RF Test Report

Applicant	:	Arizon RFID Technology
Product Name	:	Fixed UHF RFID Reader
Trade Name	:	ARIZON
Model Number	:	AL-820
Applicable Standard	:	FCC 47 CFR PART 15 SUBPART C ANSI C63.10:2013
Received Date	:	Jan. 03, 2024
Test Period	:	Sep. 05, 2024 ~ Sep. 18, 2024
Issued Date	:	Jan. 03, 2025

Issued by

Eurofins E&E Wireless Taiwan Co., Ltd.
No. 140-1, Changan Street, Bade District,
Taoyuan City 334025, Taiwan (R.O.C.)
Tel：+886-3-2710188 / Fax：+886-3-2710190

Testing Laboratory
1330

Taiwan Accreditation Foundation accreditation number: 1330
Frequency Range: 9 kHz to 325 GHz
Bade test site：
Test Firm Registration Number: 226252
Test Firm Designation Number: TW0010
Wugu test site：
Test Firm Registration Number: 191812
Test Firm Designation Number: TW0034

Note:
1.The test results are valid only for samples provided by customers and under the test conditions described in this report.
2.This report shall not be reproduced except in full, without the written approval of Eurofins E&E Wireless Taiwan Co., Ltd.
3.The relevant information is provided by customers in this test report. According to the correctness, appropriateness or completeness of the information provided by the customer, if there is any doubt or error in the information which affects the validity of the test results, the laboratory does not take the responsibility.

Revision History

Rev.	Issued Date	Description	Revised by
00	Nov. 04, 2024	Initial Issue	Snow Wang
01	Jan. 03, 2025	Update Product Name and Applicant address Update chapter 5.3 (P.35/36)	Snow Wang

Verification of Compliance

Applicant	:	Arizon RFID Technology
Product Name	:	Fixed UHF RFID Reader
Trade Name	:	ARIZON
Model Number	:	AL-820
FCC ID	:	2BFT5-AL-820
Applicable Standard	:	FCC 47 CFR PART 15 SUBPART C ANSI C63.10:2013
Test Result	:	Complied
Performing Lab.	:	Eurofins E&E Wireless Taiwan Co., Ltd. No. 140-1, Changan Street, Bade District, Taoyuan City 334025, Taiwan (R.O.C.) Tel：+886-3-2710188 / Fax：+886-3-2710190 Taiwan Accreditation Foundation accreditation number: 1330

Testing Laboratory 1330

Eurofins E&E Wireless Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Eurofins E&E Wireless Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Approved By : Kai Yu Yang

TABLE OF CONTENTS

1 General Information

1.1. Summary of Test Result

Standard	Item	Result	Remark
15.207	AC Power Conducted Emission	PASS	-----
15.203	Antenna Requirement	PASS	-----
15.247(b)(2)	Max. Output Power	PASS	-----
15.247(d)	Transmitter Radiated Emissions	PASS	-----
15.247(a)(1)(i)	20 dB RF Bandwidth	PASS	-----
15.247(a)(1)	Carrier Frequency Separation	PASS	-----
15.247(a)(1)(i)	Number of Hopping	PASS	-----
15.247(a)(1)(i)	Time of Occupancy (Dwell Time)	PASS	-----
15.247(d)	Out of Band Conducted Spurious Emission	PASS	-----

Note : This equipment is class A. The test result refer to the Part 15B report.

Standard	Description
CFR47, Part 15, Subpart C	Intentional Radiators
ANSI C63. 10: 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

Decision Rule

■ Uncertainty is not included.

□ Uncertainty is included.

1.2. Testing Location

Lab Name: Eurofins E&E Wireless Taiwan Co., Ltd.

Site Address: ☐ No. 140-1, Changan Street, Bade District, Taoyuan City 334025, Taiwan (R.O.C.)

Site Address: ■ No. 2, Wuquan 5th Rd. Wugu Dist., New Taipei City, Taiwan (R.O.C.)

1.3. Measurement Uncertainty

Test Item	Frequency	Uncertainty	
		BD	WG
Conducted Emission	150 kHz ~ 30 MHz	2.7 dB	2.6 dB
Conducted Output Power		1.1 dB	1.1 dB
RF Bandwidth		4.5 %	4.5 %
Power Spectral Density		1.1 dB	1.1 dB

Test Item	Frequency	Uncertainty				
		96601-BD	96603-BD	96602-WG	96603-WG	96604-WG
Radiated Emission	9 kHz ~ 30 MHz	1.8 dB	1.8 dB	1.9 dB	1.9 dB	1.9 dB
	30 MHz ~ 1000 MHz	4.7 dB	4.7 dB	4.7 dB	4.7 dB	4.5 dB
	1000 MHz ~ 18000 MHz	4.7 dB	4.8 dB	4.6 dB	4.7 dB	5.1 dB
	18000 MHz ~ 26500 MHz	4.0 dB	4.1 dB	3.9 dB	4.1 dB	4.3 dB
	26500 MHz ~ 40000 MHz	4.2 dB	4.2 dB	4.2 dB	4.2 dB	4.6 dB

1.4. Test Site Environment

Items	Required (IEC 60068-1)	Interval(*)
Temperature (°C)	15-35	20-30
Humidity (%RH)	25-75	45-75

(*)The measurement ambient temperature is within this range.

2 EUT Description

The product specifications of the EUT presented in the report are declared by the manufacturer who shall take full responsibility for the authenticity(except Max. RF Output Power).

Applicant	Arizon RFID Technology 17F, No. 51, Sec.2, Chung-Ching South Rd., Taipei City 100, Taiwan	
Product Name	Fixed UHF RFID Reader	
Trade Name	ARIZON	
Model Number	AL-820	
FCC ID	2BFT5-AL-820	
Frequency Range	902.75 ~ 927.25 MHz	
Modulation Type	ASK	
Operate Temp. Range	-20 ~ +55 ℃	
EUT Power Rating	DC 24 V,1.2 A	
Antenna information	Type	Max. Gain (dBi)
	Panel RHCP Antenna	8.51
Max. RF Output Power	0.09817 W	

3 Test Methodology

3.1. Mode of Operation

Decision of Test Eurofins has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Pre-Test Mode
Continuous TX mode

After verification, all tests were carried out with the worst case test modes.

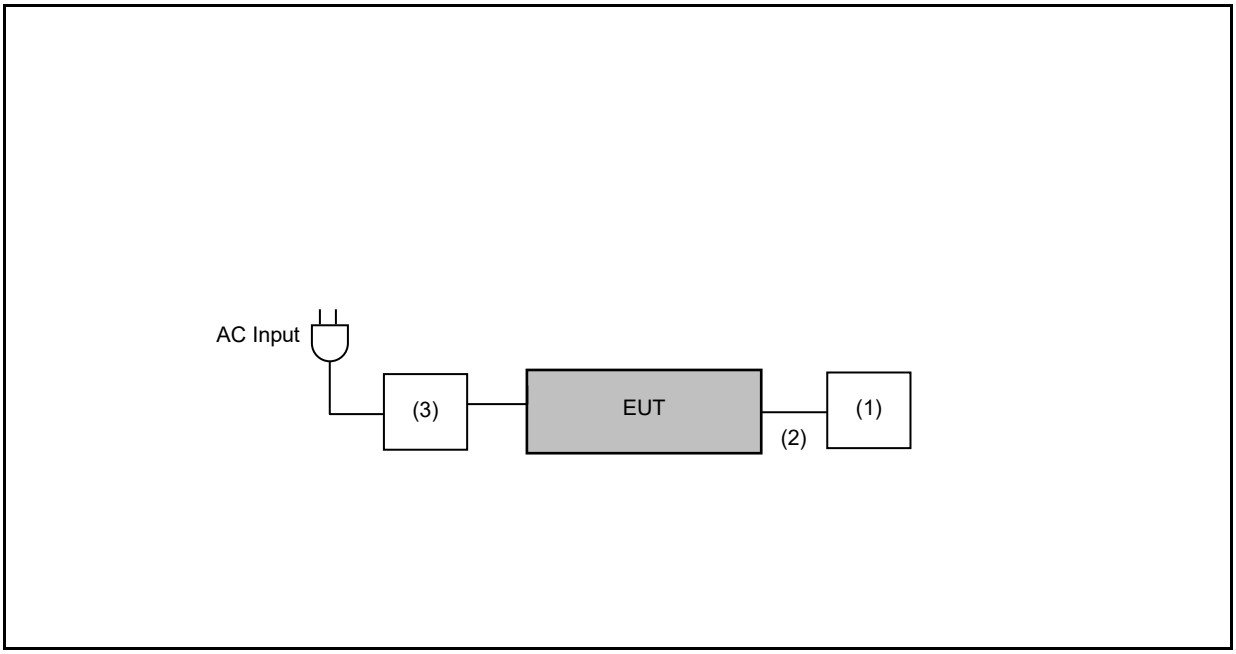
By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “X axis” position was the worst, then the final test was executed the worst condition and test data were recorded in this report.

3.2. EUT Test Step

1	Setup the EUT shown on “Configuration of Test System Details”.
2	Turn on the power of all equipment.
3	Turn on TX function.
4	EUT run test program.

3.3. Configuration of Test System Details

Radiated Emissions



Devices Description					
Product		Manufacturer	Model Number	Serial Number	Power Cord
(1)	Notebook	ASUS	X542U	---	---
(2)	Lan Cable	Urban Inspiration	UTP CAT.5e TIA/EIA	---	---
(3)	Adapter	CWT	KPL-040M-VI	---	---

3.4. Test Instruments

For Radiated Emissions
Test Period: September 12, 2024 ~ Sep. 16, 2024
Testing Engineer: Marin Lee

Radiation test sites		Semi Anechoic Room 96602-WG				
Use	Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
☒	LOOP Antenna (9 kHz~30 MHz)	Schwarzbeck Mess-Elektronik	FMZB 1513-60	1513-60-031	Feb. 23, 2024	1 year
☒	Trilog Broadband Antenna (30 MHz~1 GHz)	Schwarzbeck Mess-Elektronik	VULB9168	01276	Feb. 02, 2024	1 year
☒	Broadband Horn Antenna (1 GHz~18 GHz)	RF SPIN	DRH18-E	210305A18ES	Feb. 22, 2024	1 year
☒	Broadband Horn Antenna (15 GHz~40 GHz)	Schwarzbeck Mess-Elektronik	BBHA9170	01133	Jan. 18, 2024	1 year
☒	Spectrum Analyzer (10 Hz~44 GHz)	KEYSIGHT	N9020B	MY60112362	Jan. 29, 2024	1 year
☒	Pre-Amplifier	Agilent	8447D	2944A10961	Jul. 9, 2024	1 year
☒	Pre-Amplifier	EMCI	EMC0518A45SE	980876	Jan. 31, 2024	1 year
☒	Pre-Amplifier	EMCI	EMC184045SE	980861	Dec. 21, 2023	1 year
☒	Coaxial Cable (9 kHz~1000 MHz)	EMCI	EMCCFD400-NM-NM-2000	211006	Nov. 13, 2023	1 year
☒	Coaxial Cable (9 kHz~1000 MHz)	EMCI	EMCCFD400-NM-NM-2000	211007	Nov. 13, 2023	1 year
☒	Coaxial Cable (9 kHz~1000 MHz)	EMCI	EMCCFD400-NM-NM-6000	211015	Nov. 13, 2023	1 year
☒	Coaxial Cable (1 GHz~18 GHz)	EMCI	EMC104-SM-SM-1000	211026	Nov. 13, 2023	1 year
☒	Coaxial Cable (1 GHz~18 GHz)	EMCI	EMC104-SM-SM-2000	211035	Nov. 13, 2023	1 year
☒	Coaxial Cable (1 GHz~18 GHz)	EMCI	EMC104-SM-SM-8000	211036	Nov. 13, 2023	1 year
☒	Coaxial Cable (18 GHz~40 GHz)	EMCI	EMC101G-KM-KM-600	211211	Jan. 16, 2024	1 year
☒	Coaxial Cable (18 GHz~40 GHz)	EMCI	EMC101G-KM-KM-2000	211210	Jan. 16, 2024	1 year
☒	Coaxial Cable (18 GHz~40 GHz)	EMCI	EMC101G-KM-KM-6000	211209	Jan. 16, 2024	1 year
☒	Highpass Filter	Warison	STI15-9796	001	Nov. 13, 2023	1 year
☒	Software	R_RAM	V1.3	N/A	N.C.R.	---

Note: N.C.R. = No Calibration Request

For Conduction Emissions
Test Period: September 16, 2024
Testing Engineer: Marin Lee

Radiation test sites		Conducted Emission Measurement Conduction01-WG				
Use	Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
☒	Test Receiver	R&S	ESR3	102919	Nov 30, 2023	1 year
☒	LISN	R&S	ENV216	101041	Apr 8, 2024	1 year
☒	Cable	EMCI	EMCCFD300-BM-NM-4000	220402	Jun 12, 2024	1 year
☒	Software	ELEKTRA	94.50.4	N.A.	N.C.R.	N.C.R.

For Conducted
Test Period: Sep. 05 ,2024 ~ Sep. 10, 2024
Testing Engineer: Sandy Yang

Test Site		RF03-WG				
Use	Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
☒	Power Sensor	Anritsu	MA24418A	12662	Dec. 01, 2023	1 year
☒	Spectrum Analyzer (10 Hz~26.5 GHz)	Keysight	N9010B	MY63460164	Mar. 08, 2024	1 year

Note: N.C.R. = No Calibration Request.

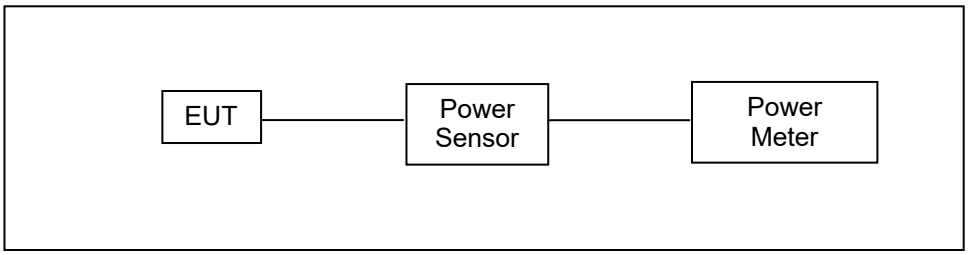
4 Measurement Procedure

4.1. Maximum Conducted Output Power Measurement

■ **Limit**

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

■ **Test Setup**



■ **Test Procedure**

Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems. This is the only method recognized by the FCC. The tests below are run with the EUT's transmitter set at high power in Transmit mode. The EUT is needed to force selection of output power level and channel number. While testing, EUT was set to transmit continuously. Remove the Subjective device's antenna and connect the RF output port to power sensor. The maximum peak output power shall not exceed 1 watt.

Use a direct connection between the antenna port of transmitter and the power sensor, for prevent the power sensor input attenuation 40-50 dB. Set the RBW Bandwidth of the emission or use a channel power meter mode.

For antennas with gains of 6 dBi or less, maximum allowed transmitter output is 1 watt (+30 dBm). For antennas with gains greater than 6 dBi, transmitter output level must be decreased by an amount equal to (GAIN - 6)/3 dBm.

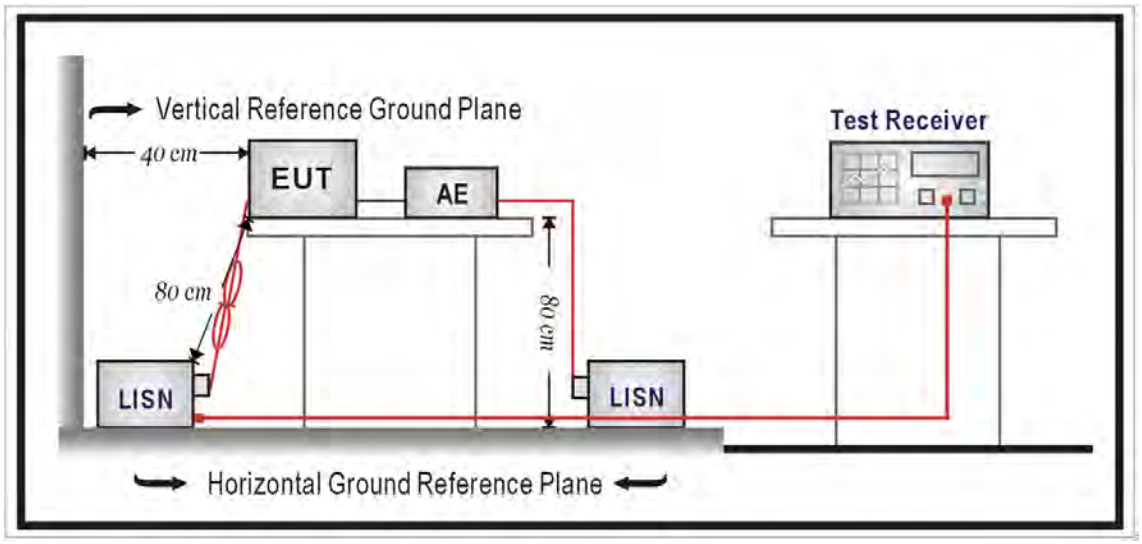
The antenna port of the EUT was connected to the input of a power sensor. Power was read directly and cable loss correction was added to the reading to obtain power at the EUT antenna terminals.

4.2. AC Power Line Conducted Emission Measurement

■ **Limit**

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

■ **Test Setup**



■ **Test Procedure**

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 Ω// 50 uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50 Ω// 50 uH coupling impedance with 50 ohm termination.

Tabletop device shall be placed on a non-conducting platform, of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The wall of screened room shall be located 40 cm to the rear of the EUT. Other surfaces of tabletop or floor standing EUT shall be at least 80 cm from any other ground conducting surface including one or more LISNs. For floor-standing device shall be placed under the EUT with a 12 mm insulating material.

Conducted emissions were investigated over the frequency range from 0.15 MHz to 30 MHz using a resolution bandwidth of 9 kHz. The equipment under test (EUT) shall be meet the limits in section 4.1, as applicable, including the average limit and the quasi-peak limit when using respectively, an average detector and quasi-peak detector measured in accordance with the methods described of related standard. When all of peak value were complied with quasi-peak and average limit from 150 kHz to 30 MHz then quasi-peak and average measurement was unnecessary.

The AMN shall be placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for AMNs mounted on top of the ground reference plane. This distance is between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment shall be at least 0.8 m from the AMN. If the mains power cable is longer than 1 m then the cable shall be folded back and forth at the centre of the lead to form a bundle no longer than 0.4 m. All of interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long. All of EUT and AE shall be separate place more than 0.1 m. All 50 Ω ports of the LISN shall be resistively terminated into 50 Ω loads when not connected to the measuring instrument.

If the reading of the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 s at each measurement frequency; the higher reading shall be recorded with the exception of any brief isolated high reading which shall be ignored.

4.3. Radiated Emission Measurement

■ **Limit**

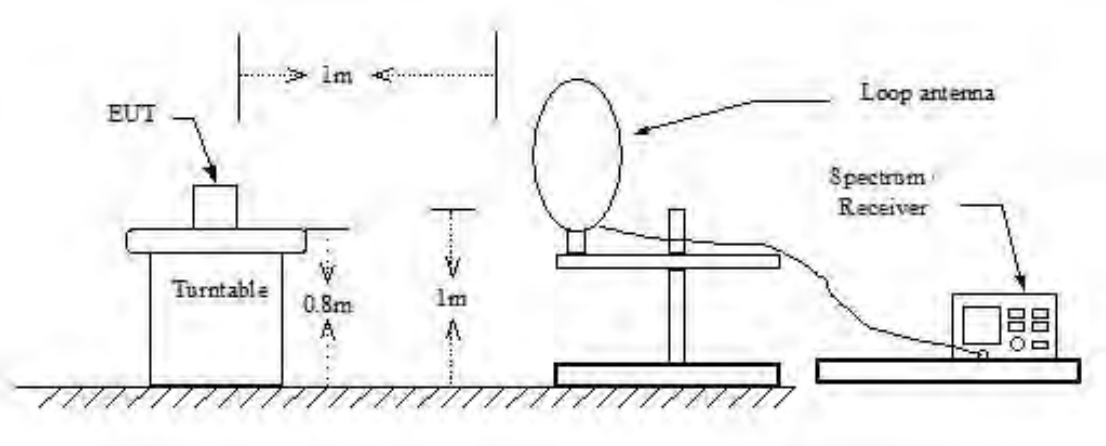
According to §15.209(a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m at 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

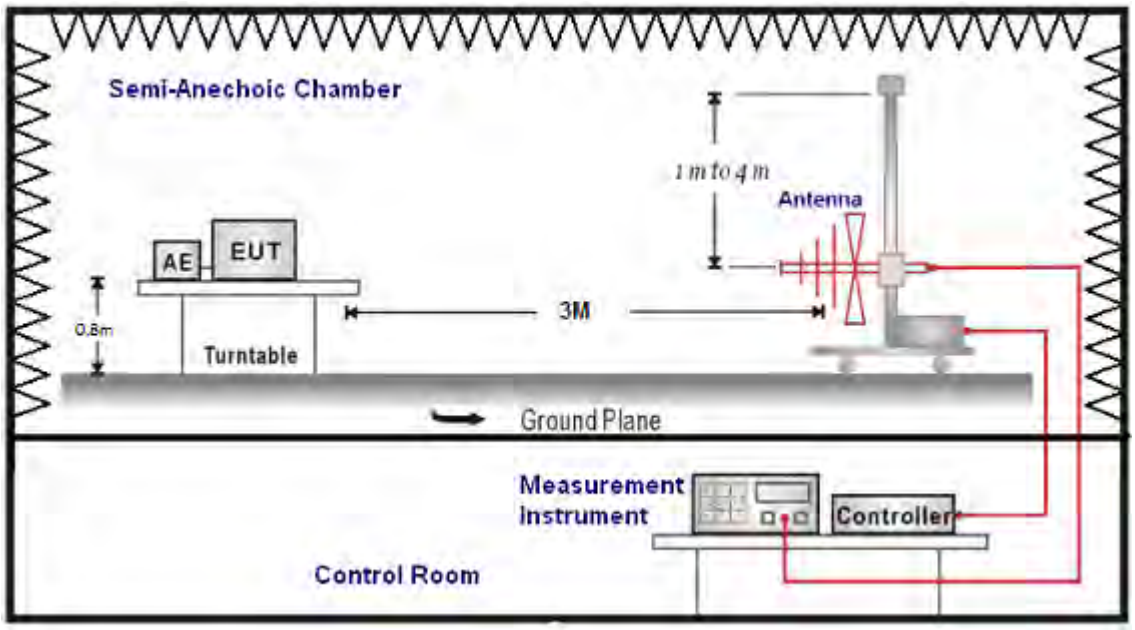
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

■ **Setup**

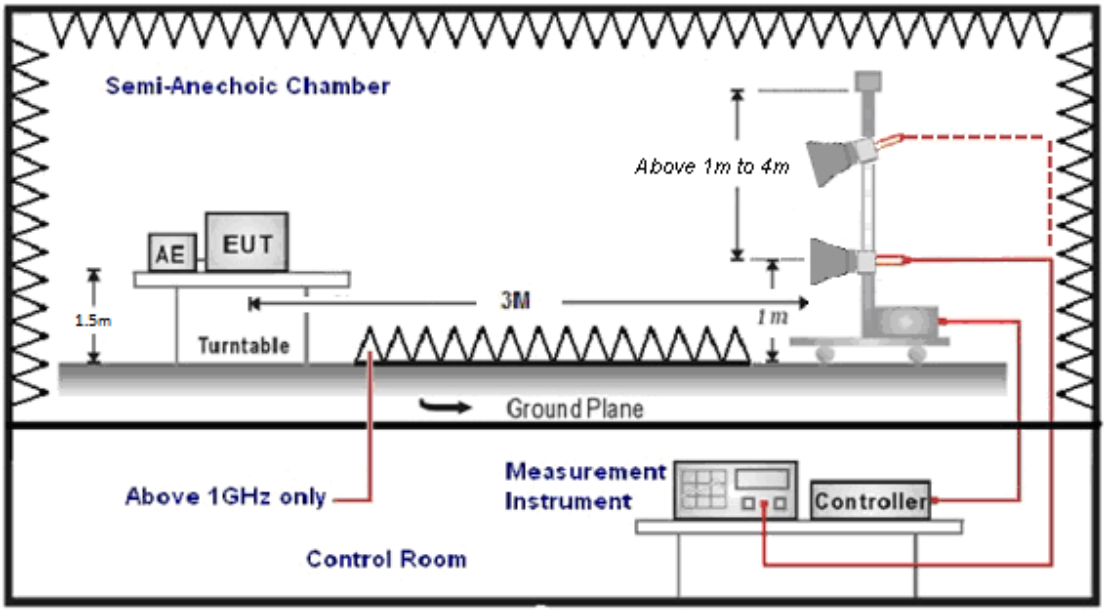
9 kHz ~ 30 MHz



Below 1 GHz



Above 1 GHz



■ **Test Procedure**

Final radiation measurements were made on a three-meter, Semi Anechoic Chamber. The EUT system was placed on a nonconductive turntable which is 0.8 or 1.5 meters height, top surface 1.0 x 1.5 meter. The spectrum was examined from 250 MHz to 2.5 GHz in order to cover the whole spectrum below 10th harmonic which could generate from the EUT. During the test, EUT was set to transmit continuously & Measurements spectrum range from 9 kHz to 26.5 GHz is investigated.

For measurements below 30 MHz the resolution bandwidth is set to 10 kHz for peak detection measurements or 9 kHz for quasi-peak detection measurements. The video bandwidth is 3 times of the resolution bandwidth.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 3 MHz for peak measurements and 10 Hz for average measurements when Duty cycle >98 % / 1/T for average measurements when Duty cycle <98 %. A nonconductive material surrounded the EUT to supporting the EUT for standing on tree orthogonal planes. At each condition, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization.

SCHWARZBECK MESS-ELEKTRONIK Biconilog Antenna at 3 Meter and the SCHWARZBECK Double Ridged Guide Antenna was used in frequencies 1 – 26.5 GHz at a distance of 1 meter. All test results were extrapolated to equivalent signal at 3 meters utilizing an inverse linear distance extrapolation Factor (20 dB/decade).

For testing above 1 GHz, the emission level of the EUT in peak mode was 20 dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. No post – detector video filters were used in the test.

The spectrum analyzer's 6 dB bandwidth was set to 1 MHz, and the analyzer was operated in the peak detection mode, for frequencies both below and up 1 GHz. The average levels were obtained by subtracting the duty cycle correction factor from the peak readings.

The following procedures were used to convert the emission levels measured in decibels referenced to 1 microvolt (dBuV) into field intensity in micro volts pre meter (uV/m).

The actual field intensity in decibels referenced to 1 microvolt in to field intensity in micro colts per meter (dBuV/m).

The actual field is intensity in referenced to 1 microvolt per meter (dBuV/m) is determined by algebraically adding the measured reading in dBuV, the antenna factor (dB), and cable loss (dB) and Subtracting the gain of preamplifier (dB) is auto calculate in spectrum analyzer.

(1) Amplitude (dBuV/m) = FI (dBuV) +AF (dBuV) +CL (dBuV)-Gain (dB)
FI= Reading of the field intensity.
AF= Antenna factor.
CL= Cable loss.
P.S Amplitude is auto calculate in spectrum analyzer.

(2) Actual Amplitude (dBuV/m) = Amplitude (dBuV)-Dis(dB)
The FCC specified emission limits were calculated according the EUT operating frequency and by following linear interpolation equations:
(a) For fundamental frequency : Transmitter Output < +30 dBm
(b) For spurious frequency : Spurious emission limits = fundamental emission limit /10

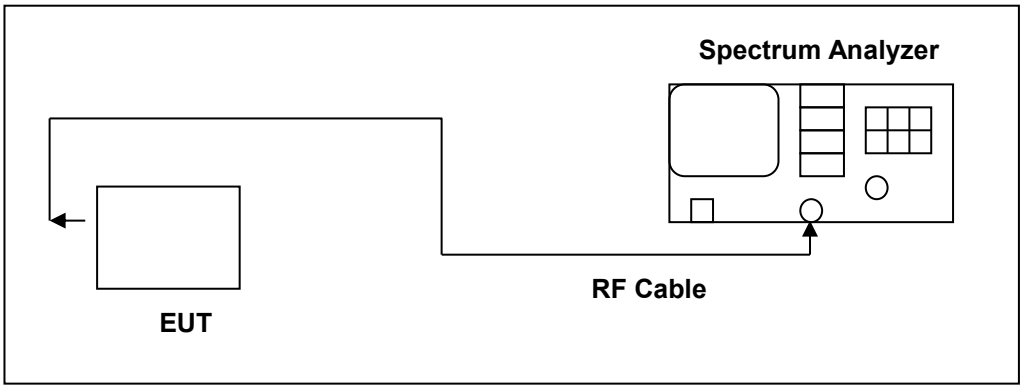
Data of measurement within this frequency range without mark in the table above means the reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.

4.4. 20 dB RF Bandwidth Measurement

■ **Limit**

N/A

■ **Test Setup**



■ **Test Procedure**

20 dB RF Bandwidth

1. Span = approx. 2 to 3 times the 20 dB bandwidth, centered on a hopping frequency
2. RBW ≥ 1 % of the 20 dB span
3. VBW ≥ RBW
4. Sweep = auto
5. Detector function = peak
6. Trace = max hold

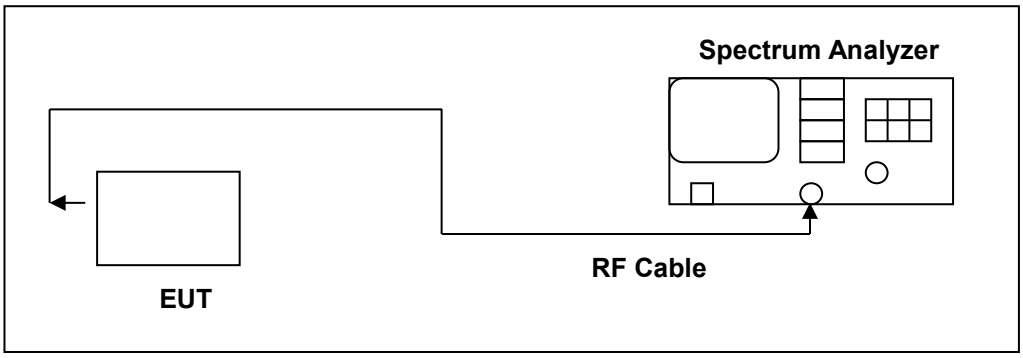
The trace was allowed to stabilize. The EUT was transmitting at its maximum data rate. The marker-to-peak function was used to set the marker to the peak of the emission. The marker-delta function was used to measure 20 dB down one side of the emission. The marker-delta function and marker was moved to the other side of the emission until it was even with the reference marker. The marker-delta reading at this point was the 20 dB bandwidth of the emission.

4.5. Carrier Frequency Separation Measurement

■ Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

■ Test Setup



■ Test Procedure

Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems. This is the only method recognized by the FCC. The RF output port of the Equipment-Under-Test is directly coupled to the input of the EMC analyzer through a specialized RF connector and a 10 dB passive attenuator. A fully charged battery was used for the supply voltage. The Bluetooth frequency hopping function of the EUT was enabled. The following spectrum analyzer settings were used:

1. Span = wide enough to capture the peaks of two adjacent channels
2. Resolution (or IF) Bandwidth (RBW) ≥ 1 % of the span
3. Video (or Average) Bandwidth (VBW) ≥ RBW
4. Sweep = auto
5. Detector function = peak
6. Trace = max hold

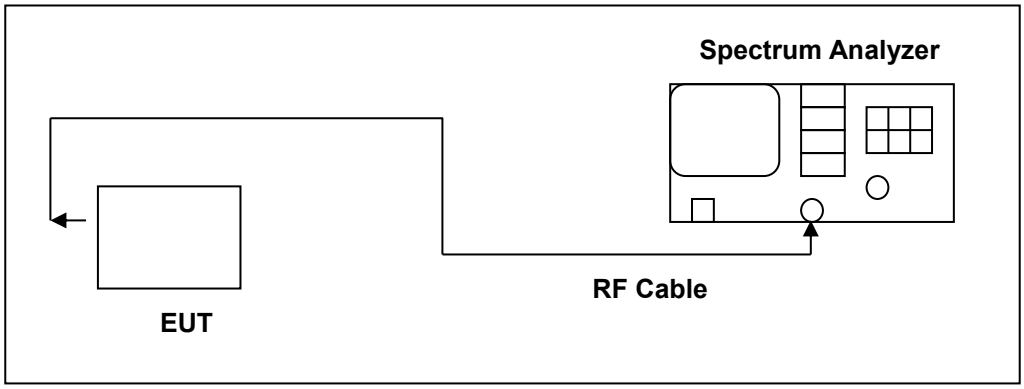
The trace was allowed to stabilize. The marker-delta function was used to determine the separation between the peaks of the adjacent channels.

4.6. Number of Hopping Measurement

■ **Limit**

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

■ **Test Setup**



■ **Test Procedure**

Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems. This is the only method recognized by the FCC. The RF output port of the Equipment-Under-Test is directly coupled to the input of the EMC analyzer through a specialized RF connector and a 10 dB passive attenuator. A fully charged battery was used for the supply voltage. The Bluetooth frequency hopping function of the EUT was enabled. The spectrum analyzer used the following settings:

1. Span = the frequency band of operation
2. RBW ≥ 1 % of the span
3. VBW ≥ RBW
4. Sweep = auto
5. Detector function = peak
6. Trace = max hold

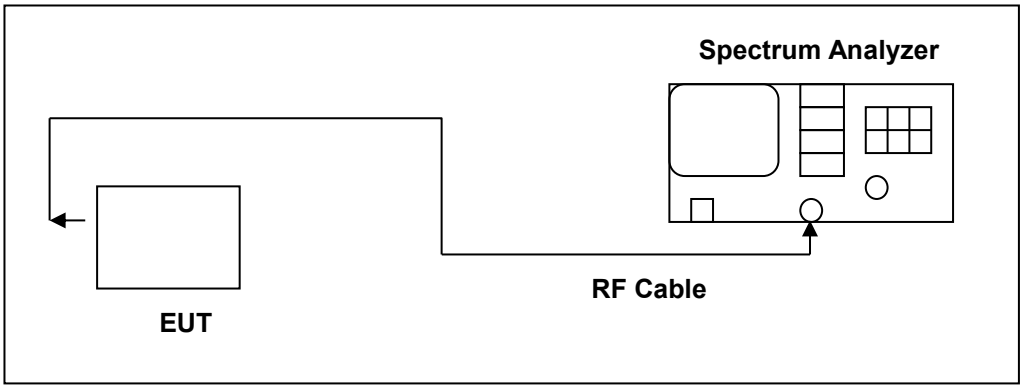
The trace was allowed to stabilize.

4.7. Time of Occupancy (Dwell Time) Measurement

■ Limit

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

■ Test Setup



■ Test Procedure

Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems. This is the only method recognized by the FCC. The RF output port of the Equipment-Under-Test is directly coupled to the input of the spectrum through a specialized RF connector and a 10 dB passive attenuator. A fully charged battery was used for the supply voltage. The Bluetooth hopping function of the EUT was enabled. The following spectrum analyzer settings were used:

1. Span = zero span, centered on a hopping channel
2. RBW = 1 MHz
3. VBW $\geq$ RBW
4. Sweep = as necessary to capture the entire dwell time per hopping channel
5. Detector function = peak
6. Trace = max hold

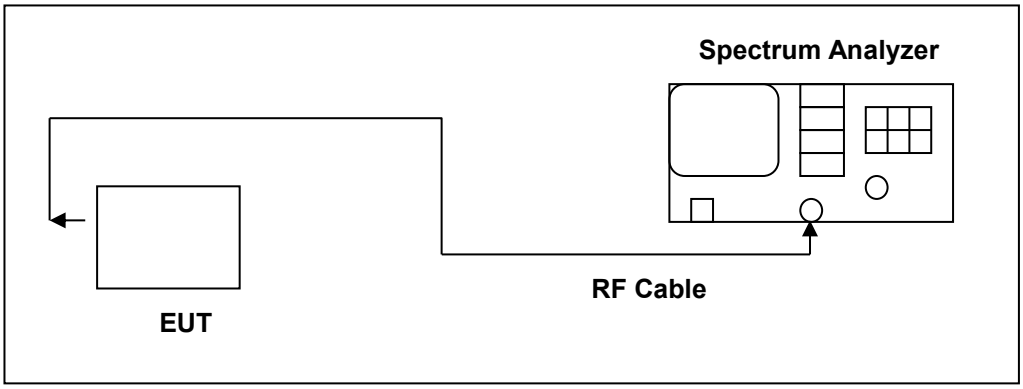
The marker-delta function was used to determine the dwell time.

4.8. Out of Band Conducted Emissions Measurement

■ Limit

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

■ Test Setup



■ Test Procedure

Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems. This is the only method recognized by the FCC. In any 100 kHz bandwidth outside the EUT pass band, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20 dB below that of the maximum in-band 100 kHz emission, antenna output of the EUT was coupled directly to spectrum analyzer; if an external attenuator and/or cable was used, these losses are compensated for with the analyzer OFFSET function.

All other types of emissions from the EUT shall meet the general limits for radiated frequencies outside the pass band.

4.9. Antenna Measurement

■ Limit

For intentional device, according to 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.

And According to 15.247 (b)(4), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

■ Antenna Connector Construction

See section 2 – antenna information.

4.10. Other requirements

■ **System Receiver Input Bandwidth**

Each channel bandwidth is 100 kHz.

The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

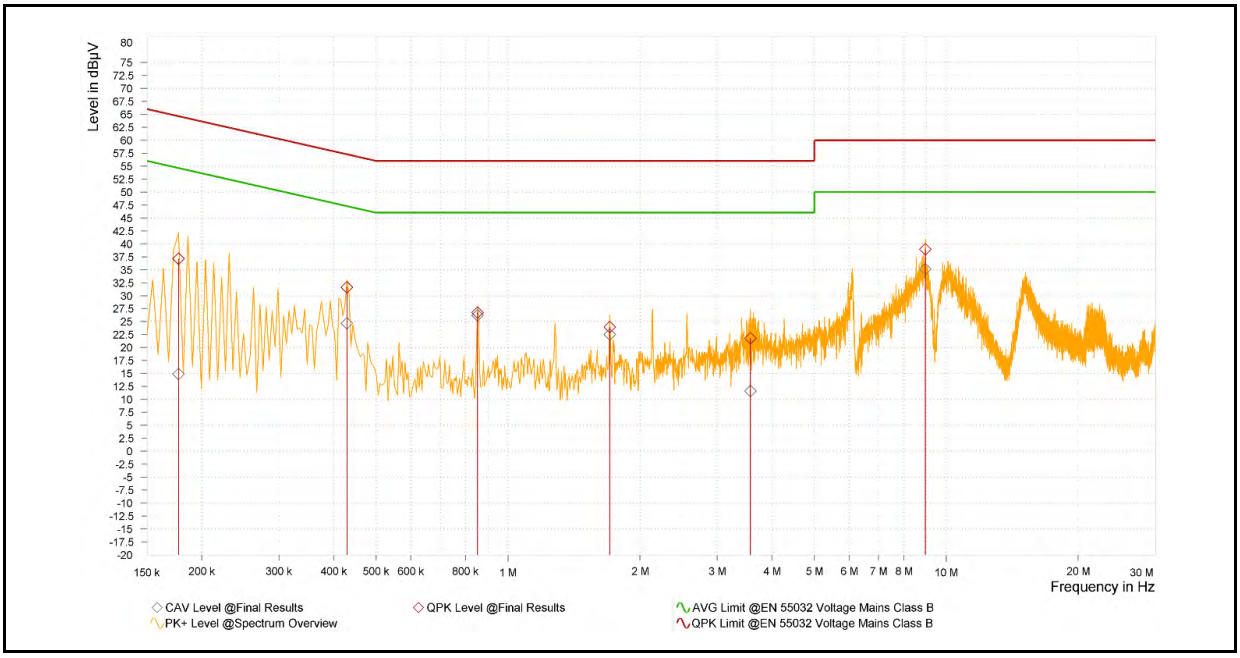
■ **Equipment Description**

The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. 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.

5 Test Results

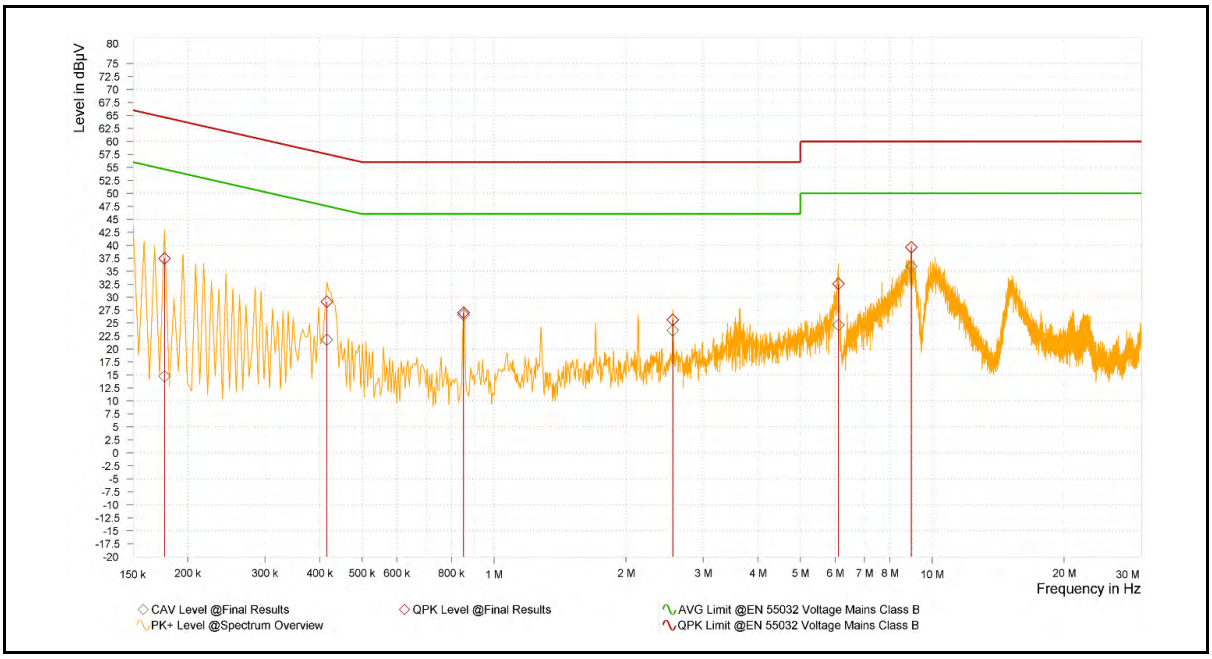
5.1. Conducted Emission

Standard:	FCC Part 15.247	Line:	L1
Test item:	Conducted Emission	Power:	AC 120 V/60 Hz
Mode:	Transmit mode		
Description:			



Rg	Frequency [MHz]	QP Result [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Result [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Correction factor [dB]	Line
1	0.177	37.15	64.63	27.48	14.88	54.63	39.74	9.61	L1
1	0.429	31.61	57.27	25.66	24.67	47.27	22.60	9.62	L1
1	0.852	26.73	56.00	29.27	26.24	46.00	19.76	9.64	L1
1	1.707	23.95	56.00	32.05	22.51	46.00	23.49	9.66	L1
1	3.575	21.76	56.00	34.24	11.60	46.00	34.40	9.70	L1
1	8.961	38.95	60.00	21.05	35.17	50.00	14.83	9.80	L1

Standard:	FCC Part 15.247	Line:	N
Test item:	Conducted Emission	Power:	AC 120 V/60 Hz
Mode:	Transmit mode		
Description:			



Rg	Frequency [MHz]	QP Result [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Result [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Correction factor [dB]	Line
1	0.177	37.45	64.63	27.17	14.76	54.63	39.87	9.59	N
1	0.416	29.11	57.54	28.43	21.80	47.54	25.74	9.60	N
1	0.852	27.02	56.00	28.98	26.55	46.00	19.45	9.62	N
1	2.558	25.61	56.00	30.39	23.62	46.00	22.38	9.68	N
1	6.113	32.55	60.00	27.45	24.63	50.00	25.37	9.77	N
1	8.957	39.60	60.00	20.40	35.88	50.00	14.12	9.82	N

5.2. Conducted Test Results

Maximum Conducted Output Power Measurement

Test Mode	Frequency (MHz)	RF Power setting in Test Software	Test Software Version
Continuous TX mode	902.75	13	CoolTerm Version2.0.0
	915.25	13	
	927.25	13	

Test Mode	Continuous TX mode				
Frequency (MHz)	Average Power		Peak Power		Limit (W)
	(dBm)	(W)	(dBm)	(W)	
902.75	19.19	0.08293	19.92	0.09817	0.561
915.25	18.65	0.07323	19.81	0.09572	0.561
927.25	19.09	0.08104	19.82	0.09594	0.561

Note: The relevant measured result has the offset with cable loss already.

If Antenna > 6dBi, Limit - (GANT-6)，So Power Limit = 1W(30dBm) - (8.51-6) = 0.561 W

20 dB RF Bandwidth Measurement

Test Mode	Continuous TX mode			
Channel	Frequency	20dB BW	Limit	Max 20dB BW
	(MHz)	(kHz)	(kHz)	kHz
Low Channel	902.75	144.20	n/a	144.20
Mid Channel	915.25	143.00	n/a	
High Channel	927.25	143.30	n/a	

■ **Test Graphs**

Continuous TX mode	
902.75 MHz	
915.25 MHz	
927.25 MHz	

Carrier Frequency Separation Measurement

Test Mode	Continuous TX mode	
Frequency (MHz)	Measurement Results (kHz)	Limit (kHz)
902.75	501.00	≥ 144.20
915.25	500.00	≥ 143.00
927.25	500.00	≥ 143.30

■ **Test Graphs**

Continuous TX mode	
902.75 MHz	
915.25 MHz	
927.25 MHz	

Number of Hopping Measurement

Test Mode	Continuous TX mode	
Frequency Range (MHz)	Measurement Results (Ch)	Limit (ch)
902.75-927.25	50	≥ 50

Continuous TX mode	
CH0~CH49	

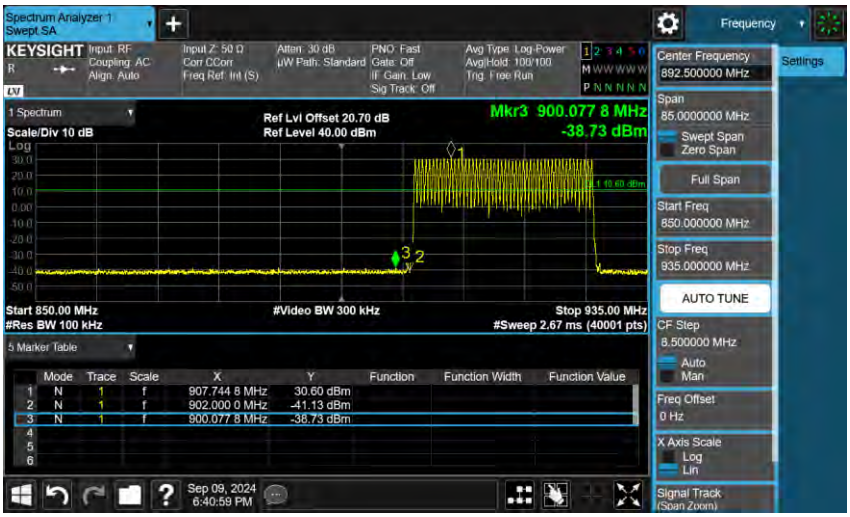
Time of Occupancy (Dwell Time) Measurement

Captured Burst (ms)	Pulse Number	Dwell Time (ms)	Limit (ms)	Result
0.256	2	0.51	400	Pass

Dwell Time = Pulse x Pulse number in Period

Period = 0.4 (seconds / channel) x 50 (channel) = 20 seconds

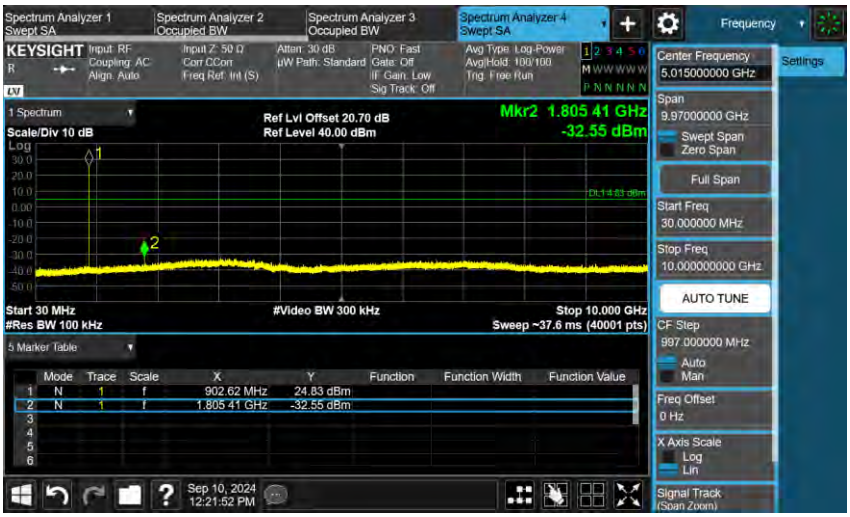
■ **Test Graphs**

Continuous TX mode	
Average Hopping Channel	
Package Transfer Time	

Out of Band Conducted Emissions Measurement

- **Test Graphs**

Conducted Spurious Emission

Continuous TX mode	
902.75 MHz	
915.25	
927.25 MHz	

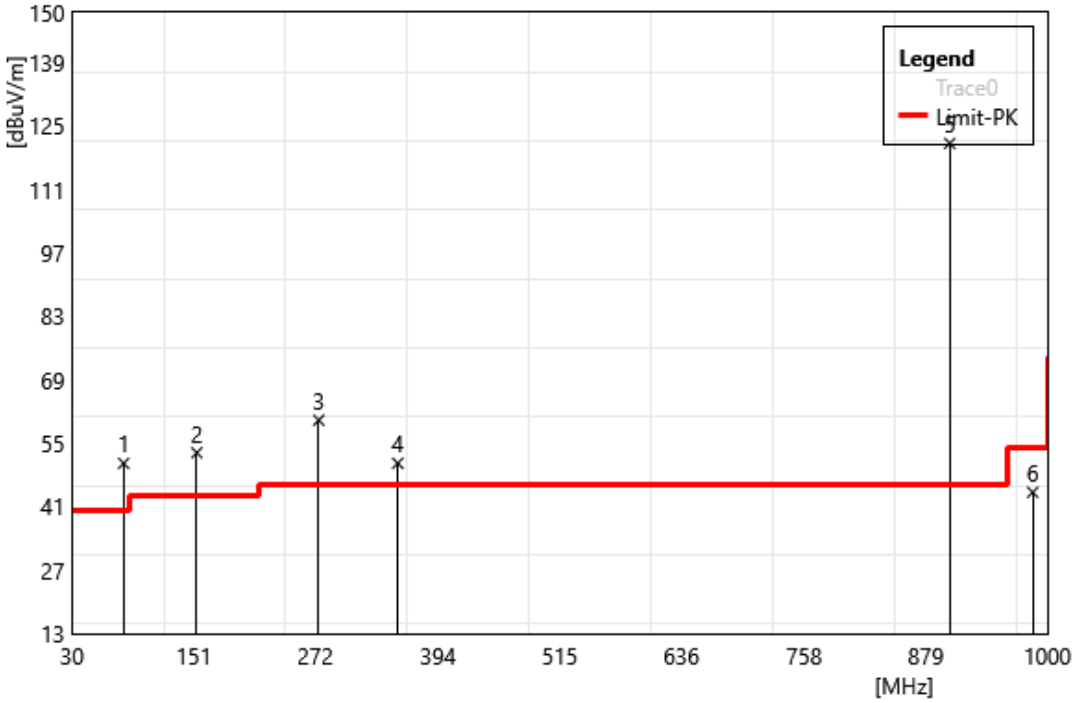
Conducted Band Edge

Continuous TX mode	
902.75 MHz	
927.25 MHz	

5.3. Radiated Emission Measurement

Below 1 GHz

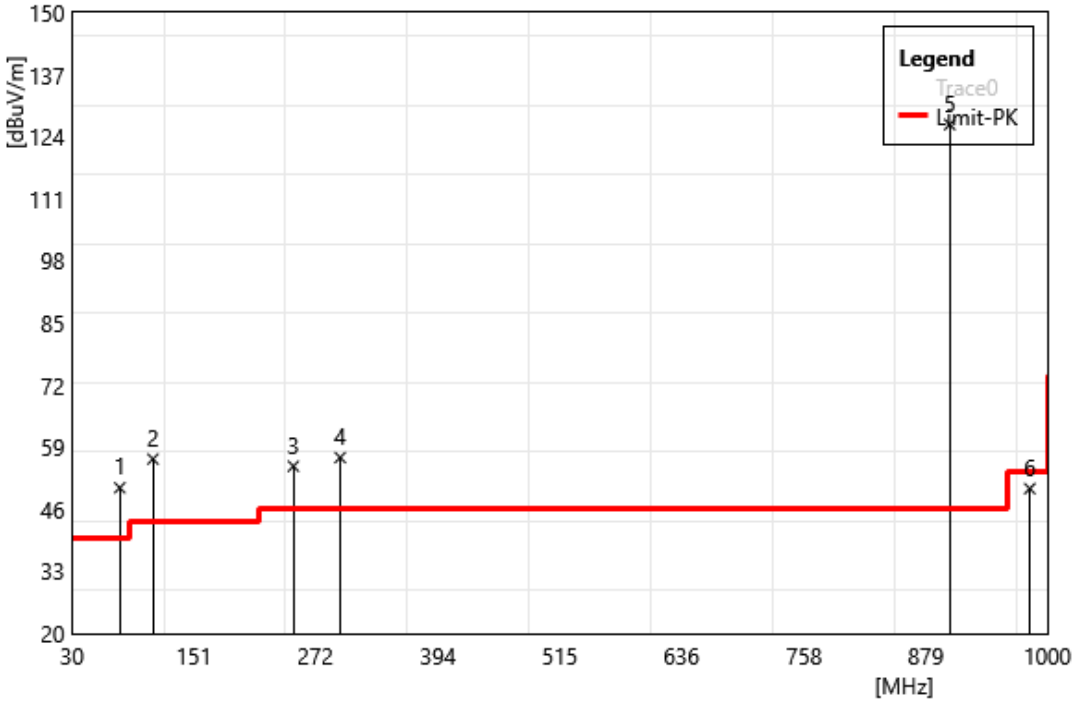
Test Site:	96602 - WG	Standard:	Part 15.247
Test Mode:	RFID 902.75 MHz		
Polarization:	Horizontal		
Remark:			



ID	Frequency MHz	Reading dBuV	Correct Factor dB/m	Result dBuV/m	Limit dBuV/m	Margin dB	Remark
1	81.41	63.42	-12.87	50.55	40.00	10.55	PEAK
2	154.16	60.12	-7.23	52.89	43.50	9.39	PEAK
3	275.41	67.18	-7.10	60.08	46.00	14.08	PEAK
4	353.98	56.28	-5.70	50.58	46.00	4.58	PEAK
5	903.00	117.10	4.04	121.14	46.00	75.14	PEAK
6	985.45	38.80	5.37	44.17	54.00	-9.83	PEAK

Note : This equipment is class A. The test result refer to the Part 15B report.

Test Site:	96602 - WG	Standard:	Part 15.247
Test Mode:	RFID 902.75 MHz		
Polarization:	Vertical		
Remark:			



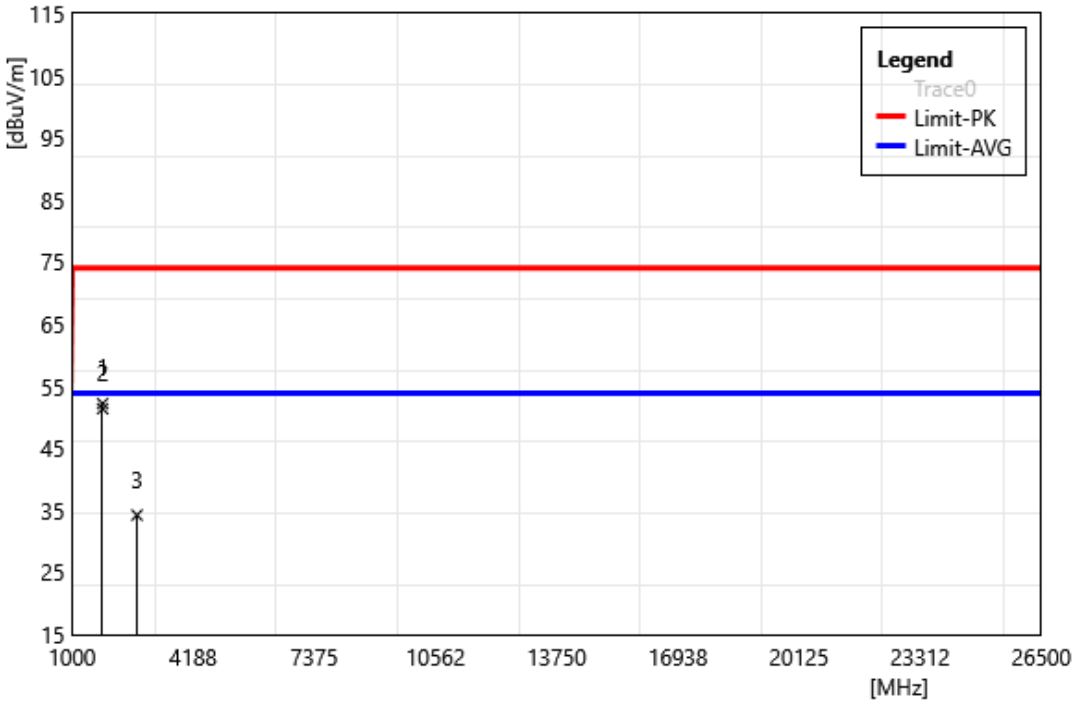
ID	Frequency MHz	Reading dBuV	Correct Factor dB/m	Result dBuV/m	Limit dBuV/m	Margin dB	Remark
1	77.53	62.31	-11.80	50.51	40.00	10.51	PEAK
2	110.51	67.40	-10.86	56.54	43.50	13.04	PEAK
3	250.19	63.21	-8.18	55.03	46.00	9.03	PEAK
4	296.75	63.40	-6.57	56.83	46.00	10.83	PEAK
5	903.00	122.53	4.04	126.57	46.00	80.57	PEAK
6	982.54	45.05	5.28	50.33	54.00	-3.67	PEAK

Note : This equipment is class A. The test result refer to the Part 15B report.

Harmonic

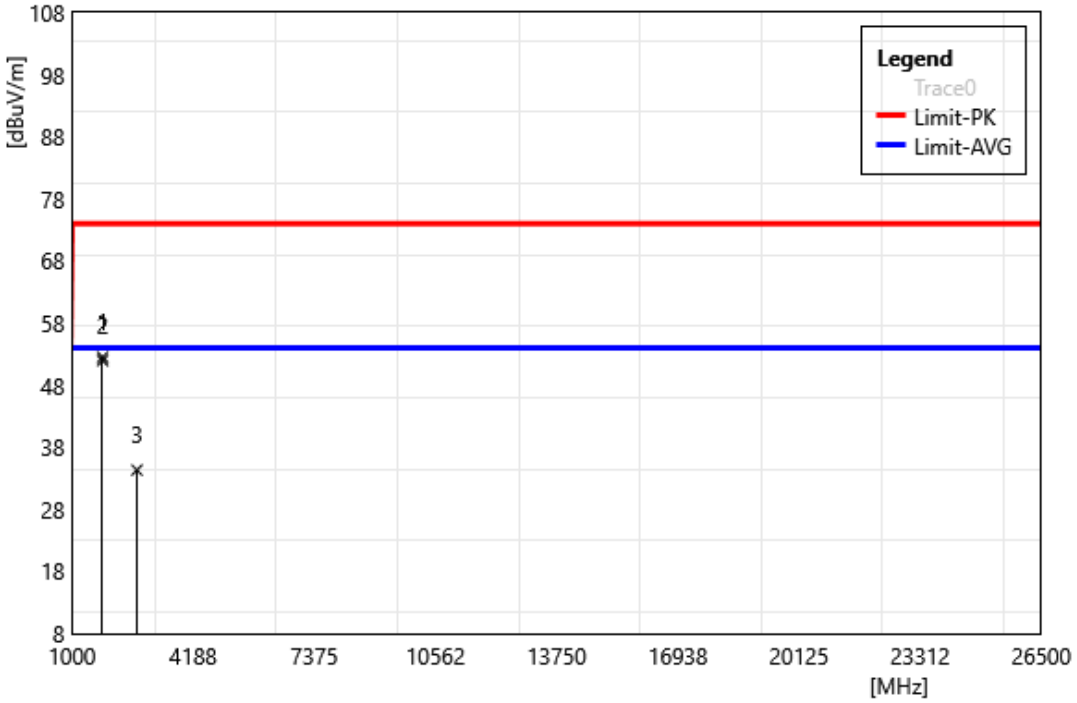
Above 1 GHz

Test Site:	96602 - WG	Standard:	PART 15.247
Test Mode:	RFID 902.75 MHz		
Polarization:	Horizontal		
Remark:			



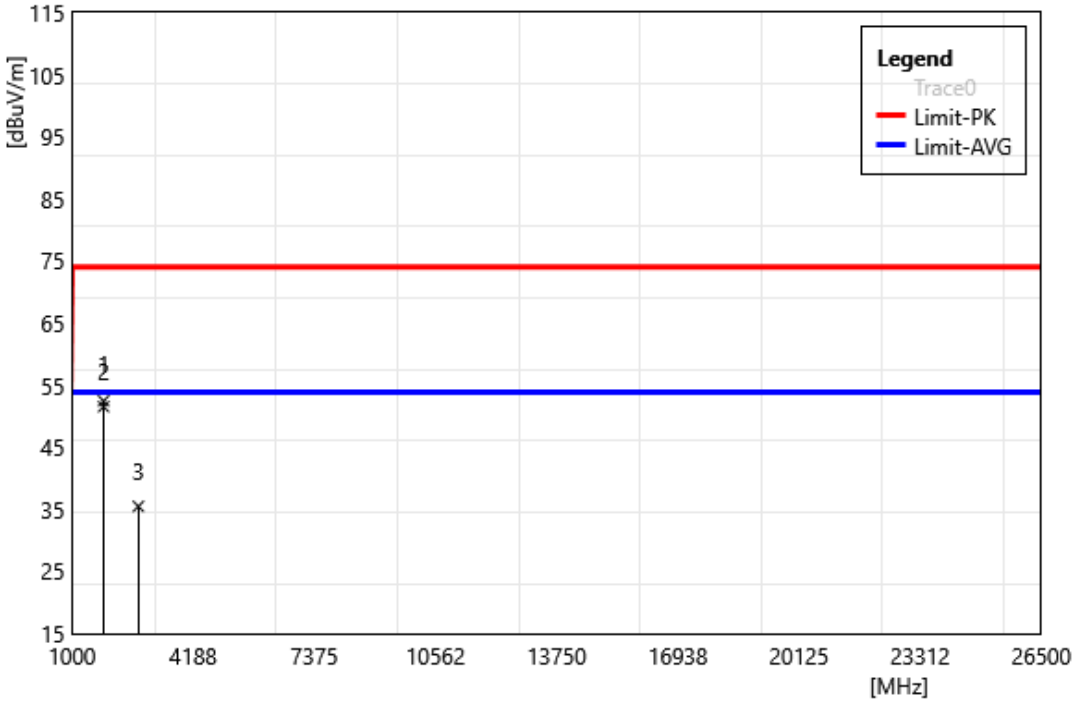
ID	Frequency MHz	Reading dBuV	Correct Factor dB/m	Result dBuV/m	Limit dBuV/m	Margin dB	Remark
1	1805.50	72.19	-20.00	52.19	74.00	-21.81	PEAK
2	1805.50	71.37	-20.00	51.37	54.00	-2.63	AVG
3	2708.25	49.71	-15.48	34.23	74.00	-39.77	PEAK

Test Site:	96602 - WG	Standard:	PART 15.247
Test Mode:	RFID 902.75 MHz		
Polarization:	Vertical		
Remark:			



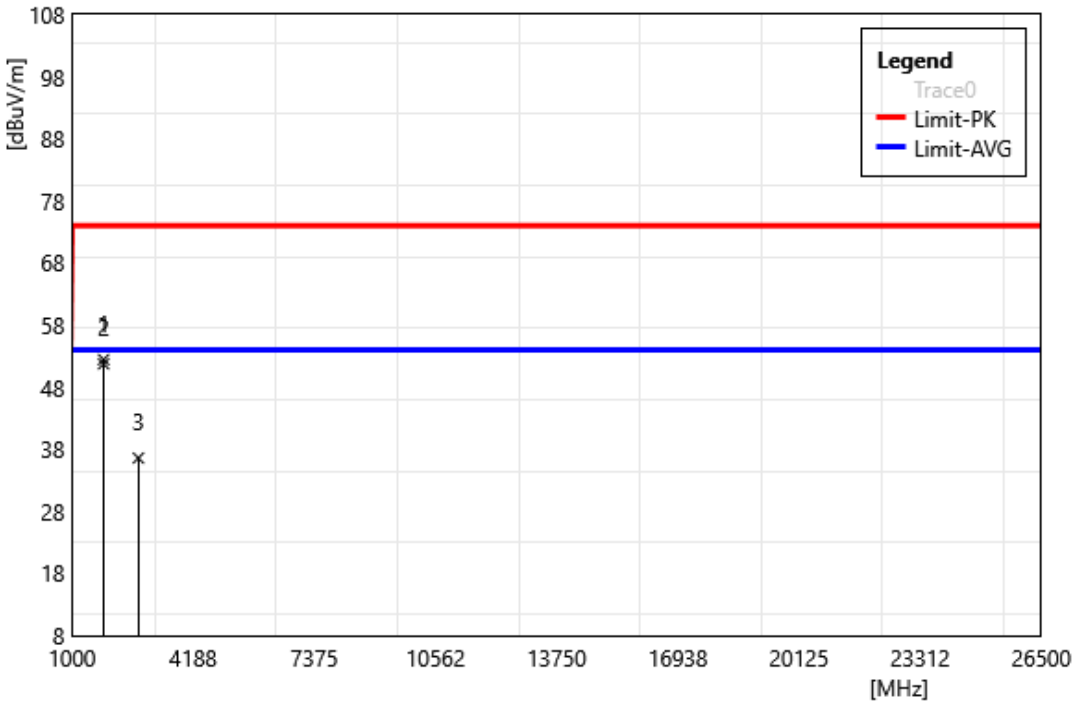
ID	Frequency MHz	Reading dBuV	Correct Factor dB/m	Result dBuV/m	Limit dBuV/m	Margin dB	Remark
1	1805.50	72.51	-20.00	52.51	74.00	-21.49	PEAK
2	1805.50	71.96	-20.00	51.96	54.00	-2.04	AVG
3	2708.25	49.81	-15.48	34.33	74.00	-39.67	PEAK

Test Site:	96602 - WG	Standard:	PART 15.247
Test Mode:	RFID 915.25 MHz		
Polarization:	Horizontal		
Remark:			



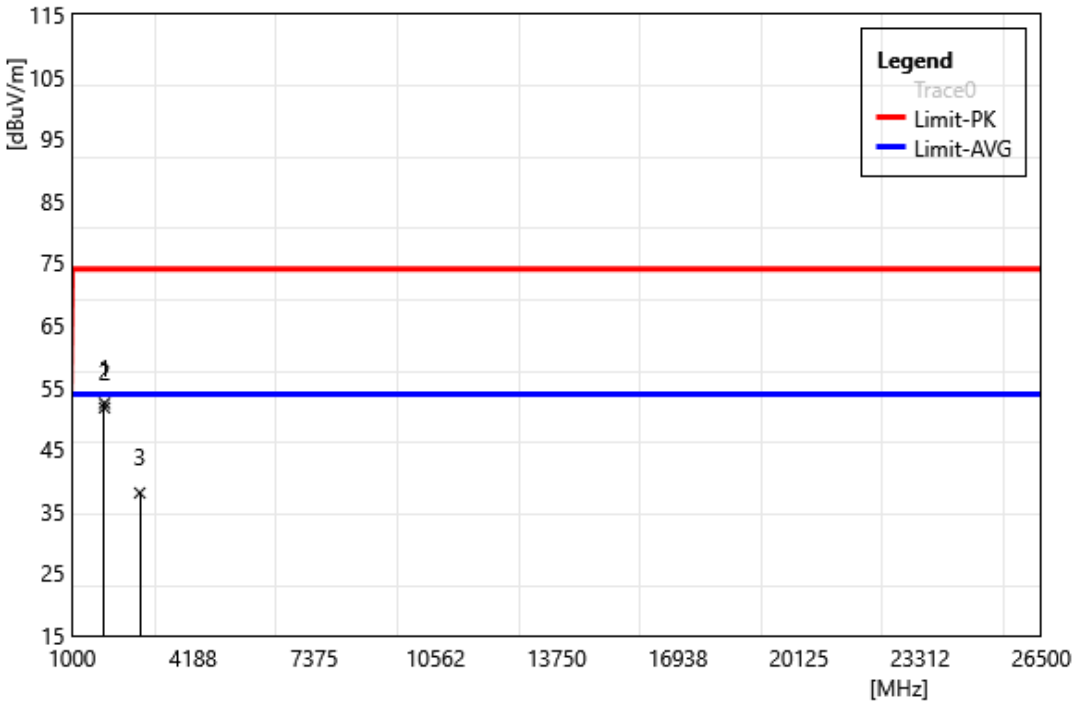
ID	Frequency MHz	Reading dBuV	Correct Factor dB/m	Result dBuV/m	Limit dBuV/m	Margin dB	Remark
1	1830.50	72.32	-19.85	52.47	74.00	-21.53	PEAK
2	1830.50	71.38	-19.85	51.53	54.00	-2.47	AVG
3	2745.75	50.71	-15.22	35.49	74.00	-38.51	PEAK

Test Site:	96602 - WG	Standard:	PART 15.247
Test Mode:	RFID 915.25 MHz		
Polarization:	Vertical		
Remark:			



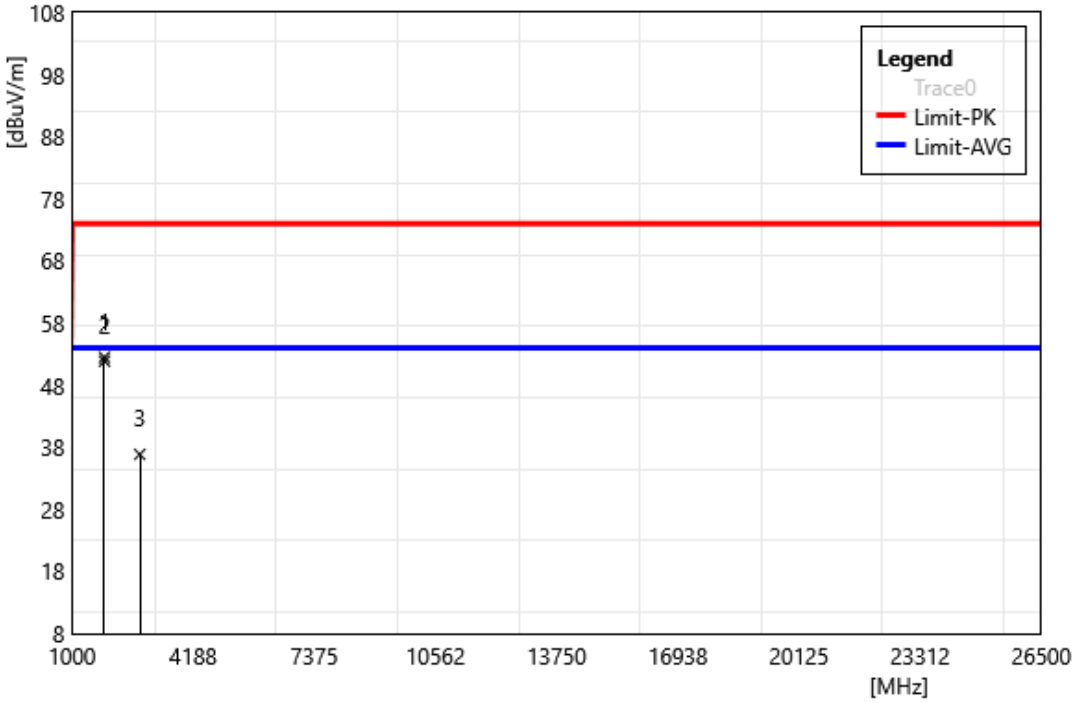
ID	Frequency MHz	Reading dBuV	Correct Factor dB/m	Result dBuV/m	Limit dBuV/m	Margin dB	Remark
1	1830.50	72.29	-19.85	52.44	74.00	-21.56	PEAK
2	1830.50	71.60	-19.85	51.75	54.00	-2.25	AVG
3	2745.75	51.81	-15.22	36.59	74.00	-37.41	PEAK

Test Site:	96602 - WG	Standard:	PART 15.247
Test Mode:	RFID 927.25 MHz		
Polarization:	Horizontal		
Remark:			



ID	Frequency MHz	Reading dBuV	Correct Factor dB/m	Result dBuV/m	Limit dBuV/m	Margin dB	Remark
1	1854.50	72.03	-19.63	52.40	74.00	-21.60	PEAK
2	1854.50	71.32	-19.63	51.69	54.00	-2.31	AVG
3	2781.75	52.92	-14.95	37.97	74.00	-36.03	PEAK

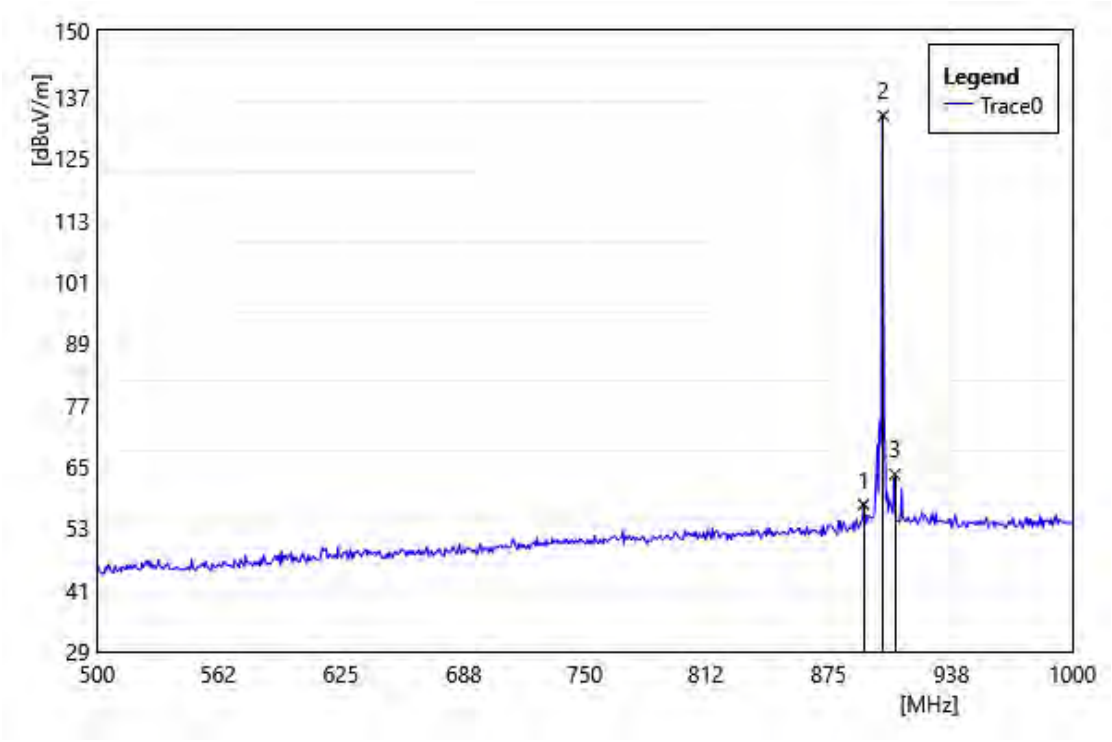
Test Site:	96602 - WG	Standard:	PART 15.247
Test Mode:	RFID 927.25 MHz		
Polarization:	Vertical		
Remark:			



ID	Frequency MHz	Reading dBuV	Correct Factor dB/m	Result dBuV/m	Limit dBuV/m	Margin dB	Remark
1	1854.50	72.13	-19.63	52.50	74.00	-21.50	PEAK
2	1854.50	71.50	-19.63	51.87	54.00	-2.13	AVG
3	2781.75	51.80	-14.95	36.85	74.00	-37.15	PEAK

Band Edge

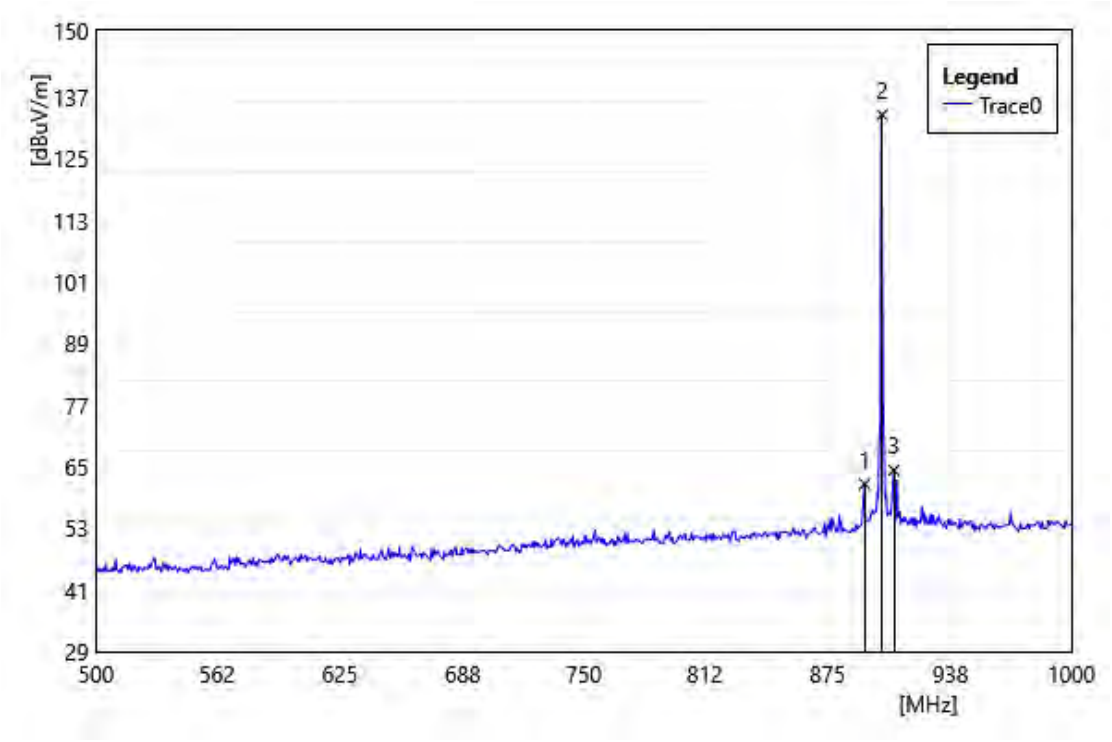
Test Site:	96602 - WG	Standard:	Part 15.247
Test Mode:	RFID 902.75 MHz		
Polarization:	Horizontal		
Remark:			



ID	Frequency MHz	Reading dBuV	Correct Factor dB/m	Result dBuV/m	Limit dBuV/m	Margin dB	Remark
1	893.00	53.83	3.82	57.65	113.46	-55.81	PEAK
2	903.00	129.42	4.04	133.46	---	---	PEAK
3	909.00	59.36	4.20	63.56	113.46	-49.9	PEAK

*Limit=Result-20

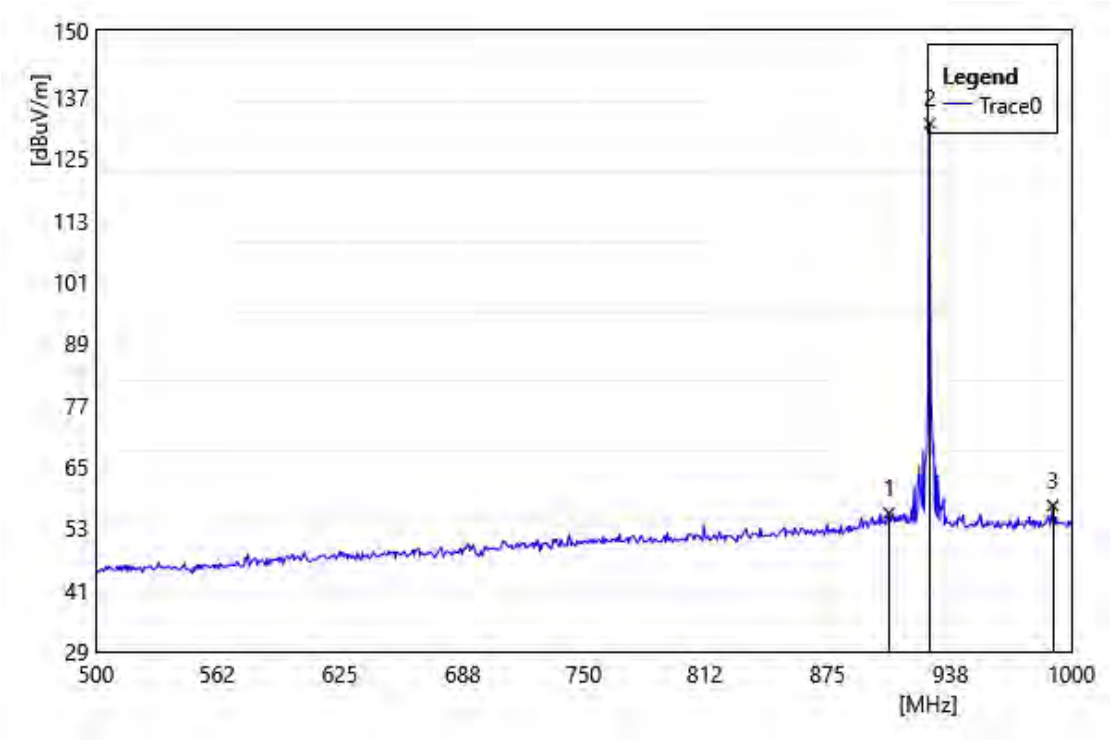
Test Site:	96602 - WG	Standard:	Part 15.247
Test Mode:	RFID 902.75 MHz		
Polarization:	Vertical		
Remark:			



ID	Frequency MHz	Reading dBuV	Correct Factor dB/m	Result dBuV/m	Limit dBuV/m	Margin dB	Remark
1	894.00	57.83	3.82	61.65	113.59	-51.94	PEAK
2	903.00	129.55	4.04	133.59	---	---	PEAK
3	909.00	60.11	4.20	64.32	113.59	-49.27	PEAK

*Limit=Result-20

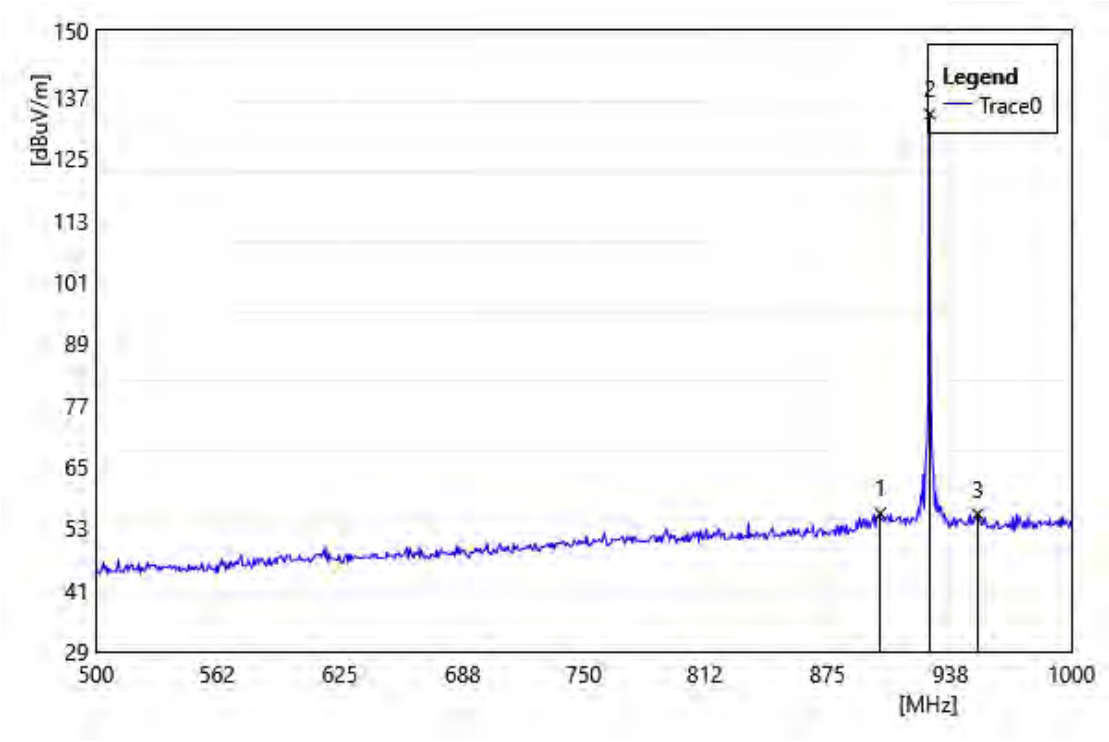
Test Site:	96602 - WG	Standard:	Part 15.247
Test Mode:	RFID 927.25 MHz		
Polarization:	Horizontal		
Remark:			



ID	Frequency MHz	Reading dBuV	Correct Factor dB/m	Result dBuV/m	Limit dBuV/m	Margin dB	Remark
1	906.50	51.85	4.13	55.98	111.92	-55.94	PEAK
2	927.50	127.15	4.77	131.92	--	--	PEAK
3	990.50	51.96	5.49	57.45	111.92	-54.47	PEAK

*Limit=Result-20

Test Site:	96602 - WG	Standard:	Part 15.247
Test Mode:	RFID 927.25 MHz		
Polarization:	Vertical		
Remark:			



ID	Frequency MHz	Reading dBuV	Correct Factor dB/m	Result dBuV/m	Limit dBuV/m	Margin dB	Remark
1	902.00	51.92	4.01	55.93	113.72	-57.79	PEAK
2	927.50	128.95	4.77	133.72	---	---	PEAK
3	952.00	50.80	5.01	55.81	113.72	-57.91	PEAK

*Limit=Result-20

---END---