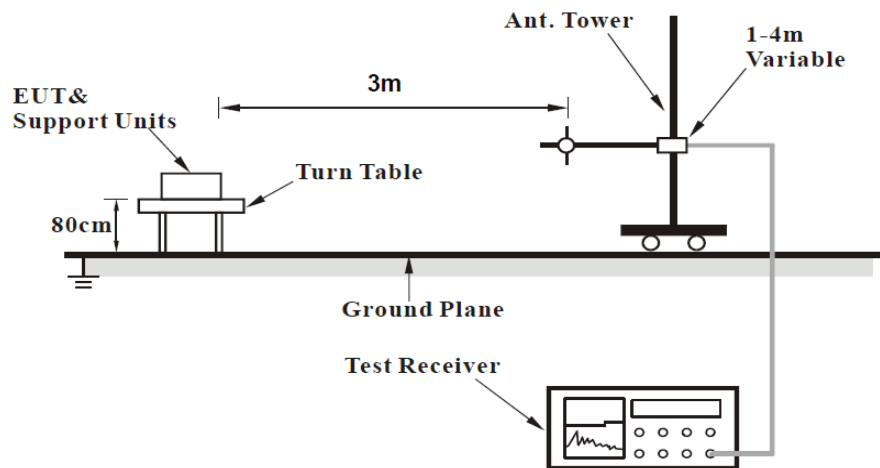
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Average Measurements Up 1GHz (Method VB)

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; If the EUT is configured to transmit with duty cycle $\geq 98\%$, set VBW = 10 Hz.
If the EUT duty cycle is $< 98\%$, set VBW $\geq 1/T$. T is the minimum transmission duration.
4. Detector = Peak
5. Sweep time = auto
6. Trace mode = max hold
7. Trace was allowed to stabilize

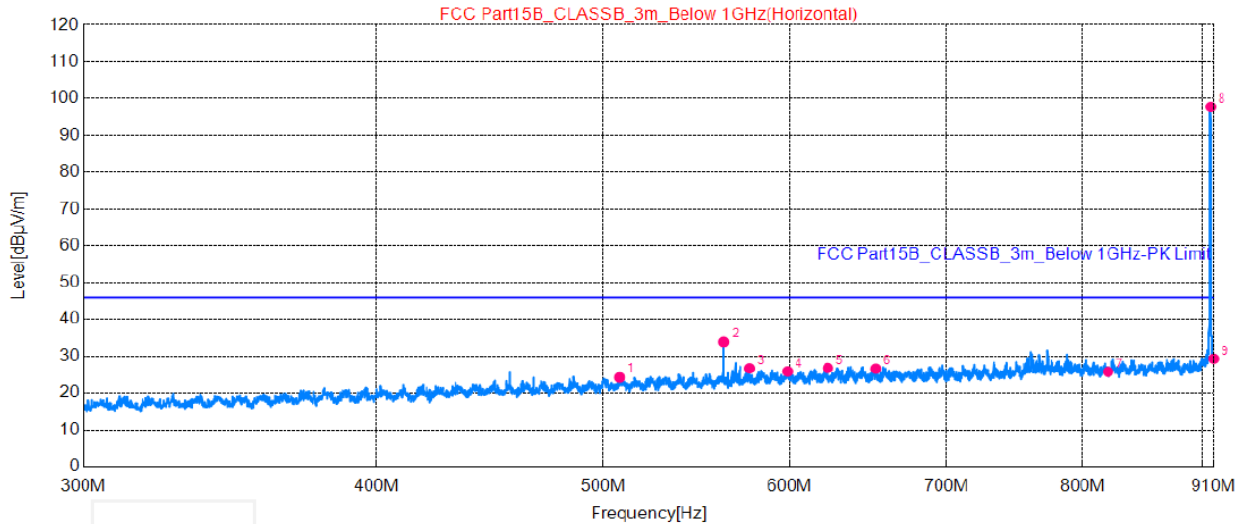
4.8.4 Test Setup

For Radiated emission 30MHz to 1GHz



4.8.5 Test Results

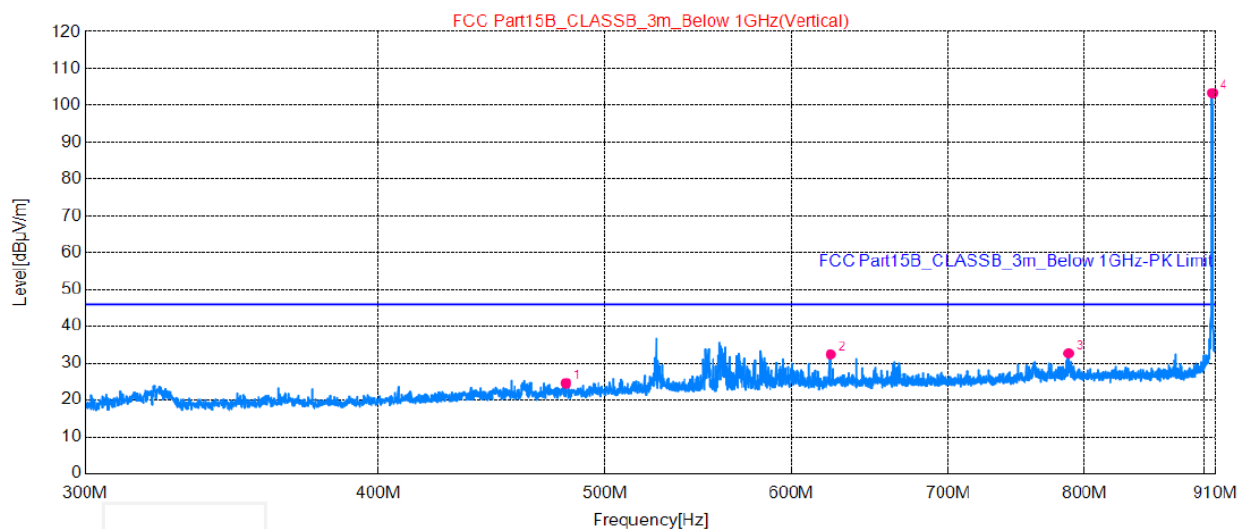
Hopping OFF



Suspected List

NO.	Freq. [MHz]	Reading [dB μ V/m]	Factor [dB]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	507.7660	27.66	-3.36	24.30	46.00	21.70	200	343	Horizontal
2	562.5440	36.19	-2.29	33.90	46.00	12.10	200	172	Horizontal
3	577.0620	28.52	-1.83	26.69	46.00	19.31	200	348	Horizontal
4	598.9000	27.10	-1.21	25.89	46.00	20.11	200	32	Horizontal
5	623.0560	27.66	-0.87	26.79	46.00	19.21	200	358	Horizontal
6	652.9460	27.42	-0.82	26.60	46.00	19.40	200	242	Horizontal
7	820.4520	24.29	1.50	25.79	46.00	20.21	200	307	Horizontal
8	907.4380	95.07	2.68	97.75	46.00	-51.75	200	146	Horizontal
9	910.0000	26.46	2.83	29.29	46.00	16.71	200	232	Horizontal

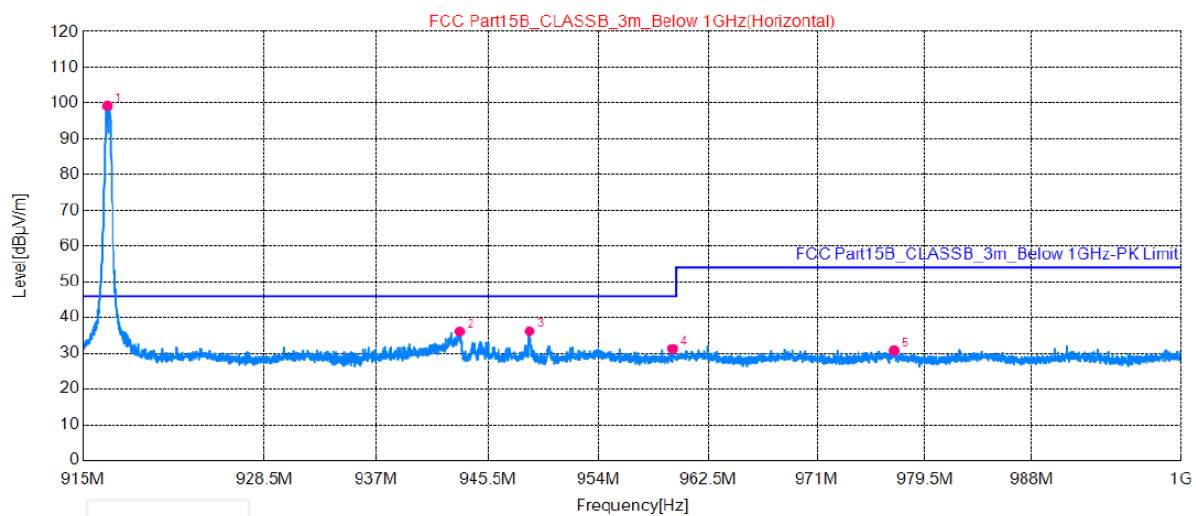
Hopping OFF



Suspected List

NO.	Freq. [MHz]	Reading [dB µ V/m]	Factor [dB]	Level [dB µ V/m]	Limit [dB µ V/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	480.9260	28.44	-3.91	24.53	46.00	21.47	100	338	Vertical
2	623.7880	33.23	-0.85	32.38	46.00	13.62	100	330	Vertical
3	787.8780	31.24	1.41	32.65	46.00	13.35	100	176	Vertical
4	907.4380	100.69	2.68	103.37	46.00	-57.37	100	86	Vertical

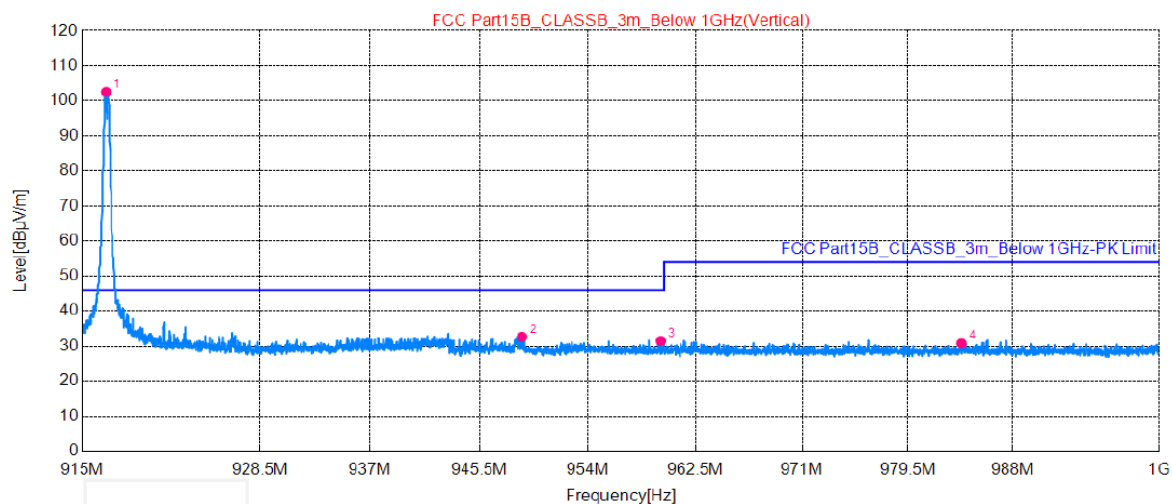
Hopping OFF



Suspected List

NO.	Freq. [MHz]	Reading [dB μ V/m]	Factor [dB]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	916.8020	96.06	3.18	99.24	46.00	-53.24	200	152	Horizontal
2	943.3220	32.20	3.84	36.04	46.00	9.96	200	98	Horizontal
3	948.6600	32.25	3.87	36.12	46.00	9.88	200	98	Horizontal
4	959.7270	27.41	3.87	31.28	46.00	14.72	200	258	Horizontal
5	977.0840	26.88	3.85	30.73	54.00	23.27	200	348	Horizontal

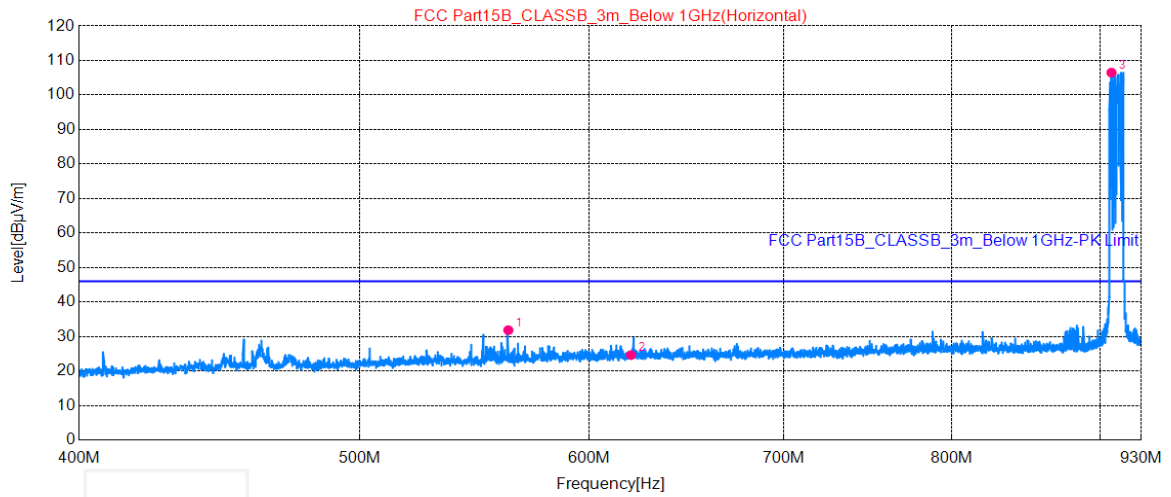
Hopping OFF



Suspected List

NO.	Freq. [MHz]	Reading [dB μ V/m]	Factor [dB]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	916.8020	99.32	3.18	102.50	46.00	-56.50	100	90	Vertical
2	948.8130	28.80	3.87	32.67	46.00	13.33	100	79	Vertical
3	959.7440	27.62	3.87	31.49	46.00	14.51	100	358	Vertical
4	983.8330	26.95	3.86	30.81	54.00	23.19	100	232	Vertical

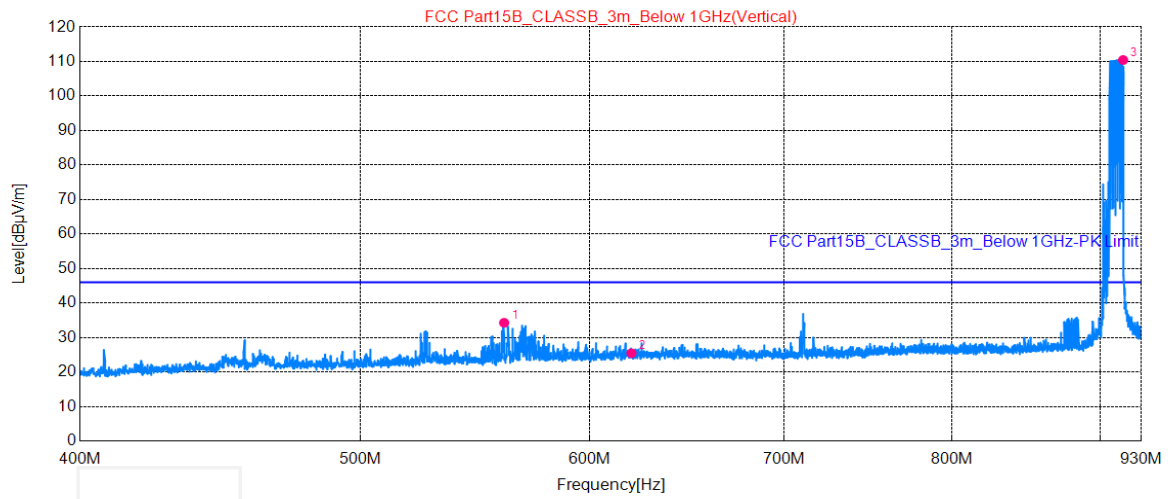
Hopping ON



Suspected List

NO.	Freq. [MHz]	Reading [dB μ V/m]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	562.4980	34.14	31.85	46.00	14.15	200	202	Horizontal	QP
2	620.0560	25.60	24.64	46.00	21.36	200	258	Horizontal	QP
3	908.2700	103.78	106.50	46.00	-60.50	200	216	Horizontal	QP

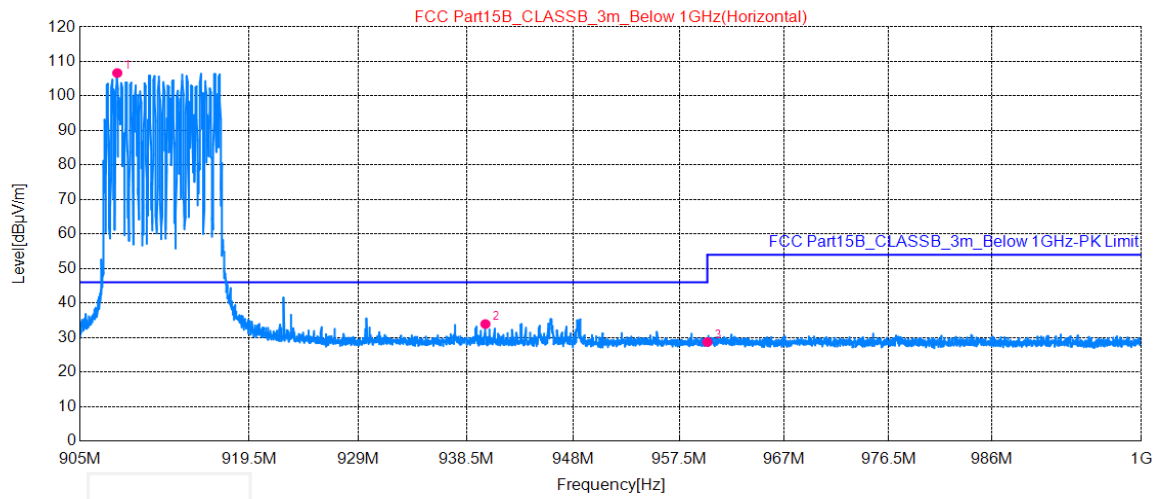
Hopping ON



Suspected List

NO.	Freq. [MHz]	Reading [dB μ V/m]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	560.3780	36.64	34.28	46.00	11.72	100	255	Vertical	QP
2	620.0560	26.42	25.46	46.00	20.54	100	80	Vertical	QP
3	916.6440	107.27	110.44	46.00	-64.44	100	138	Vertical	QP

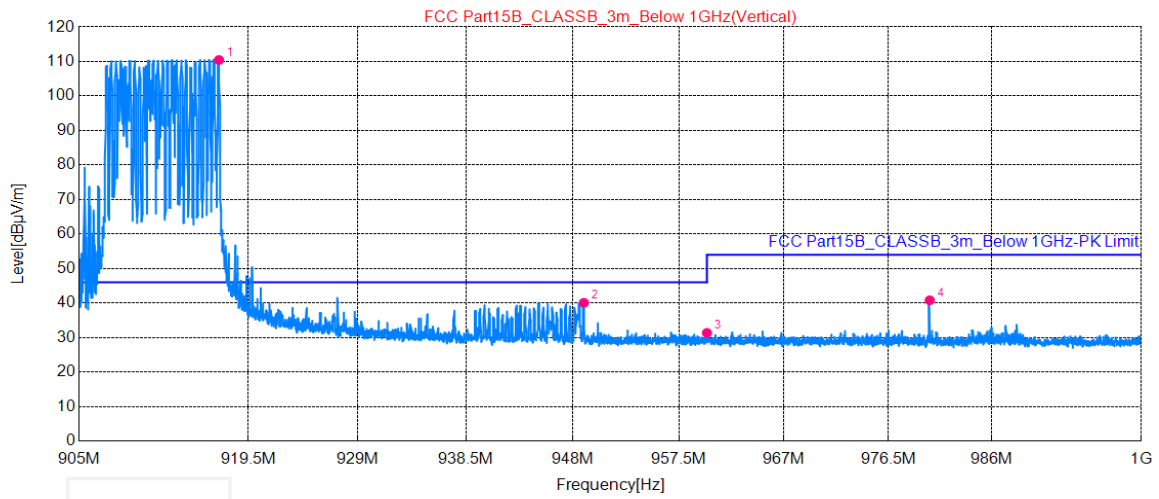
Hopping ON



Suspected List

NO.	Freq. [MHz]	Reading [dB μ V/m]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	908.1730	103.94	106.66	46.00	-60.66	200	211	Horizontal	QP
2	940.1690	30.09	33.92	46.00	12.08	200	211	Horizontal	QP
3	960.0050	24.83	28.69	54.00	25.31	200	12	Horizontal	QP

Hopping ON



Suspected List

NO.	Freq. [MHz]	Reading [dB μ V/m]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	916.9700	107.27	110.46	46.00	-64.46	100	123	Vertical	QP
2	948.9660	36.21	40.08	46.00	5.92	100	125	Vertical	QP
3	960.0050	27.48	31.34	54.00	22.66	100	234	Vertical	QP
4	980.3160	36.93	40.80	54.00	13.20	100	263	Vertical	QP

4.9 Radiated Emission Measurement

4.9.1 Limits

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

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 1000 MHz, 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 20 dB under any condition of modulation.

4.9.2 Test Procedures

For Radiated emission below 30MHz

- a. The EUT was placed on a 80cm height table 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. Both X and Y axes of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotate table was turned from

0 degree to 360 degree 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:

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

For Radiated emission above 30MHz

- a. The EUT was placed on a 80cm height(above 1GHz is 1.5m height) table 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 detected 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:

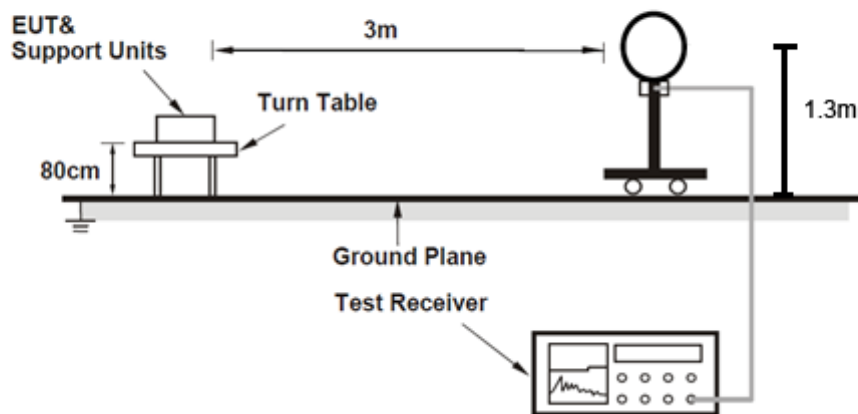
- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz & 360 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
- 2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 1/T for RMS Average (Duty cycle < 98 %) for Peak detection at frequency above 1 GHz.
- 4. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz (Duty cycle $\geq$ 98 %) for Average detection (AV) at frequency above 1 GHz.
- 5. All modes of operation were investigated and the worst-case emissions are reported.

4.9.3 Deviation from Test Standard

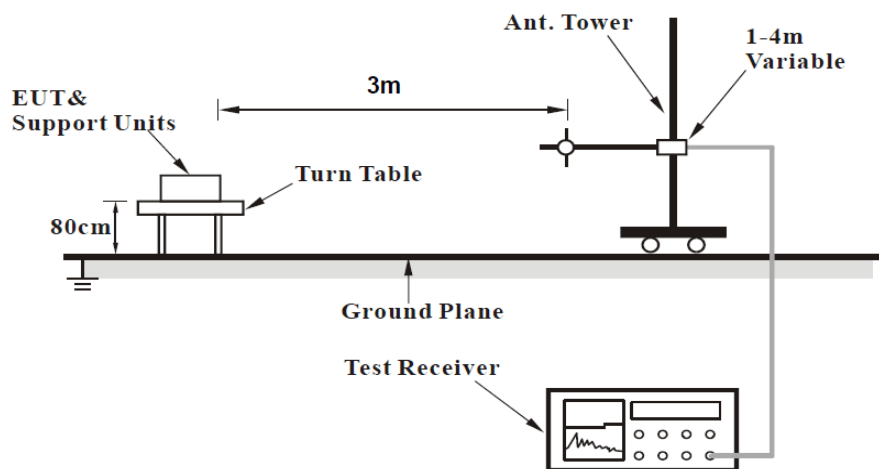
No deviation.

4.9.4 Test Setup

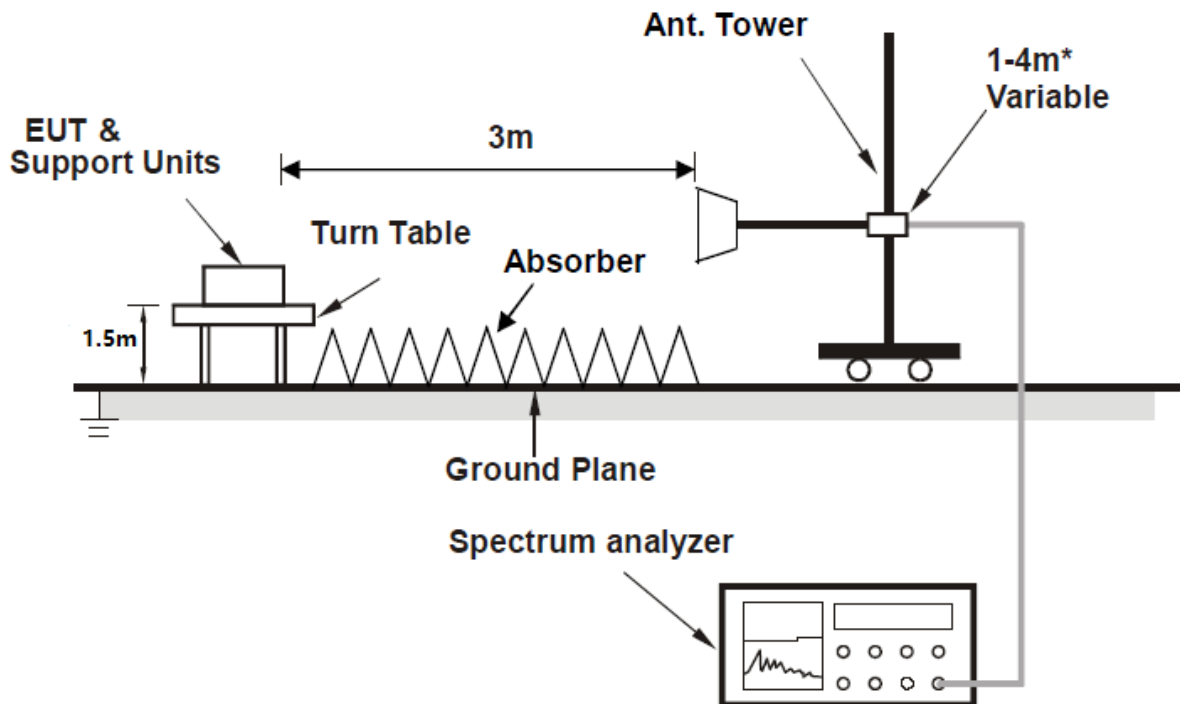
For Radiated emission below 30MHz



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).

4.9.5 EUT Operating Conditions

- a. Placed the EUT on a testing table.
- b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

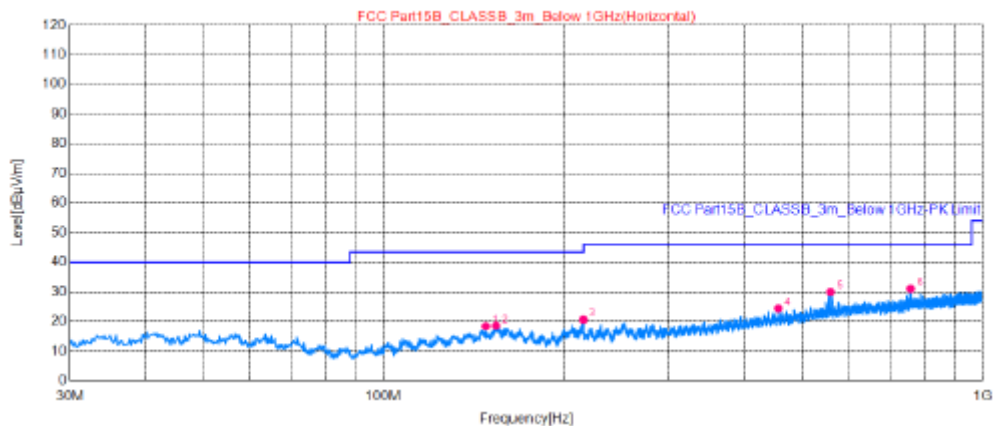
4.9.6 Test Results

Radiated Emissions Range 9kHz~30MHz

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Radiated Emissions Range 30MHz~1GHz

Channel	907.3 MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz	Antenna Polarity	Horizontal



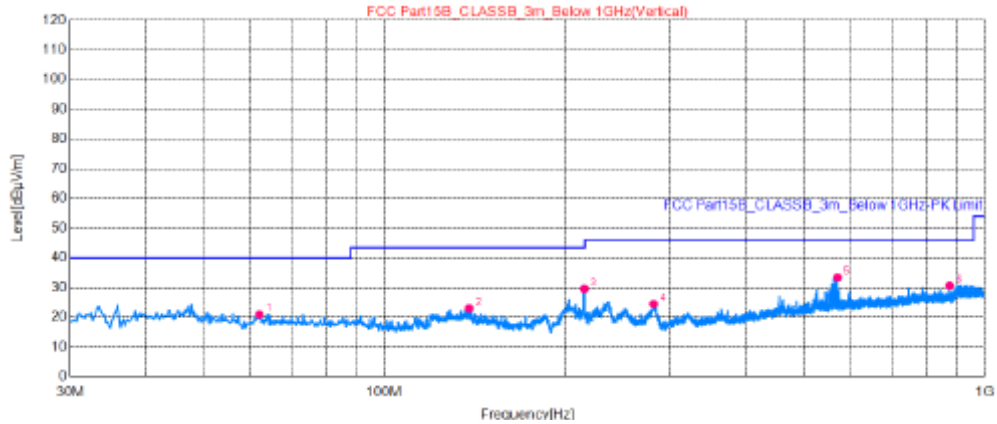
Suspected List

NO	Freq. [MHz]	Reading [dB μ V/m]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	148.3	28.14	18.4	43.5	25.07	200	36	Horizontal	QP
2	154.1	28.00	18.5	43.5	24.92	200	226	Horizontal	QP
3	215.6	32.79	20.6	43.5	22.84	200	104	Horizontal	QP
4	456.0	28.76	24.4	46.0	21.57	200	358	Horizontal	QP
5	558.0	32.38	29.9	46.0	16.04	200	166	Horizontal	QP
6	759.4	30.18	31.0	46.0	14.92	200	188	Horizontal	QP

REMARKS:

- Emission Level(dBuV/m) = Spectrum reading (dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
- The other emission levels were very low against the limit.
- Margin value = Limit value – Emission Level

Channel	907.3 MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz	Antenna Polarity	Vertical



Suspected List

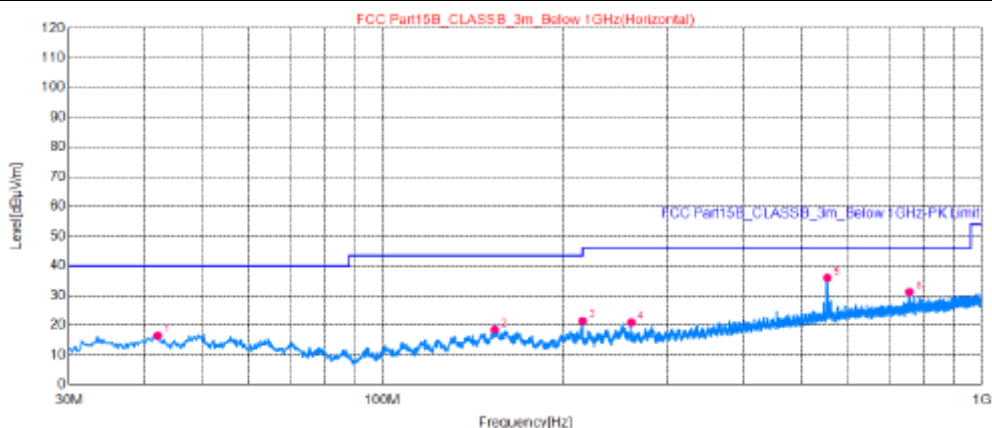
NO.	Freq. [MHz]	Reading [dB μ V/m]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	62.01	32.40	20.94	40.00	19.06	100	270	Vertical	QP
2	138.6	33.21	22.99	43.50	20.51	100	259	Vertical	QP
3	215.4	41.68	29.55	43.50	13.95	100	292	Vertical	QP
4	281.2	32.99	24.48	46.00	21.52	100	194	Vertical	QP
5	569.1	35.44	33.38	46.00	12.62	100	200	Vertical	QP
6	875.4	28.74	30.69	46.00	15.31	100	2	Vertical	QP

REMARKS:

- Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
- The other emission levels were very low against the limit.
- Margin value = Limit value – Emission Level

Radiated Emissions Range 30MHz~1GHz

Channel	912.1 MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz	Antenna Polarity	Horizontal



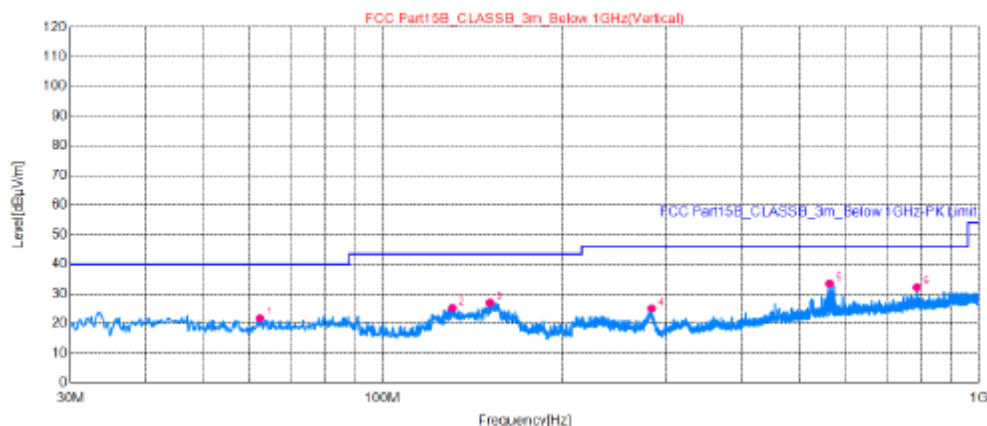
Suspected List

NO	Freq. [MHz]	Reading [dB μ V/m]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	42.22	26.86	16.5	40.0	23.50	200	265	Horizontal	QP
2	153.9	28.00	18.5	43.5	24.92	200	325	Horizontal	QP
3	215.8	33.60	21.4	43.5	22.03	200	222	Horizontal	QP
4	260.2	30.51	20.9	46.0	25.01	200	195	Horizontal	QP
5	552.6	38.53	35.9	46.0	10.04	200	4	Horizontal	QP
6	758.8	30.31	31.2	46.0	14.80	200	106	Horizontal	QP

REMARKS:

- Emission Level(dBuV/m) = Spectrum reading (dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
- The other emission levels were very low against the limit.
- Margin value = Limit value – Emission Level

Channel	912.1 MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz	Antenna Polarity	Vertical



Suspected List

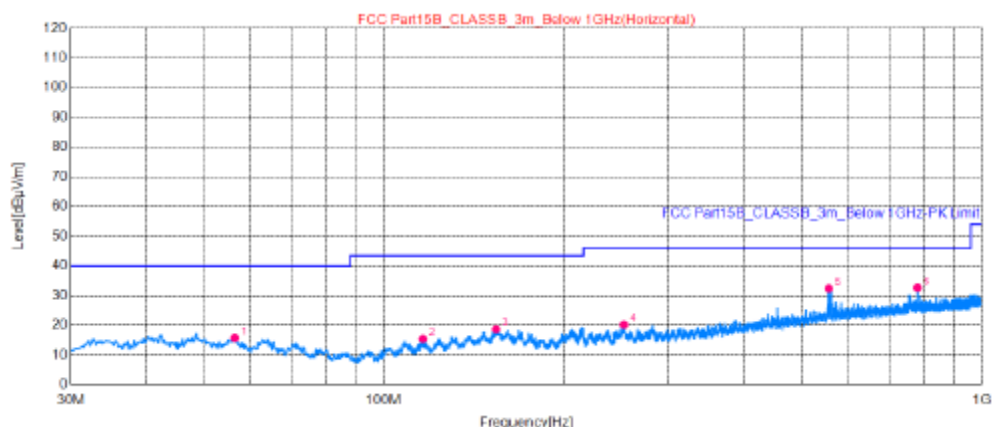
NO.	Freq. [MHz]	Reading [dB µ V/m]	Level [dB µ V/m]	Limit [dB µ V/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	62.39	33.31	21.80	40.00	18.20	100	318	Vertical	QP
2	131.0	36.09	25.25	43.50	18.25	100	272	Vertical	QP
3	151.6	36.59	27.04	43.50	16.46	100	291	Vertical	QP
4	282.7	33.55	25.10	46.00	20.90	100	198	Vertical	QP
5	562.5	35.77	33.48	46.00	12.52	100	340	Vertical	QP
6	787.7	30.83	32.24	46.00	13.76	100	155	Vertical	QP

REMARKS:

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Limit value – Emission Level

Radiated Emissions Range 30MHz~1GHz

Channel	916.9 MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz	Antenna Polarity	Horizontal



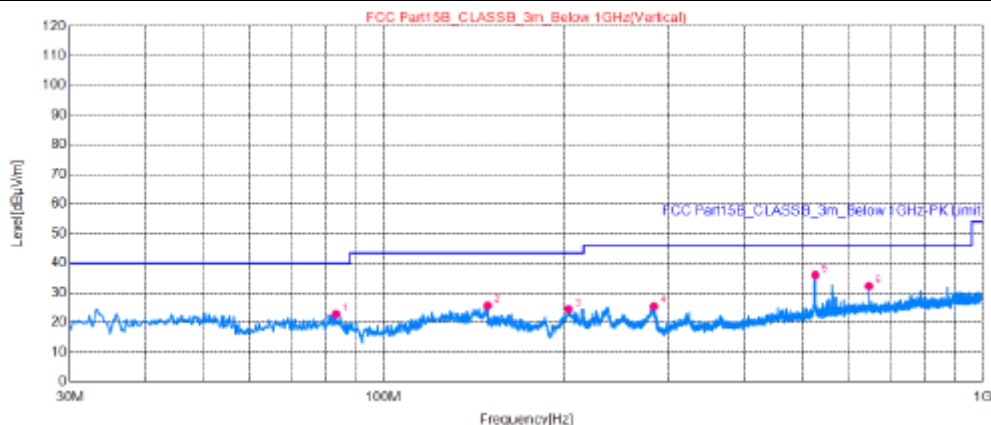
Suspected List

NO.	Freq. [MHz]	Reading [dB μV/m]	Level [dB μV/m]	Limit [dB μV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	56.38	26.59	15.7	40.0	24.25	200	22	Horizontal	QP
2	116.3	27.80	15.4	43.5	28.08	200	108	Horizontal	QP
3	154.1	28.09	18.6	43.5	24.83	200	19	Horizontal	QP
4	252.3	30.05	20.2	46.0	25.78	200	232	Horizontal	QP
5	555.3	34.89	32.4	46.0	13.60	200	165	Horizontal	QP
6	781.7	31.27	32.6	46.0	13.35	200	313	Horizontal	QP

REMARKS:

- Emission Level(dBuV/m) = Spectrum reading (dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
- The other emission levels were very low against the limit.
- Margin value = Limit value – Emission Level

Channel	916.9 MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz	Antenna Polarity	Vertical



Suspected List

NO.	Freq. [MHz]	Reading [dB μ V/m]	Level [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	83.35	37.78	22.81	40.00	17.19	100	292	Vertical	QP
2	149.3	35.36	25.70	43.50	17.80	100	238	Vertical	QP
3	203.8	36.78	24.55	43.50	18.95	100	265	Vertical	QP
4	282.7	33.92	25.47	46.00	20.53	100	181	Vertical	QP
5	525.8	38.92	36.01	46.00	9.99	100	203	Vertical	QP
6	646.5	33.10	32.31	46.00	13.69	100	159	Vertical	QP

REMARKS:

- Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
- The other emission levels were very low against the limit.
- Margin value = Limit value – Emission Level

Radiated Emission Range 1GHz~10th Harmonic

Channel		907.3 MHz		Detector Function		Peak (PK)	
Frequency Range		1GHz ~ 25GHz				Average (AV)	
Spurious Emission Level							
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	1814.3000	53.48	74.00	20.52	-20.23	H	PK
2	1816.0000	50.17	54.00	3.83	-20.22	H	AV
3	1814.3000	55.77	74.00	18.23	-20.23	V	PK
4	1816.0000	50.99	54.00	3.01	-20.22	V	AV

Channel		912.1 MHz		Detector Function		Peak (PK)	
Frequency Range		1GHz ~ 25GHz				Average (AV)	
Spurious Emission Level							
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	1824.3000	51.19	74.00	22.81	-20.18	H	PK
2	1824.5000	50.57	54.00	3.43	-20.17	H	AV
3	1824.3000	54.90	74.00	19.10	-20.18	V	PK
4	1824.5000	50.56	54.00	3.44	-20.17	V	AV

Channel		916.9 MHz		Detector Function		Peak (PK)	
Frequency Range		1GHz ~ 25GHz				Average (AV)	
Spurious Emission Level							
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	1833.0000	54.42	74.00	19.58	-20.15	H	PK
2	1834.7000	49.67	54.00	4.33	-20.14	H	AV
3	1833.0000	57.55	74.00	16.45	-20.15	V	PK
4	1834.7000	47.35	54.00	6.65	-20.14	V	AV

REMARKS:

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value =Limit value – Emission Level

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo)

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