TEST REPORT

APPLICANT	:	Shenzhen Chainway Information Technology Co.,Ltd.
PRODUCT NAME	:	Fixed Android UHF Reader
MODEL NAME	:	URA8
BRAND NAME	:	CHAINWAY
FCC ID	:	2AC6AURA8
STANDARD(S)	:	47 CFR Part 15 Subpart C
RECEIPT DATE	:	2019-10-30
TEST DATE	:	2019-12-12 to 2020-01-10
ISSUE DATE	:	2020-01-14

Edited by: Peng Mi (Rapporteur)

Approved by: Peng Huarui (Supervisor)

NOTE: This document is issued by MORLAB, the test report shall not be reproduced except in full without prior written permission of the company. The test results apply only to the particular sample(s) tested and to the specific tests carried out which is available on request for validation and information confirmed at our website.

MORLAB
SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd.
FL1-3, Building A, FeiYang Science Park, No.8 LongChang Road,
Block67, BaoAn District, ShenZhen , GuangDong Province, P. R. China
Tel: 86-755-36698555 Fax: 86-755-36698525
Http://www.morlab.cn E-mail: service@morlab.cn

DIRECTORY

1. Technical Information ····· 4
1.1. Applicant and Manufacturer Information ····· 4
1.2. Equipment Under Test (EUT) Description ····· 4
1.3. The Channel Number and Frequency ····· 5
1.4. Test Standards and Results ····· 6
1.5. Environmental Conditions ····· 7
2. 47 CFR Part 15C Requirements ····· 8
2.1. Antenna Requirement ····· 8
2.2. Hopping Mechanism ····· 9
2.3. Number of Hopping Frequency ····· 10
2.4. Duty Cycle of Test Signal ····· 12
2.5. Maximum Peak Conducted Output Power ····· 13
2.6. Maximum Average Conducted Output Power ····· 16
2.7. 20dB Bandwidth ····· 17
2.8. Carried Frequency Separation ····· 20
2.9. Time of Occupancy (Dwell time) ····· 22
2.10. Conducted Spurious Emissions ····· 24
2.11. Conducted Emission ····· 29
2.12. Radiated Emission ····· 33
Annex A Test Uncertainty ····· 40
Annex B Testing Laboratory Information ····· 41

Change History		
Version	**Date**	**Reason for change**
1.0	2020-01-14	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Shenzhen Chainway Information Technology Co.,Ltd.
Applicant Address:	9/F, Building 2, Daqian Industrial Park, Longchang Rd., District 67, Bao'an, Shenzhen
Manufacturer:	Shenzhen Chainway Information Technology Co.,Ltd.
Manufacturer Address:	9/F, Building 2, Daqian Industrial Park, Longchang Rd., District 67, Bao'an, Shenzhen

1.2. Equipment Under Test (EUT) Description

Product Name:	Fixed Android UHF Reader
Serial No:	(N/A, marked #1 by test site)
Hardware Version:	V12
Software Version:	A8_20191010
Modulation Type:	ASK
Operating Frequency Range:	902.75MHz – 927.25MHz
Antenna Type:	ANT1: Circular polarized directional Antenna
	ANT2: Circular polarized directional Antenna
	ANT3: Circular polarized directional Antenna
Antenna Gain:	ANT1: 6.0dBi
	ANT2: 9.0dBi
	ANT3: 12.0dBi

Note 1: We use the dedicated software to control the EUT continuous transmission.

Note 2: The EUT supports three kinds of antennas, all of the antennas were tested separately, only the worst test result(ANT3) were recorded in the test report.

Note 3: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

1.3. The Channel Number and Frequency

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	**902.75**	18	911.25	35	919.75
2	903.25	19	911.75	36	920.25
3	903.75	20	912.25	37	920.75
4	904.25	21	912.75	38	921.25
5	904.75	22	913.25	39	921.75
6	905.25	23	913.75	40	922.25
7	905.75	24	914.25	41	922.75
8	906.25	**25**	**914.75**	42	923.25
9	906.75	26	915.25	43	923.75
10	907.25	27	915.75	44	924.25
11	907.75	28	916.25	45	924.75
12	908.25	29	916.75	46	925.25
13	908.75	30	917.25	47	925.75
14	909.25	31	917.75	48	926.25
15	909.75	32	918.25	49	926.75
16	910.25	33	918.75	**50**	**927.25**
17	910.75	34	919.25		

Note 1: The black bold channels were selected for test.

1.4. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C for the EUT FCC ID Certification:

No.	Identity	Document Title
1	47 CFR Part 15 (10-1-15 Edition)	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section	Description	Test Date	Test Engineer	Result	Method determination /Remark
1	15.203	Antenna Requirement	N/A	N/A	PASS	No deviation
2	15.247(a)(1) 15.247(g)(h)	Hopping Mechanism	N/A	N/A	PASS	No deviation
3	15.247(a)	Number of Hopping Frequency	Dec 13, 2019	Wang Meng	PASS	No deviation
4	15.247(b)	Maximum Peak Conducted Output Power	Jan 07, 2019	Wang Meng	PASS	No deviation
5	15.247(b)	Maximum Average Conducted Output Power	Jan 07, 2019	Wang Meng	PASS	No deviation
6	15.247(a)	20dB Bandwidth	Dec 13, 2019	Wang Meng	PASS	No deviation
7	15.247(a)	Carrier Frequency Separation	Dec 13, 2019	Wang Meng	PASS	No deviation
8	15.247(a)	Time of Occupancy (Dwell time)	Dec 13, 2019	Wang Meng	PASS	No deviation
9	15.247(d)	Conducted Spurious Emission	Dec 13, 2019	Wang Meng	PASS	No deviation
10	15.207	Conducted	Jan 06, 2019	Lin Jiayong	PASS	No deviation

		Emission				
11	15.209, 15.247(d)	Radiated Emission	Jan 07, 2019	Gao Jianrou	PASS	No deviation

Note 1: The tests were performed according to the method of measurements prescribed in ANSI C63.10-2013.

Note2: The path loss during the RF test is calibrated to correct the results by the offset setting in the test equipments. The ref offset 22dB contains two parts that cable loss 2.0dB and Attenuator 20dB.

Note 3: Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.

1.5. Environmental Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15-35
Relative Humidity (%):	30-60
Atmospheric Pressure (kPa):	86-106

2. 47 CFR Part 15C Requirements

2.1. Antenna Requirement

2.1.1. Applicable Standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

2.1.2. Result: Compliant

The EUT has three kinds of external antenna coupled with RP-SMA connector. Please refer to the internal photos.

2.2. Hopping Mechanism

2.2.1. Requirement

According to FCC §15.247(a)(1), a frequency hopping spread spectrum system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

According to FCC §15.247(g), Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

According to FCC §15.247(h), the incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

2.2.2. Result: Compliant

The hopping mechanism of the EUT is based on the protocol that "***ISO18000-6C***".

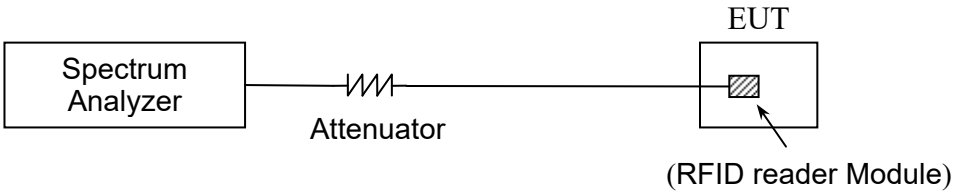
2.3. Number of Hopping Frequency

2.3.1. Requirement

According to FCC section 15.247(a)(1)(i), frequency hopping systems operating in the 902MHz to 928MHz bands shall use at least 50 hopping frequencies if the 20dB bandwidth of the hopping channel is less than 250KHz; or at least 25 hopping frequencies if the 20dB bandwidth of the hopping channel is 250KHz or greater.

2.3.2. Test Description

Test Setup:



The EUT is coupled to the Spectrum Analyzer (SA) with Attenuators the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. During the measurement, the RFID Reader Module of the EUT is activated by the PC via Lan port.

2.3.3. Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Span = the frequency band of operation
RBW ≥ 1% of the span
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize

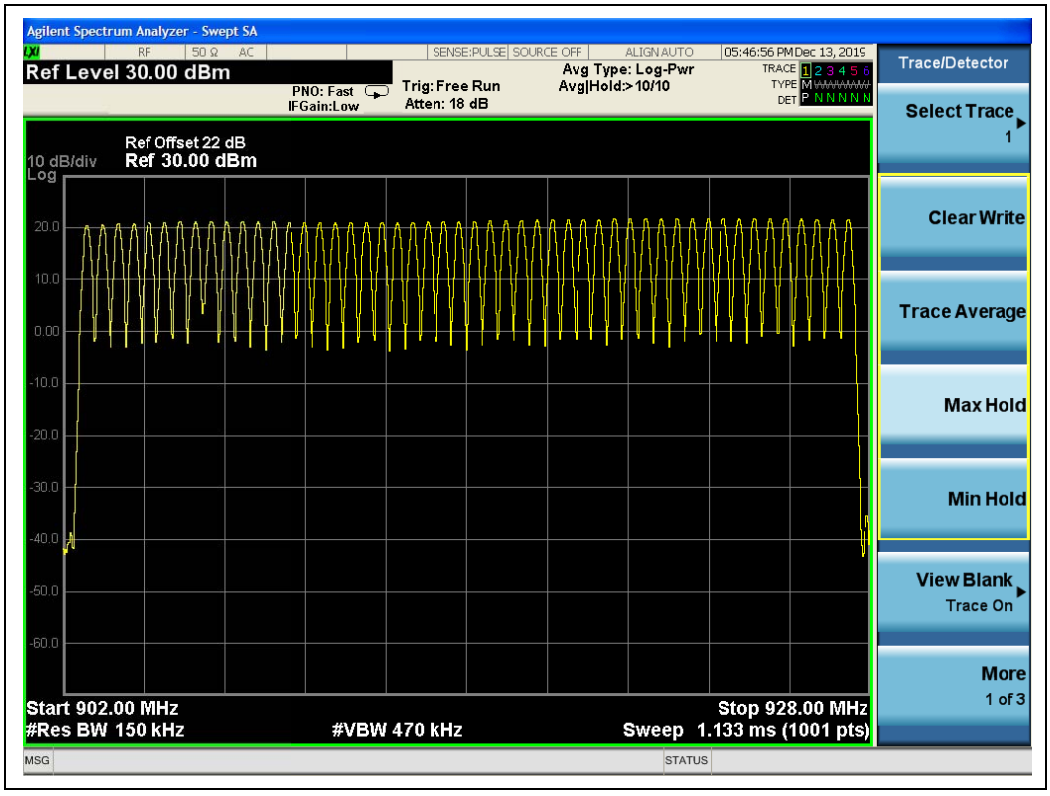
2.3.4. Test Result

The EUT operates at hopping-on test mode; the frequencies number employed is counted to verify the Module's using the number of hopping frequency.

A. Test Verdict:

Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Verdict
902.75 - 927.25	50	50	PASS

B. Test Plots:



(Number of Hopping Frequency)

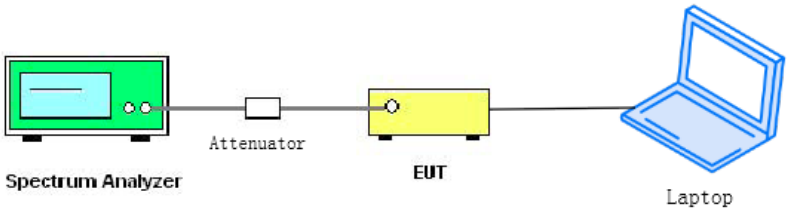
2.4. Duty Cycle of Test Signal

2.4.1. Requirement

Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%). When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be used to ensure that measurements are made only during transmissions at the maximum power control level. Such sweep triggering/signal gating techniques will require knowledge of the minimum transmission duration (T) over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation. Sweep triggering/signal gating techniques can then be used if the measurement/sweep time of the analyzer can be set such that it does not exceed T at any time that data are being acquired (i.e., no transmitter OFF-time is to be considered).
When continuous transmission cannot be achieved and sweep triggering/signal gating cannot be implemented, alternative procedures are provided that can be used to measure the average power; however, they will require an additional measurement of the transmitter duty cycle (D). Within this subclause, the duty cycle refers to the fraction of time over which the transmitter is ON and is transmitting at its maximum power control level. The duty cycle is considered to be constant if variations are less than ±2%; otherwise, the duty cycle is considered to be nonconstant.

2.4.2. Test Description

Test Setup:



ANSI C63.10 2013 Clause 11.6 was used in order to prove compliance.

2.4.3. Test Result

Frequency (MHz)	Duty Cycle (%) (D)	Duty Factor (10*lg[1/D])
902.75	57.26	2.42

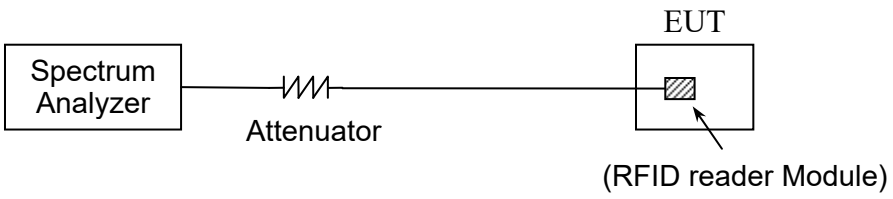
2.5. Maximum Peak Conducted Output Power

2.5.1. Requirement

According to FCC section 15.247(b)(2), for frequency hopping systems that operates in the 902MHz to 928MHz band employing at least 50 hopping channels, the maximum peak output power of the intentional radiator shall not exceed 1Watt, and 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels.

2.5.2. Test Description

Test Setup:



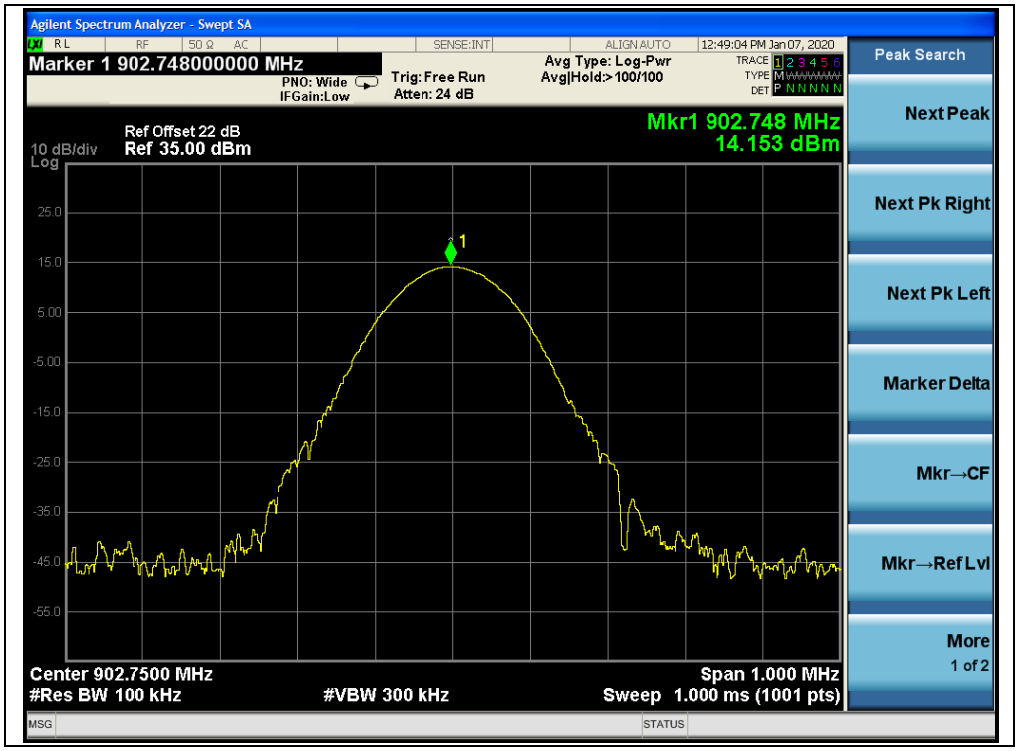
The EUT is coupled to the Spectrum Analyzer (SA) with Attenuators the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. During the measurement, the RFID Reader Module of the EUT is activated by the PC via Lan port.

2.5.3. Test Result

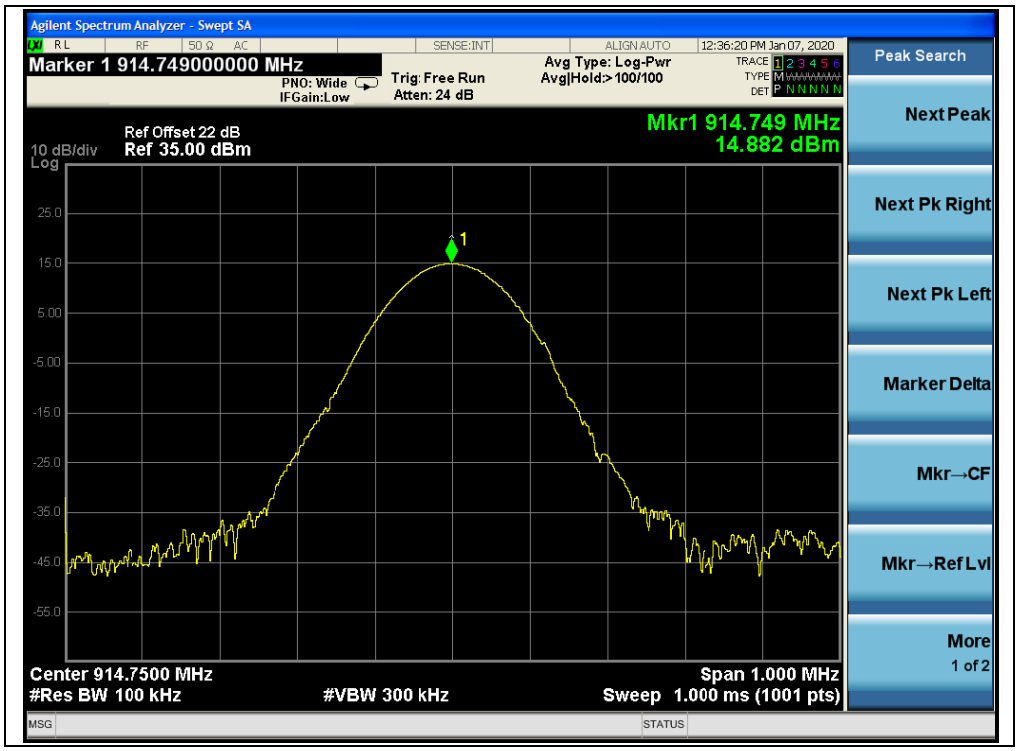
The EUT operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module.

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	902.75	14.15	0.026	30	1	PASS
25	914.75	14.88	0.031			PASS
50	927.25	15.15	0.033			PASS

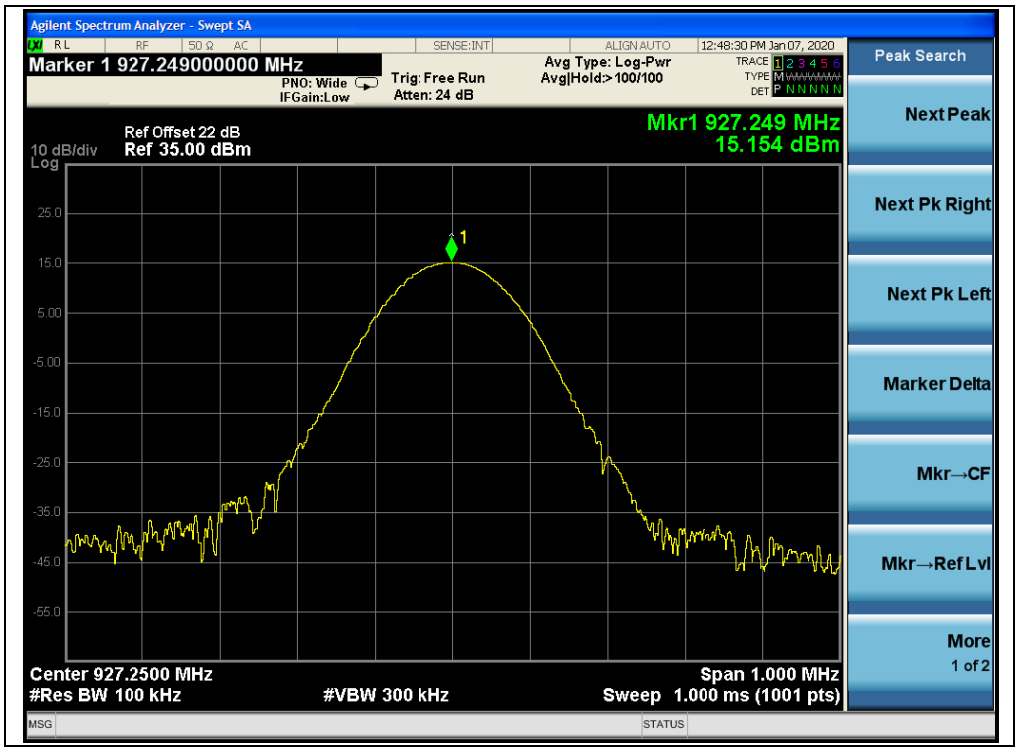
Test Plots:



(Power, Channel 1, 902.75MHz)



(Power, Channel 25, 914.75MHz)



(Power, Channel 50, 927.25MHz)

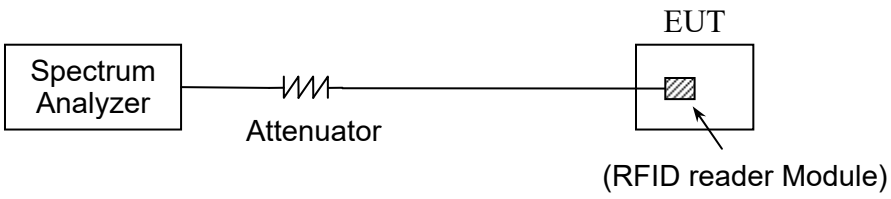
2.6. Maximum Average Conducted Output Power

2.6.1. Requirement

According to FCC section 15.247(b)(2), for frequency hopping systems that operates in the 902MHz to 928MHz band employing at least 50 hopping channels, the maximum peak output power of the intentional radiator shall not exceed 1Watt, and 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels.

2.6.2. Test Description

Test Setup:



The EUT is coupled to the Spectrum Analyzer (SA) with Attenuators the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. During the measurement, the RFID Reader Module of the EUT is activated by the PC via Lan port.

2.6.3. Test Result

The EUT operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module.

Channel	Frequency (MHz)	Average Power				Limit		Verdict
		Measured	Duty Factor	Duty factor Calculated				
		dBm		dBm	W	dBm	W	
1	902.75	11.15	2.42	13.57	0.023	30	1	PASS
25	914.75	12.38		14.80	0.030			PASS
50	927.25	11.96		14.38	0.027			PASS

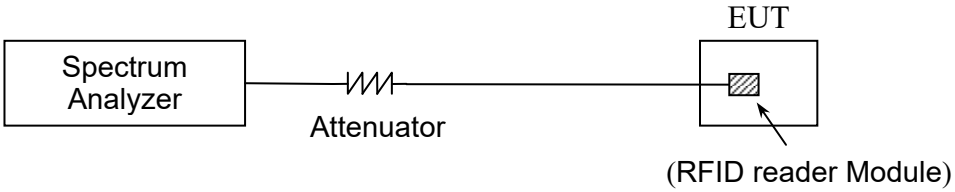
2.7. 20dB Bandwidth

2.7.1. Definition

According to FCC §15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth (10*log1% = 20dB) taking the total RF output power.

2.7.2. Test Description

Test Setup:



The EUT is coupled to the Spectrum Analyzer (SA) with Attenuators the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. During the measurement, the RFID Reader Module of the EUT is activated by the PC via Lan port.

2.7.3. Test Procedure

Use the following spectrum analyzer settings:
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
RBW ≥ 1% of the 20 dB bandwidth
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

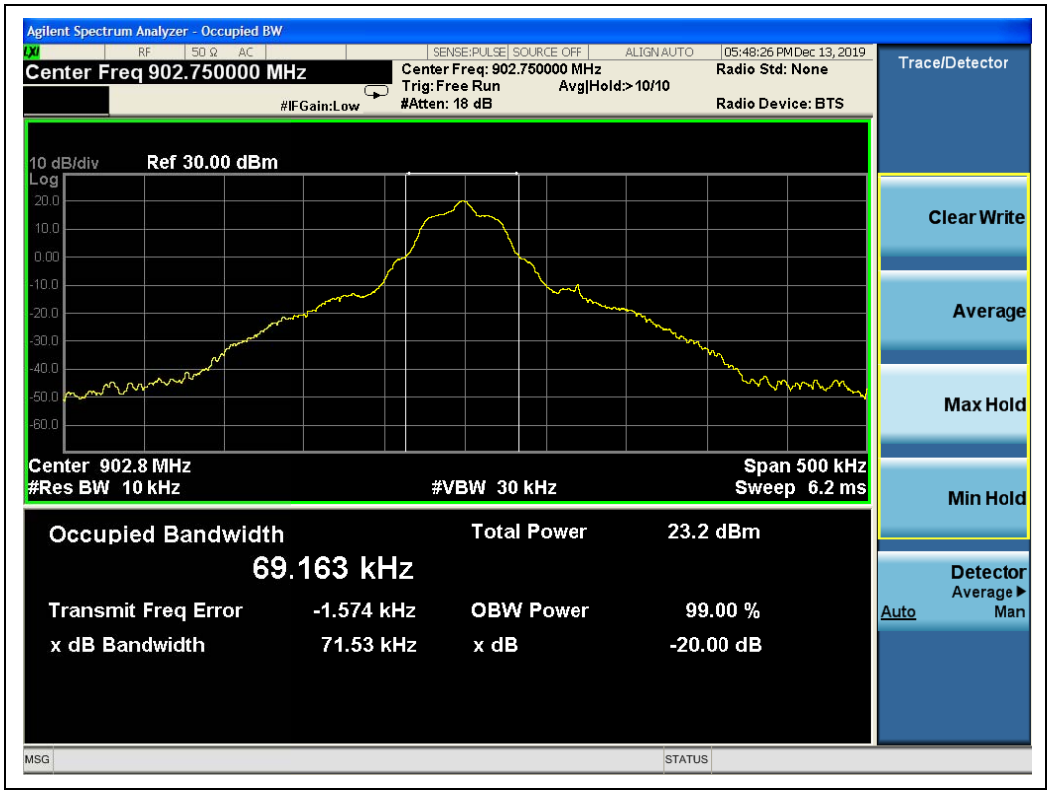
2.7.4. Test Result

The EUT operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to record the 20dB bandwidth of the Module.

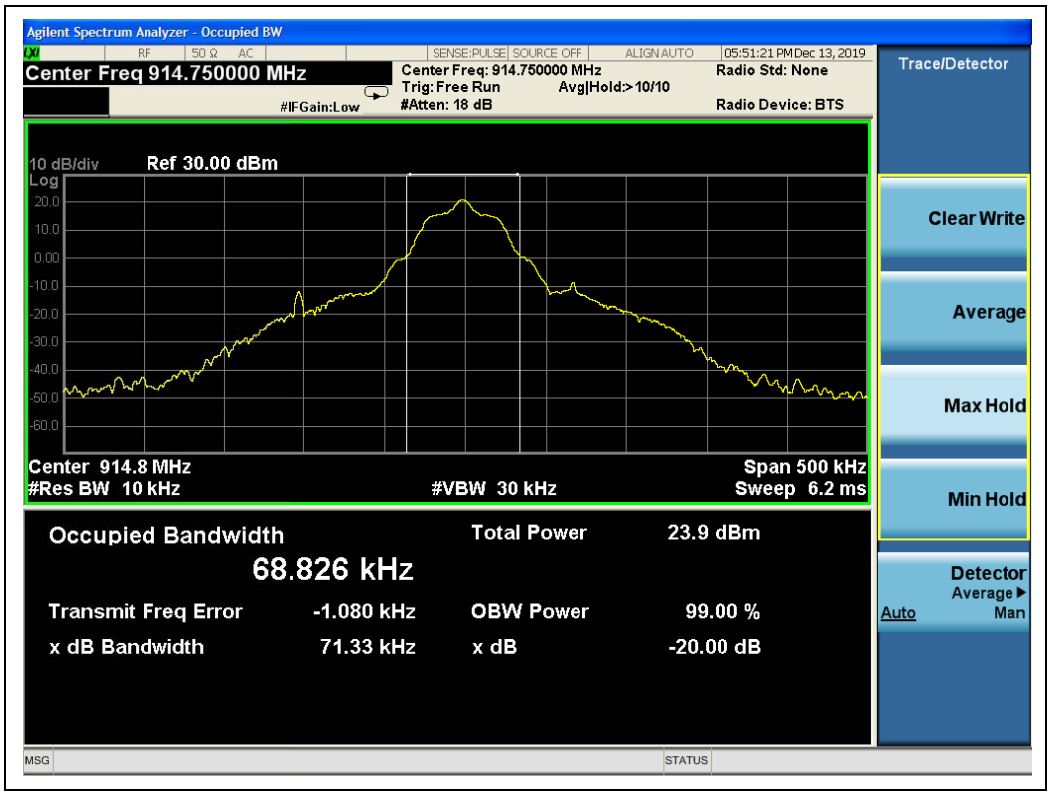
A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (kHz)	Result
1	902.75	71.53	PASS
25	914.75	71.33	PASS
50	927.25	71.35	PASS

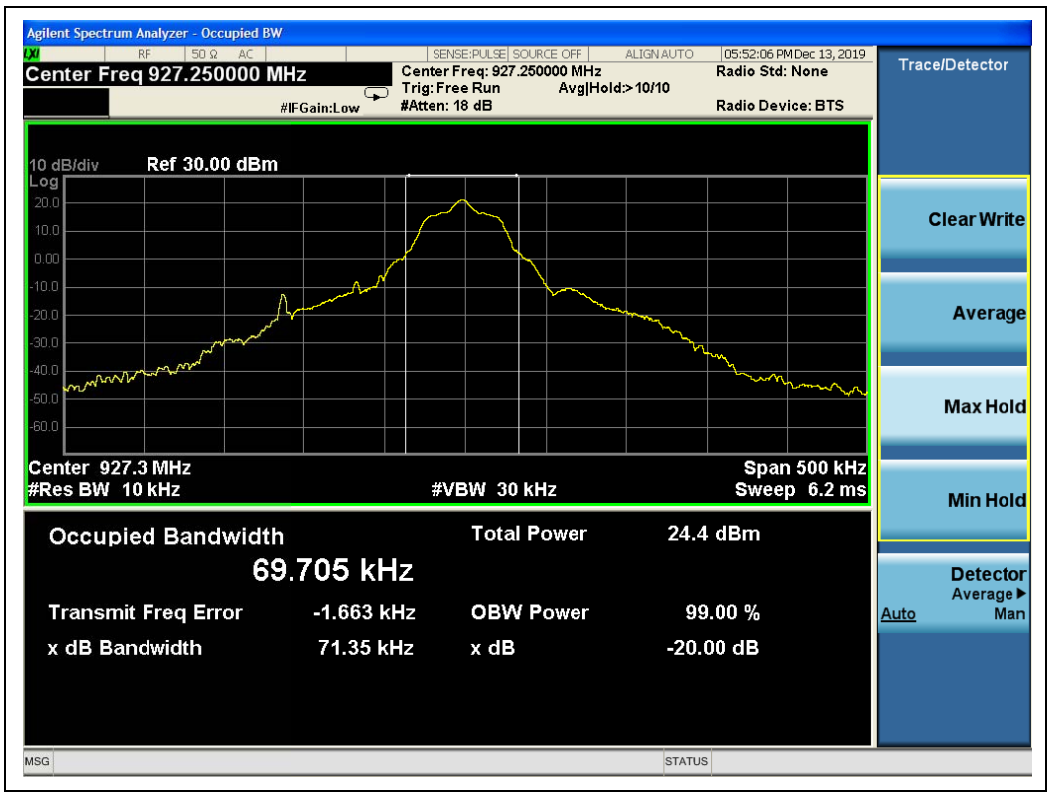
B. Test Plots:



(Bandwidth, Channel 1, 902.75MHz)



(Bandwidth, Channel 25, 914.75MHz)



(Bandwidth, Channel 50, 927.25MHz)

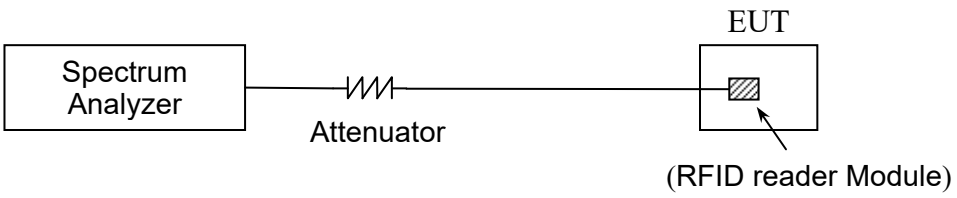
2.8. Carried Frequency Separation

2.8.1. Definition

According to FCC §15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

2.8.2. Test Description

Test Setup:



The EUT is coupled to the Spectrum Analyzer (SA) with Attenuators the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. During the measurement, the RFID Reader Module of the EUT is activated by the PC via Lan port.

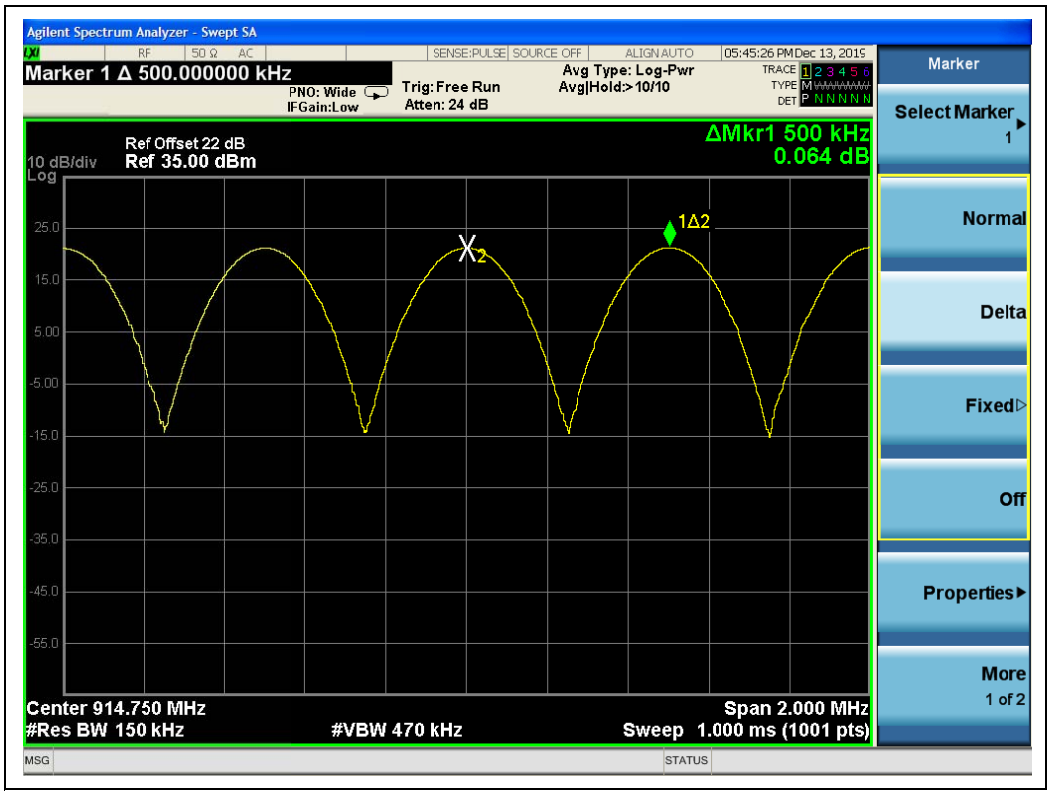
2.8.3. Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels
Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span
Video (or Average) Bandwidth (VBW) ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

2.8.4. Test Result

The EUT operates at hopping-on test mode. For any adjacent channels (e.g. the channel 26 and 27), the EUT does have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20dB bandwidth of the hopping channel (refer to section 2.4.4), whichever is greater. So, the verdict is PASSING

Measured Channel Numbers	Carried Frequency Separation (kHz)	20dB bandwidth (kHz)	Min. Limit	Verdict
26 and 27	500	71.53	20dB bandwidth	PASS



(Frequency Separation)

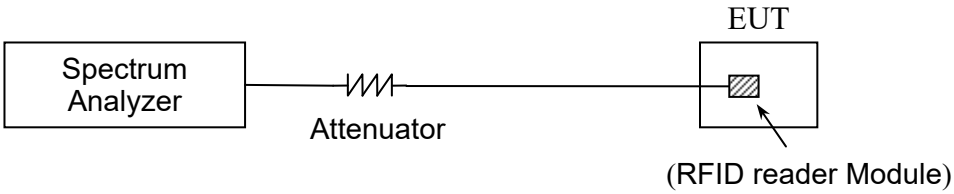
2.9. Time of Occupancy (Dwell time)

2.9.1. Requirement

According to FCC section 15.247(a)(1)(i), frequency hopping systems in the 902 - 928MHz band shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

2.9.2. Test Description

Test Setup:



The EUT is coupled to the Spectrum Analyzer (SA) with Attenuators the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. During the measurement, the RFID Reader Module of the EUT is activated by the PC via Lan port.

2.9.3. Test Procedure

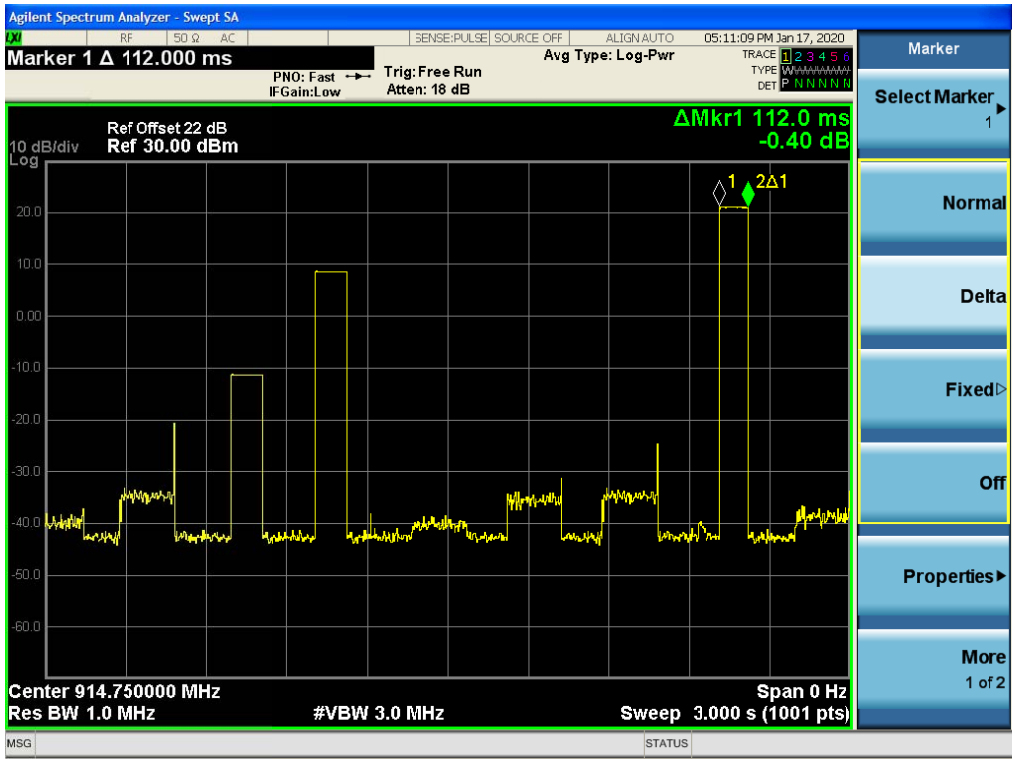
The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in 20 second scan, to enable resolution of each occurrence.
The average time of occupancy in the specified 20 second period is equal to (# of pulses in 20s) * pulse width.

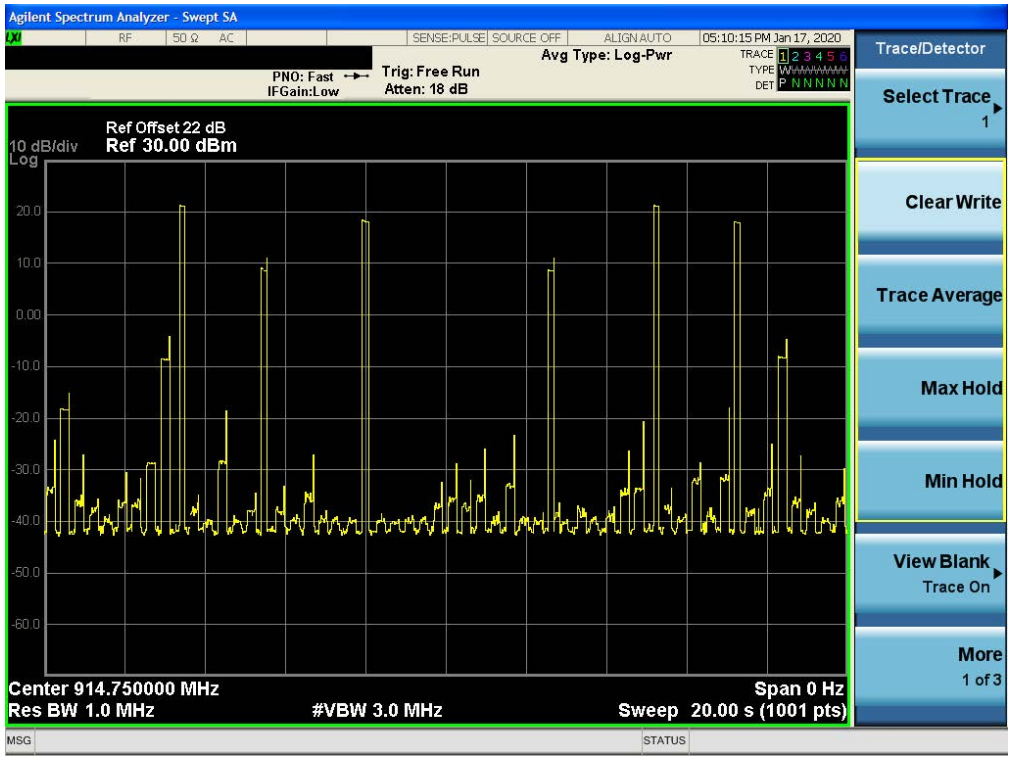
2.9.4. Test Result

A. Test Verdict:

Pulse Width (sec)	Number of pulse in 20 seconds	Average Time of Occupancy (sec)	Limit (sec)	Verdict
0.112	2	0.224	0.4	PASS

B. Test Plots:





(Dwell time)

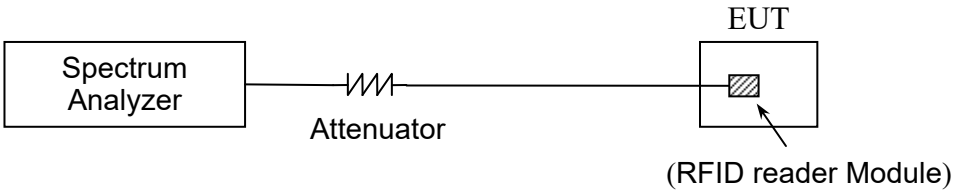
2.10. Conducted Spurious Emissions

2.10.1. Requirement

According to FCC §15.247(d), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

2.10.2. Test Description

Test Setup:



The EUT is coupled to the Spectrum Analyzer (SA) with Attenuators the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. During the measurement, the RFID Reader Module of the EUT is activated by the PC via Lan port.

2.10.3. Test Procedure

Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
RBW = 100 kHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize.

2.10.4. Test Result

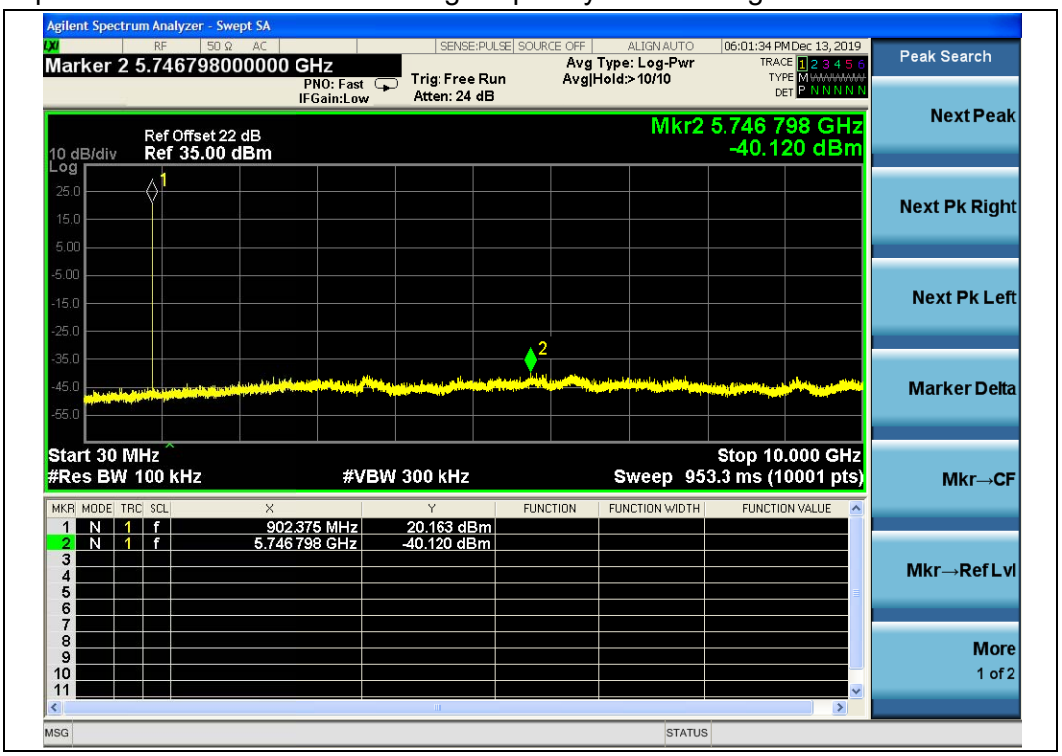
The EUT operates at hopping-off test mode. The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions.

A. Test Verdict:

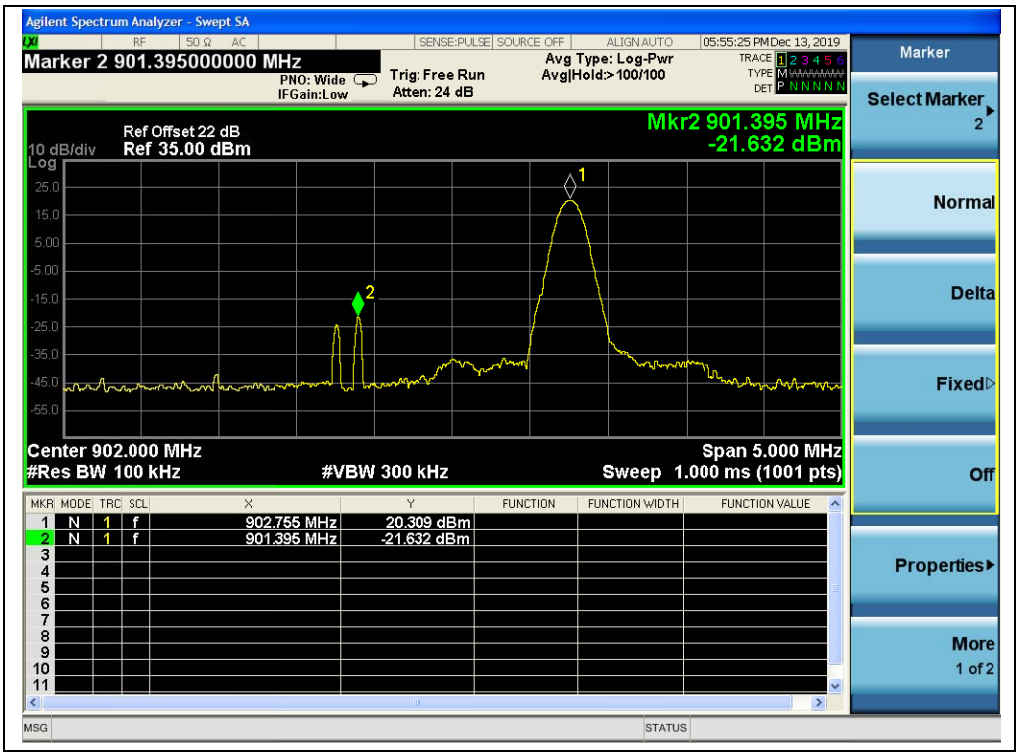
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	902.75	-40.12	20.15	0.15	PASS
25	914.75	-40.28	21.00	1.00	PASS
50	927.25	-40.33	21.31	1.31	PASS

B. Test Plots:

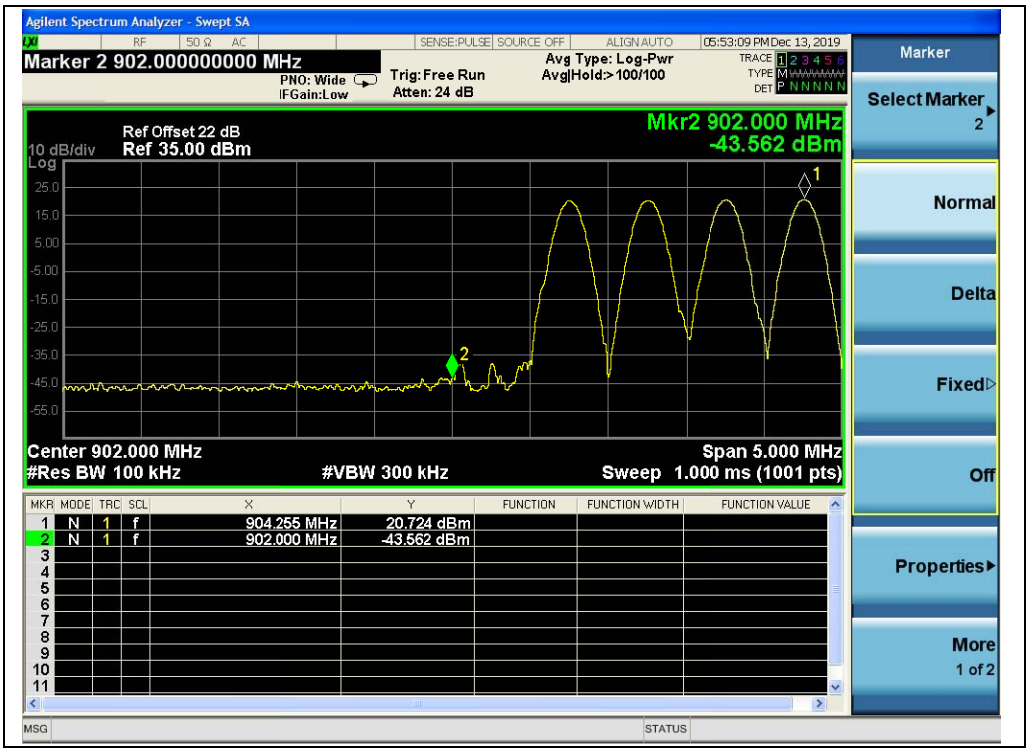
Note: The power of the Module transmitting frequency should be ignored.



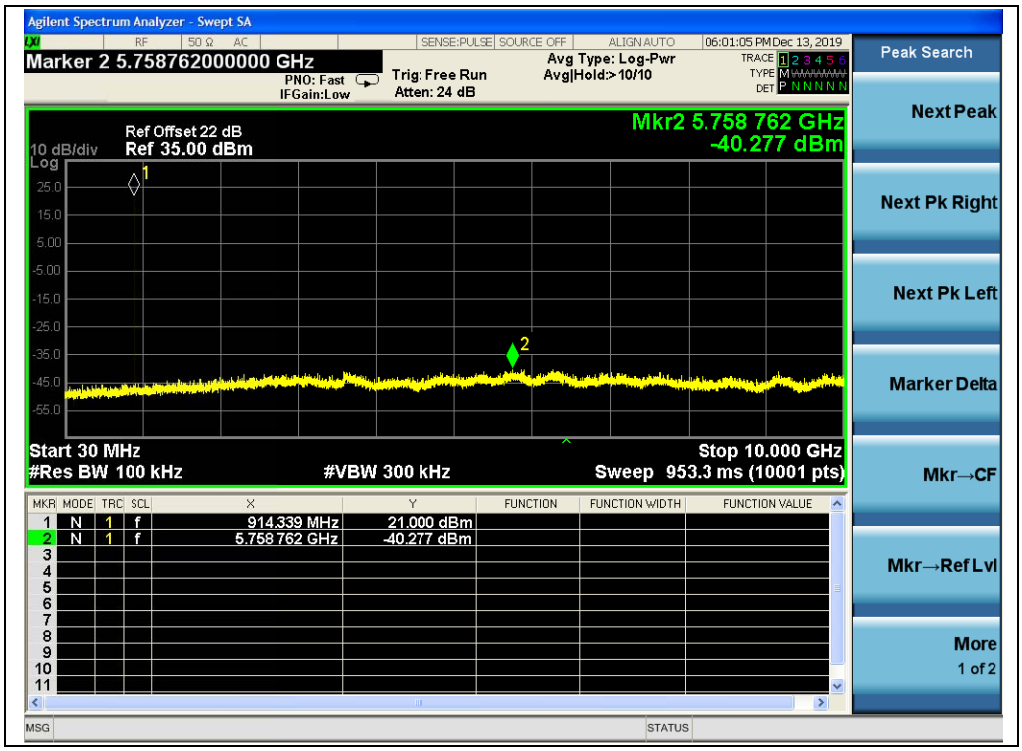
(Channel = 1, 30MHz to 25GHz)



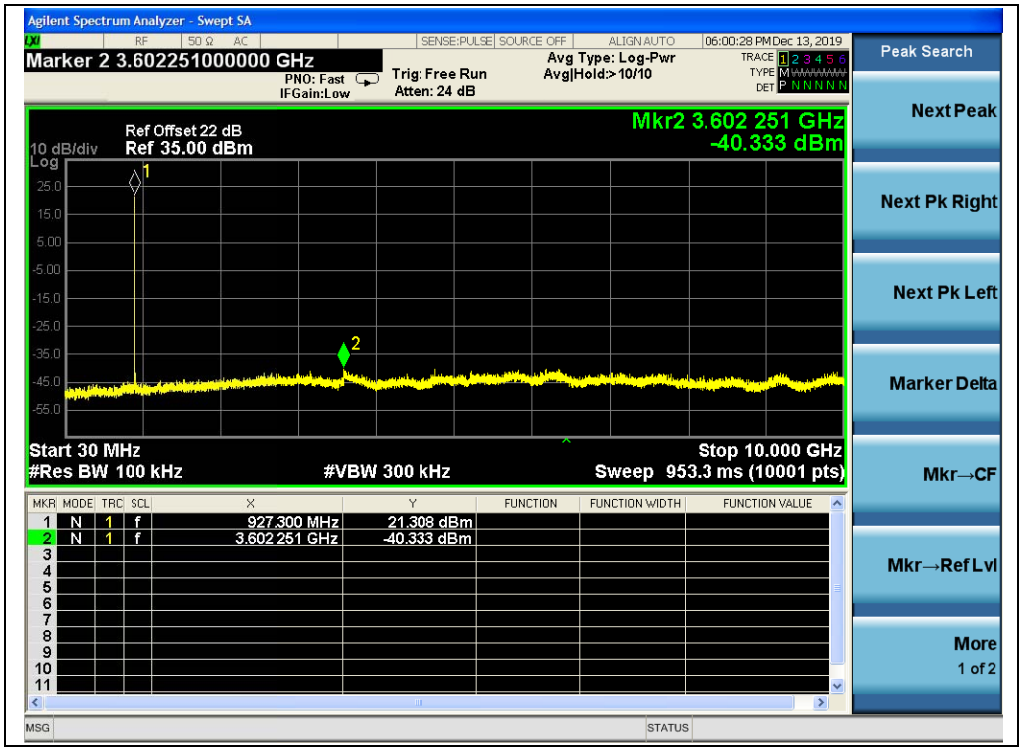
(Channel = 1, Band edge)



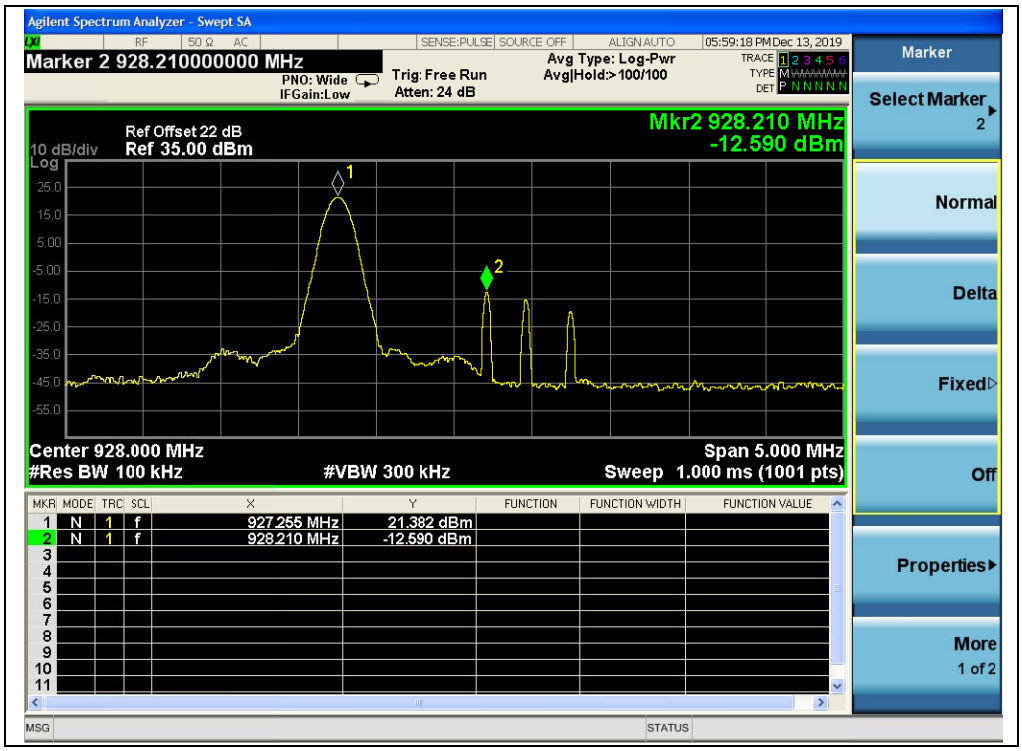
(Channel = 1, Band edge with hopping on)



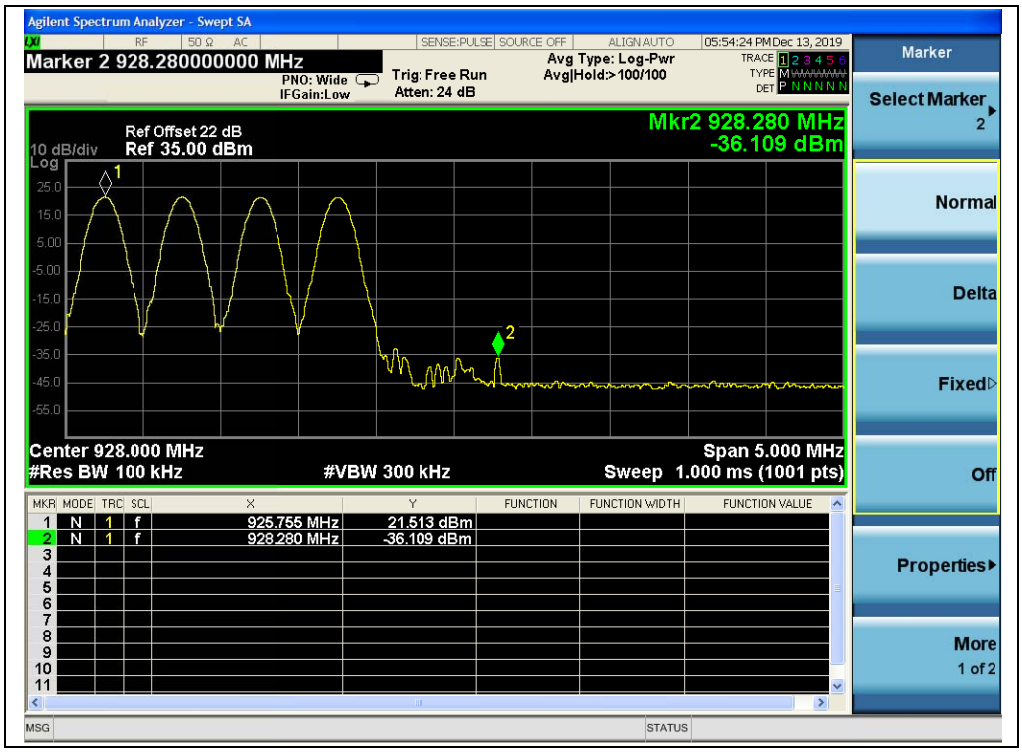
(Channel = 25, 30MHz to 25GHz)



(Channel = 50, 30MHz to 25GHz)



(Channel = 50, Band edge)



(Channel = 50, Band edge with hopping on)

2.11. Conducted Emission

2.11.1. Requirement

According to RSS-GEN section 8.8, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5- 30	60	50

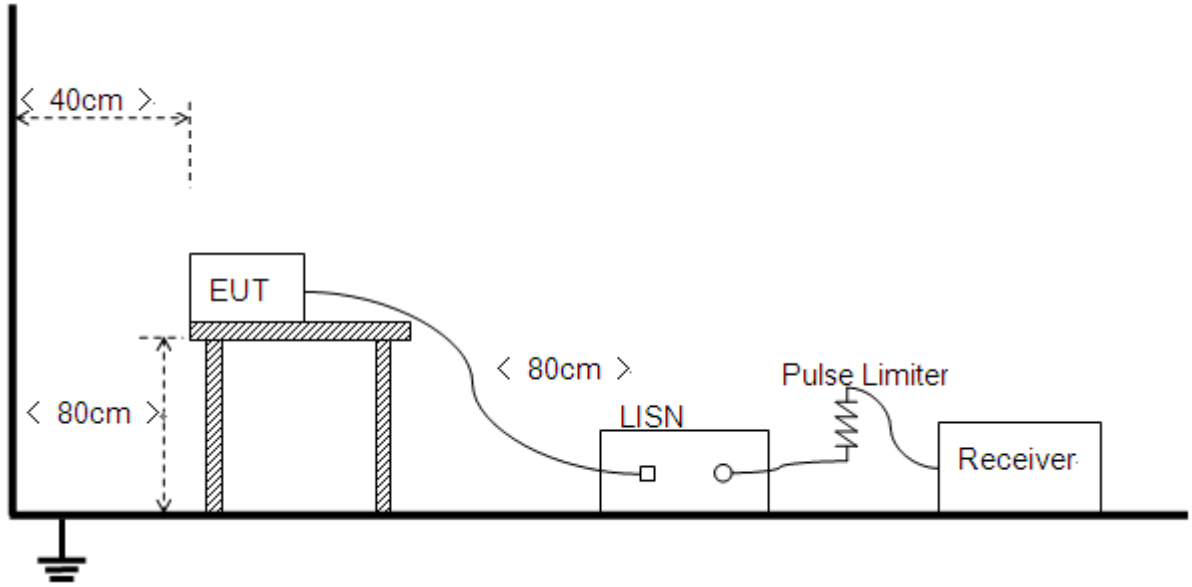
NOTE:

(a) The lower limit shall apply at the band edges.

(b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.11.2. Test Description

Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10: 2013.

2.11.3. Test Result

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

Note: Both of the test voltage AC 120V/60Hz and AC 230V/50Hz were considered and tested respectively, only the results of the worst case AC 120V/60Hz were recorded in this report.

A. Test setup:

Test Mode: EUT + Adapter + mouse +USB disk+ T-Flash+ HDMI Cable+ Display +RFID TX

Test voltage: AC 120V/60Hz

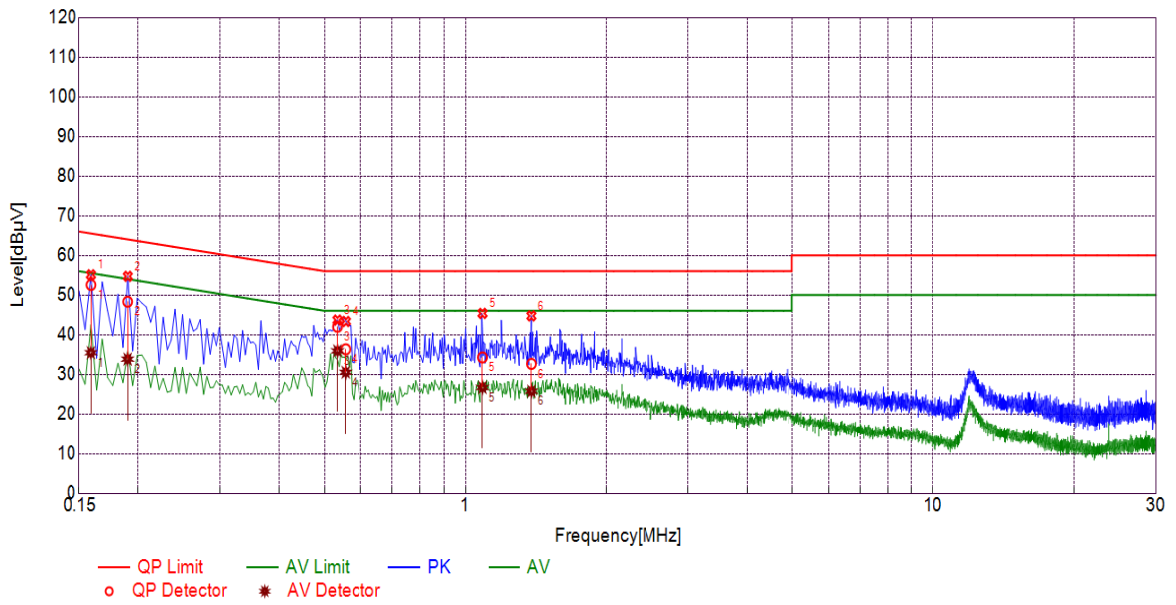
The measurement results are obtained as below:

$E\ [dB\mu V] = U_R + L_{Cable\ loss}\ [dB] + A_{Factor}$

U_R: Receiver Reading

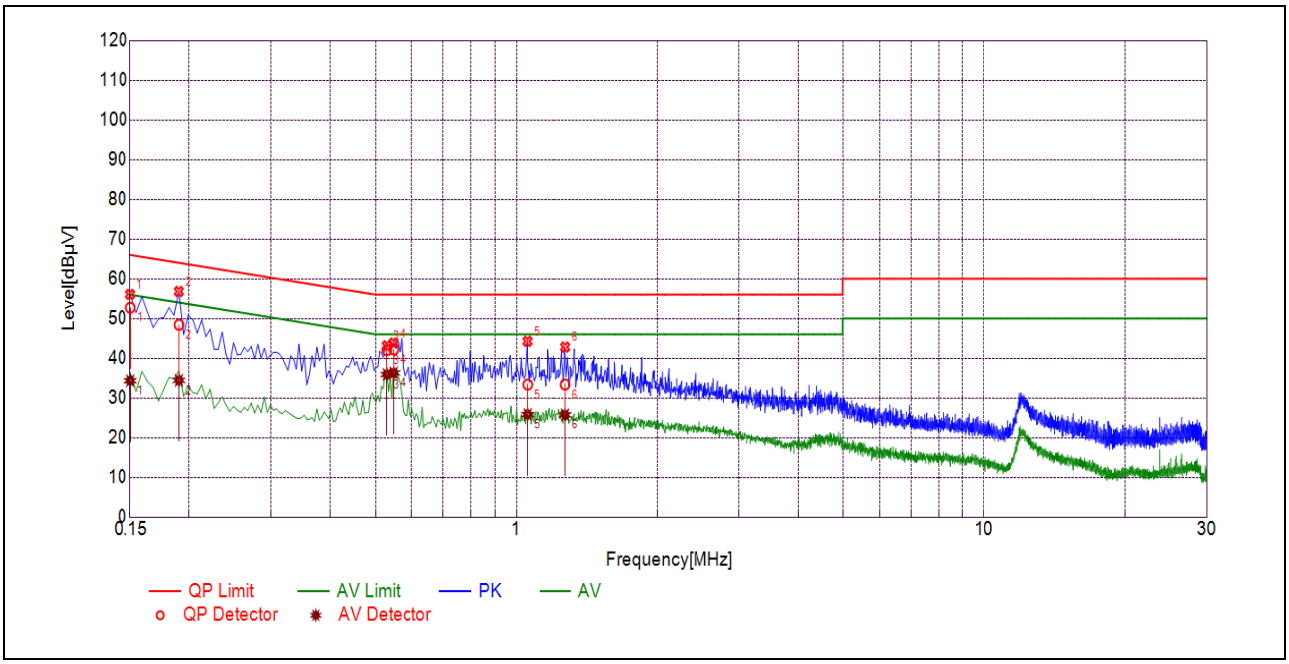
A_{Factor}: Voltage division factor of LISN

B. Test Plots:



(L Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1590	52.54	35.45	65.52	55.52	Line	PASS
2	0.1903	48.31	33.83	64.02	54.02		PASS
3	0.5324	41.99	35.91	56.00	46.00		PASS
4	0.5545	36.31	30.51	56.00	46.00		PASS
5	1.0855	34.27	26.68	56.00	46.00		PASS
6	1.3874	32.63	25.74	56.00	46.00		PASS



(N Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1501	52.71	34.33	66.00	56.00	Neutral	PASS
2	0.1906	48.42	34.41	64.01	54.01		PASS
3	0.5281	42.03	35.90	56.00	46.00		PASS
4	0.5465	42.19	36.29	56.00	46.00		PASS
5	1.0554	33.36	25.83	56.00	46.00		PASS
6	1.2741	33.39	25.74	56.00	46.00		PASS

2.12. Radiated Emission

2.12.1. Requirement

According to FCC section 15.247(d), radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).
According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Note:

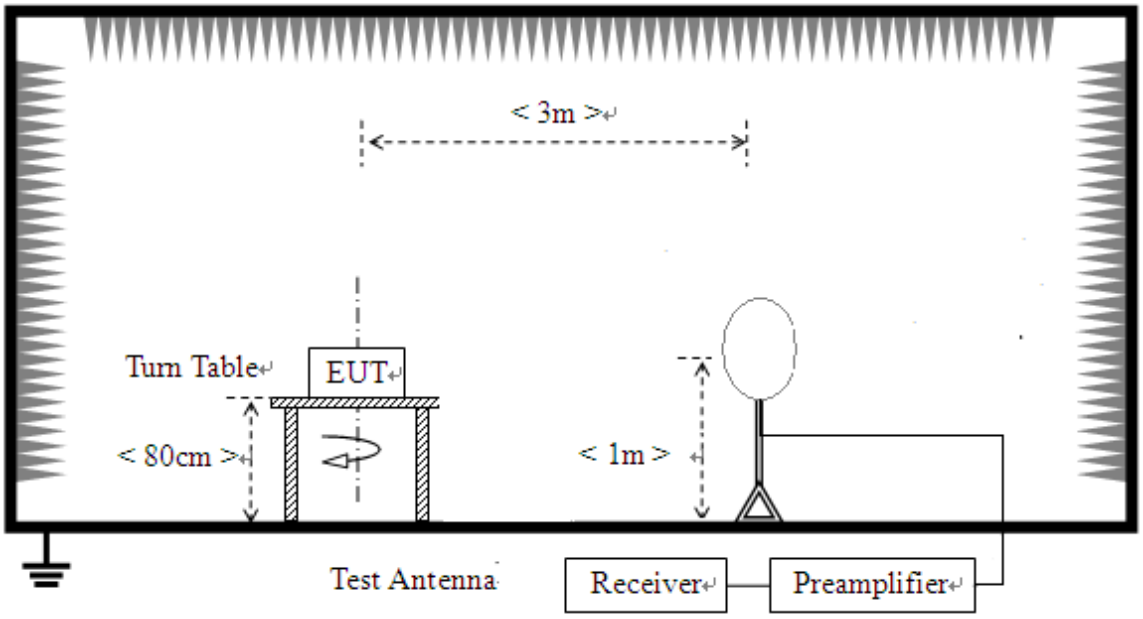
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK)

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

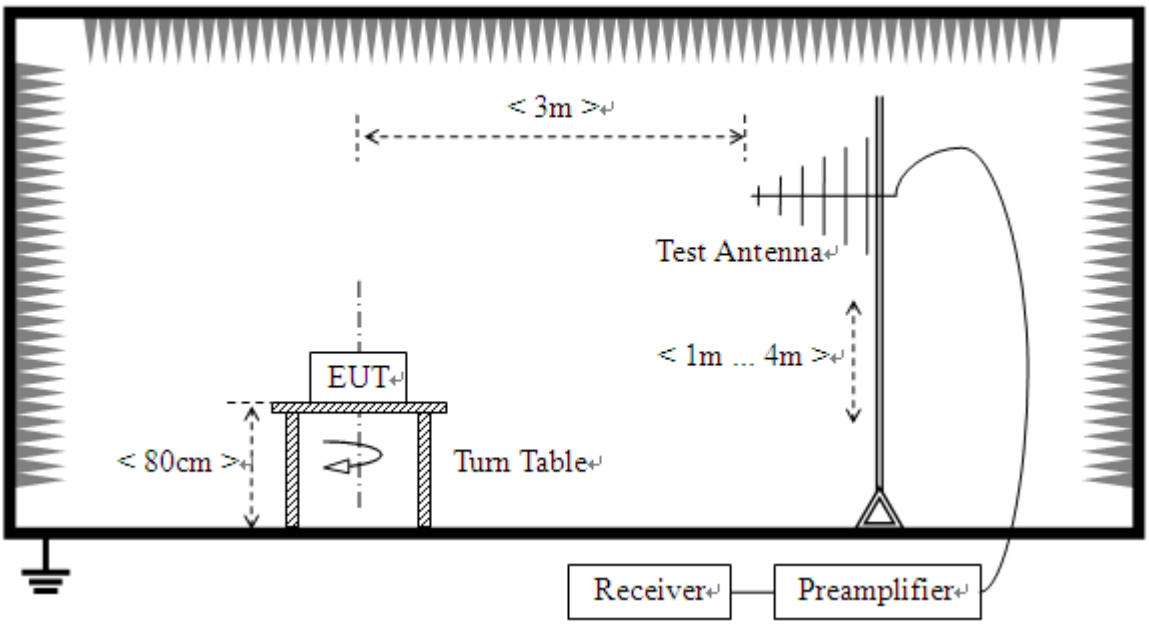
2.12.2. Test Description

Test Setup:

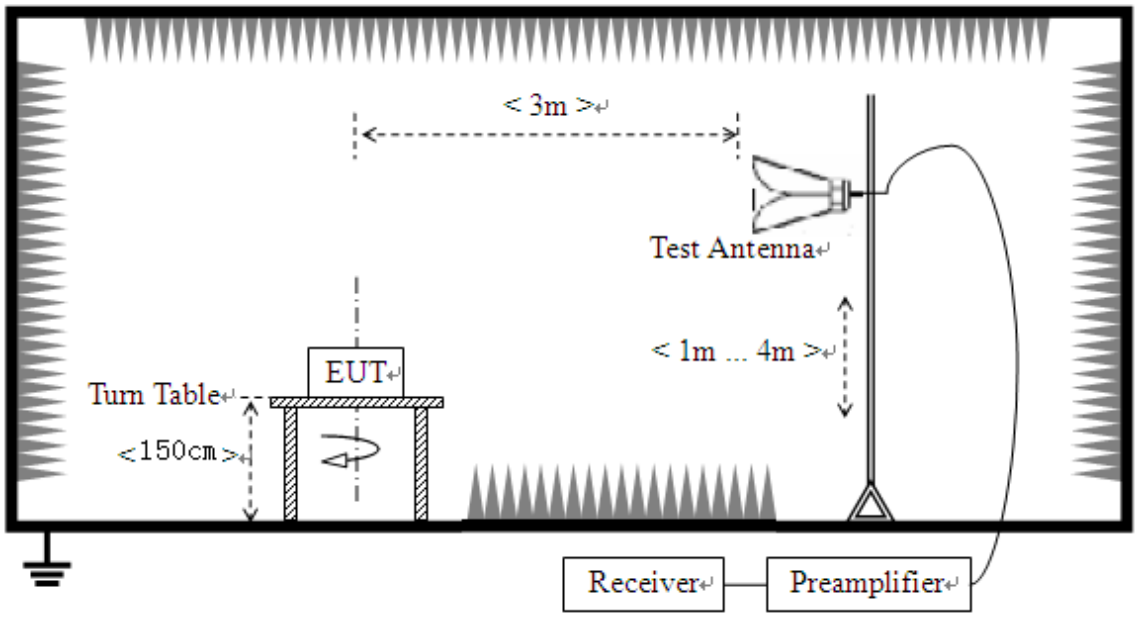
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The RF absorbing material used on the reference ground plane and on the turntable have a maximum height (thickness) of 30 cm (12 in) and have a minimum-rated attenuation of 20 dB at all frequencies from 1 GHz to 18 GHz.

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.10 (2013). For radiated emissions below or equal to 1GHz, the EUT was set-up on insulator 80cm above the Ground Plane, For radiated emissions above 1GHz, The EUT was set-up on insulator 150cm above the Ground Plane. The set-up and test methods were according to ANSI C63.10.

The EUT is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.

For the Test Antenna:

(a) In the frequency range of 9kHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
(b) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Place the test antenna at 3m away from area of the EUT, while keeping the test antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The test antenna may have to be

higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final test antenna elevation shall be that which maximizes the emissions. The test antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. The emission levels at both horizontal and vertical polarizations should be tested.

2.12.3. Test Procedure

Use the following spectrum analyzer settings:
Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

2.12.4. Test Result

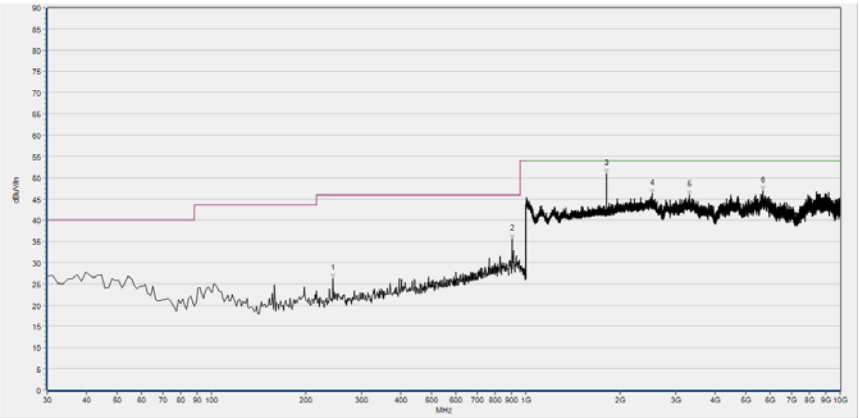
According to ANSI C63.10, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak limit, it is unnecessary to perform an quasi-peak measurement.

The measurement results are obtained as below:
E [dBμV/m] $=U_R + A_T + A_{Factor}$ [dB]; $A_T = L_{Cable\ loss}$ [dB]-G_{preamp} [dB]
A_T: Total correction Factor except Antenna
U_R: Receiver Reading
G_{preamp}: Preamplifier Gain
A_{Factor}: Antenna Factor at 3m

During the test, the total correction Factor AT and A_{Factor} were built in test software.

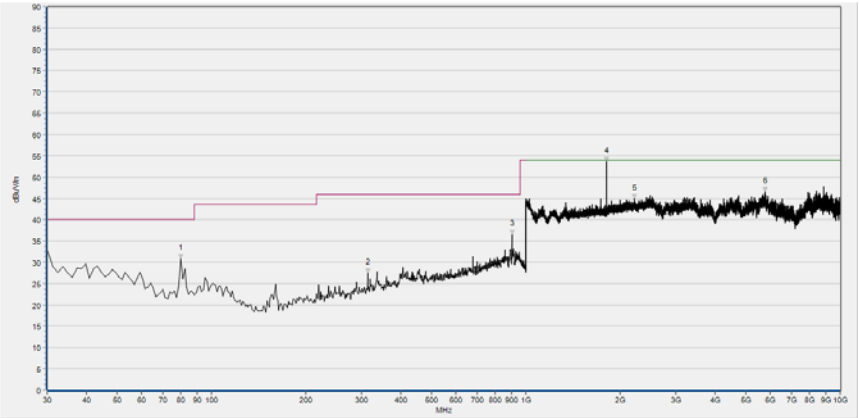
Note1: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.
Note2: For the frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

Plots for Channel = 1



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
243.667	26.24	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
902.879	35.53	N/A	N/A	N/A	46.00	N/A	Horizontal	N/A
1805.442	50.95	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2525.730	46.18	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3319.949	45.99	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5695.108	46.95	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

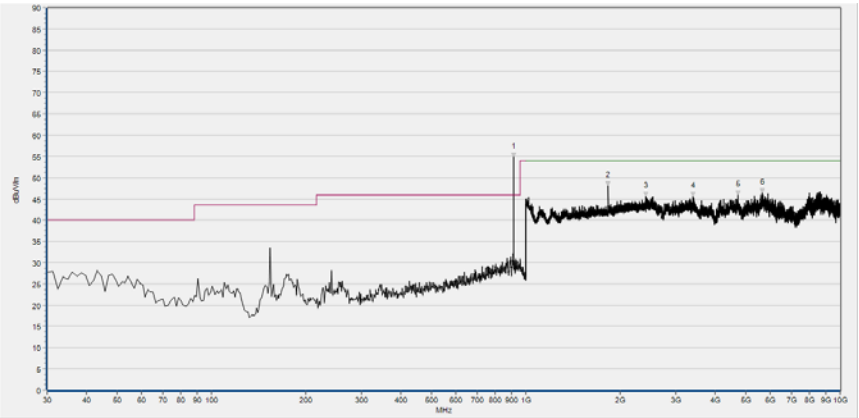
(Antenna Horizontal, 30MHz to 10GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
79.775	30.84	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
314.080	27.43	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
902.879	36.62	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1805.600	53.82	N/A	47.80	74.00	N/A	54.00	Vertical	PASS
2214.566	44.89	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5763.739	46.53	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

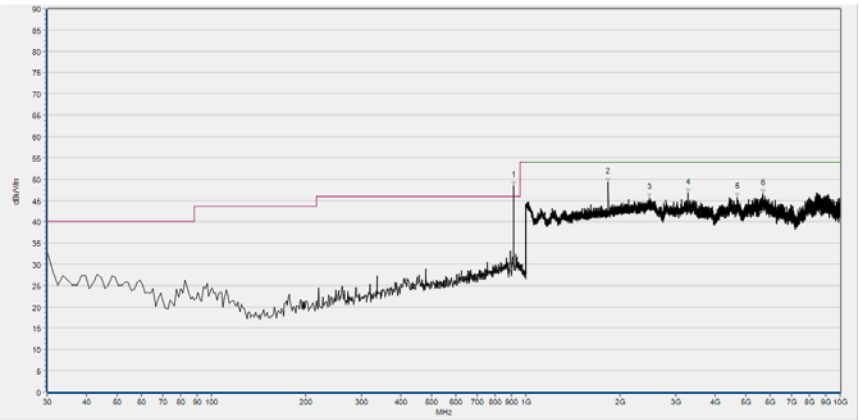
(Antenna Vertical, 30MHz to 10GHz)

Plots for Channel = 25



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
915.019	54.75	N/A	N/A	N/A	46.00	N/A	Horizontal	N/A
1829.132	48.11	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2409.204	45.55	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3400.691	45.55	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4731.588	45.86	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5645.317	46.43	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

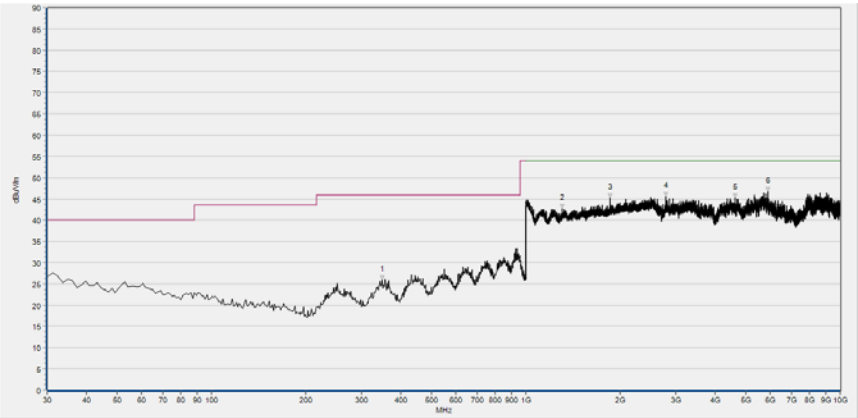
(Antenna Horizontal, 30MHz to 10GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
915.019	48.38	N/A	N/A	N/A	46.00	N/A	Vertical	N/A
1829.132	49.35	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2468.107	45.58	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3274.195	46.79	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4711.402	45.71	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5676.268	46.56	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

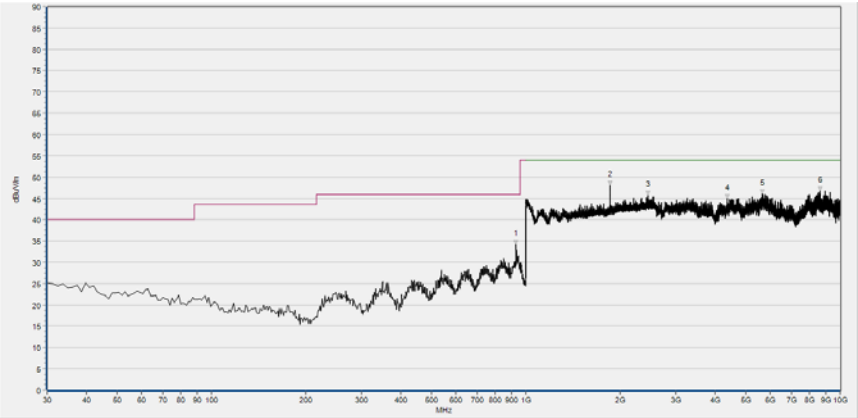
(Antenna Vertical, 30MHz to 10GHz)

Plots for Channel = 50



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
349.287	26.05	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1306.683	42.74	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
1853.461	45.30	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2791.089	45.57	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4640.080	45.21	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5880.815	46.68	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 10GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
930.801	34.17	N/A	N/A	N/A	46.00	N/A	Vertical	N/A
1853.461	48.15	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2450.180	45.74	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4373.632	44.87	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5662.811	46.16	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8639.498	46.73	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 10GHz)

Annex A Test Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for test performed on the EUT as specified in CISPR 16-1-2:

Test items	Uncertainty
Number of Hopping Frequency	±5%
Peak Output Power	±2.22dB
20dB Bandwidth	±5%
Carrier Frequency Separation	±5%
Time of Occupancy (Dwell time)	±5%
Conducted Spurious Emission	±2.77dB
Radiated Emission	±2.95dB
Conducted Emission	±2.44dB

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

Annex B Testing Laboratory Information

1. Identification of the Responsible Testing Laboratory

Laboratory Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Laboratory Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

2. Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

3. Facilities and Accreditations

All measurement facilities used to collect the measurement data are located at FL.3, Building A, FeiYang Science Park, Block 67, BaoAn District, Shenzhen, 518101 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.10-2013 and CISPR Publication 22; the FCC designation number is CN1192, the test firm registration number is 226174.

4. Test Equipments Utilized

4.1 Conducted Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Attenuator 1	(N/A.)	10dB	Resnet	N/A	N/A
EXA Signal Analzyer	MY53470836	N9010A	Agilent	2019.04.09	2020.04.08
RF cable (30MHz-26GHz)	CB01	RF01	Morlab	N/A	N/A
Coaxial cable	CB02	RF02	Morlab	N/A	N/A
SMA connector	CN01	RF03	HUBER-SUHNER	N/A	N/A
Computer	T430i	Think Pad	Lenovo	N/A	N/A

4.2 Conducted Emission Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY56400093	N9038A	KEYSIGHT	2019.05.08	2020.05.09
LISN	812744	NSLK 8127	Schwarzbeck	2019.05.08	2020.05.09
Pulse Limiter (20dB)	9391	VTSD 9561-D	Schwarzbeck	2019.05.08	2020.05.09
Coaxial cable(BNC) (30MHz-26GHz)	CB01	EMC01	Morlab	N/A	N/A
display	6007712	KDL-24EX 520	SONY	N/A	N/A
mouse	Q/ZY 1-2006	OP-220	ShuangFeiYan	N/A	N/A

4.3 List of Software Used

Description	Manufacturer	Software Version
Test system	Tonscend	V2.6
Power Panel	Agilent	V3.8
MORLAB EMCR V1.2	MORLAB	V1.0

4.4 Radiated Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY54130016	N9038A	Agilent	2019.07.26	2020.07.25
Test Antenna - Bi-Log	9163-520	VULB 9163	Schwarzbeck	2019.05.08	2020.05.09
Test Antenna - Loop	1520-022	FMZB1520	Schwarzbeck	2019.02.15	2020.02.14
Test Antenna – Horn	01774	BBHA 9120D	Schwarzbeck	2019.07.26	2020.07.25
Test Antenna – Horn	BBHA9170 #774	BBHA9170	Schwarzbeck	2019.07.26	2020.07.25
Coaxial cable (N male) (9KHz-30MHz)	CB04	EMC04	Morlab	N/A	N/A
Coaxial cable (N male) (30MHz-26GHz)	CB02	EMC02	Morlab	N/A	N/A
Coaxial cable (N male) (30MHz-26GHz)	CB03	EMC03	Morlab	N/A	N/A
1-18GHz pre-Amplifier	MA02	TS-PR18	Rohde& Schwarz	2019.05.08	2020.05.09
18-26.5GHz pre-Amplifier	MA03	TS-PR18	Rohde& Schwarz	2019.05.08	2020.05.09
Notch Filter	N/A	WRCG-2400-2483.5-60SS	Wainwright	2019.12.01	2020.11.30
Anechoic Chamber	N/A	9m*6m*6m	CRT	2017.11.19	2020.11.18

END OF REPORT