

# TLJ Group Limited

## TEST REPORT

**SCOPE OF WORK**

EMC TESTING–ZPAD3.4

**REPORT NUMBER**

230328018GZU-001

**ISSUE DATE**

05-June-2023

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FCC Part 15.249-f

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## TEST REPORT

Applicant Name & : TLJ Group Limited  
Address : 68 / 78 Leads Road, Hull, East Yorkshire, HU7 0BY, UK  
Manufacturing Site : Same as Applicant  
Intertek Report No: 230328018GZU-001  
FCC ID: 2AZBY-TLJZPAD3-4

## Test standards

**47 CFR PART 15 Subpart C: 2021 section 15.249**

## Sample Description

Product : Touchscreen Keypad  
Model No. : ZPAD3.4  
Electrical Rating : DC 4 × 1.5V Battery  
Serial No. : Not Labeled  
Date Received : 28 March 2023  
Date Test : 12 April 2023-05 June 2023  
Conducted

Prepared and Checked By

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## TEST REPORT

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## TEST REPORT

### 1.0 TEST RESULT SUMMARY

Test Item	Test Requirement	Test Method	Result
Antenna Requirement	FCC PART 15 C Section 15.203	FCC PART 15 C Section 15.203	PASS
Occupied Bandwidth	FCC PART 15 C section 15.215(c)	ANSI C63.10: Clause 6.9	PASS
Radiated Emission	FCC PART 15 C section 15.249 (a), (d)	ANSI C63.10: Clause 6.4, 6.5 & 6.6	PASS
Band Edges Measurement	FCC PART 15 C section 15.249 (d)	ANSI C63.10: Clause 6.10	PASS
Conducted Emissions at Mains Terminals	FCC PART 15 C section 15.207	ANSI C63.10: Clause 6.2	N/A

**Remark:**

N/A: not applicable. Refer to the relative section for the details.

EUT: In this whole report EUT means Equipment Under Test.

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radio Frequency.

ANSI C63.10: the detail version is ANSI C63.10:2013 in the whole report.

## TEST REPORT

### 2.0 General Description

#### 2.1 Product Description

Operating Frequency:	908.4MHz,908.42MHz,916MHz
Type of Modulation:	FSK
Number of Channels:	3 Channels
Antenna Type:	Integral
Speciality:	Z-wave
Function:	Touchscreen Keypad with Z-Wave function to transmit Pair/Unpair signal
Power Supply:	DC 4×1.5V Battery

EUT channels and frequencies list:

Test frequencies are lowest channel 0: 908.4 MHz, middle channel 1: 908.42 MHz and highest channel 2: 916 MHz.

#### 2.2 Related Submittal(s) Grants

This is an application for certification of:

DXX - Part 15 Low Power Communication Device Transmitter

Remaining portions are subject to the following procedures:

1. Receiver portion of BLE: exempt from technical requirement of this Part.

#### 2.3 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.10. Radiated emission measurement was performed in semi-anechoic chamber and conducted emission measurement was performed in shield room. For radiated emission measurement, preliminary scans and final tests were performed in the semi-anechoic chamber to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise.

#### 2.4 Test Facility

All tests were performed at:

Intertek Testing Services Shenzhen Ltd. Guangzhou Branch  
Room102/104, No 203, KeZhu Road, Science City, GETDD Guangzhou, China  
Except Conducted Emissions was performed at:

## TEST REPORT

Room 02, & 101/E201/E301/E401/E501/E601/E701/E801 of Room 01 1-8/F., No. 7-2. Caipin Road, Science City, GETDD, Guangzhou, Guangdong, China

A2LA Certificate Number 0078.10

Intertek Testing Services Shenzhen Ltd. Guangzhou Branch is accredited by A2LA and Listed in FCC website. FCC accredited test labs may perform both Certification testing under Parts 15 and 18 and Declaration of Conformity testing.

### 3.0 System Test Configuration

#### 3.1 Justification

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. It was powered by DC 6V supply.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. The spurious emissions more than 20 dB below the permissible value are not reported.

For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in the following table:

Frequency range of radiated emission measurements

Lowest frequency generated in the device	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower
At or above 10 GHz to below 30 GHz	5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified

Number of fundamental frequencies to be tested in EUT transmit band

Frequency range in which device operates	Number of frequencies	Location in frequency range of operation
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom

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More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom
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### 3.2 EUT Exercising Software

Description	Manufacturer	Model No.	SN/Version	Supplied by
For normal operation	HP	Compaq 6710b	SN:CNU8240LF9	Intertek
For fixing frequency	WIK	UART Assist	Version:V5.0.2	TLJ Group Limited

### 3.3 Special Accessories

No special accessories used.

### 3.4 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	20 dB Bandwidth	2.3%
	6dB Bandwidth	
	99% Bandwidth	
2	Carrier Frequencies Separated	2.3%
3	Dwell Time	1.2%
4	Maximum Peak Conducted Output Power	1.5dB
5	Peak Power Spectral Density	1.5dB
6	Out of Band Conducted Emissions	1.5dB
7	Band edges measurement	1.5dB
8	Radiated Emissions	4.7 dB (25 MHz-1 GHz)
		4.8 dB (1 GHz-18 GHz)
		5.21dB (18GZH-26GHz)
9	Conducted Emissions at Mains Terminals	2.58dB
10	Temperature	0.5 °C
11	Humidity	0.4 %
12	Time	1.2%

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT.

Measurement uncertainty is calculated in accordance with ETSI TR 100 028-2001.

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The measurement uncertainty is given with a confidence of 95%, k=2.

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

Uncertainty and Compliance – Unless the standard specifically states that measured values are to be extended by the measurement uncertainty in determining compliance, all compliance determinations are based on the actual measured value

### 3.5 Equipment Modification

Any modifications installed previous to testing by TLJ Group Limited will be incorporated in each production model sold / leased in the United States.

No modifications were installed by Intertek Testing Services Shenzhen Ltd. Guangzhou Branch.

### 3.6 Support Equipment List and Description

This product was tested with corresponding support equipment as below:

#### Support Equipment

Description	Manufacturer	Model No.	SN/Version	Supplied by
NoteBook	HP	Compaq 6710b	SN:CNU8240LF9	Intertek
Control board	WIK	CNMDIP34	Version:3434	TLJ Group Limited

#### Cable

Description	Model No.	Connector type	Cable length/type	Supplied by
Antenna cable	RF-01	SMA	0.2 m(shielded)	Intertek



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### 4.0 Measurement Results

#### 4.1 Antenna Requirement

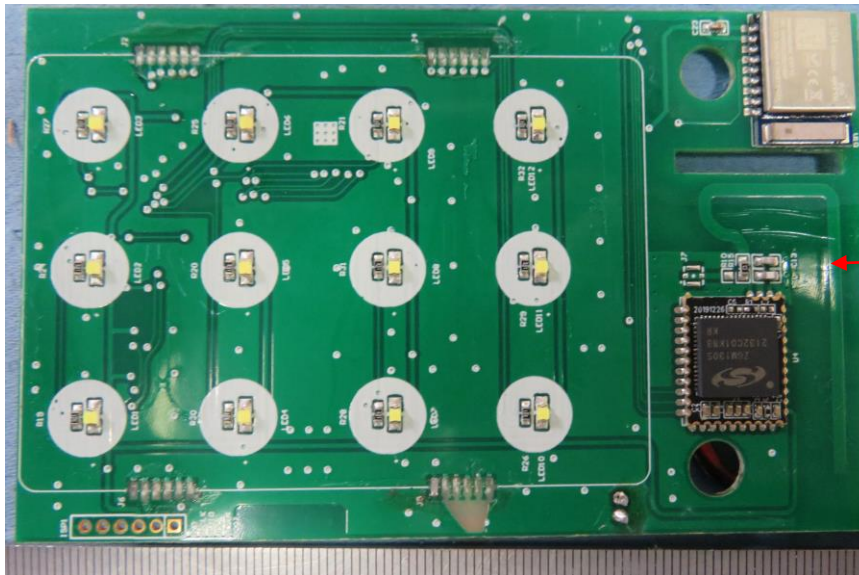
Standard requirement:

15.203 requirement:

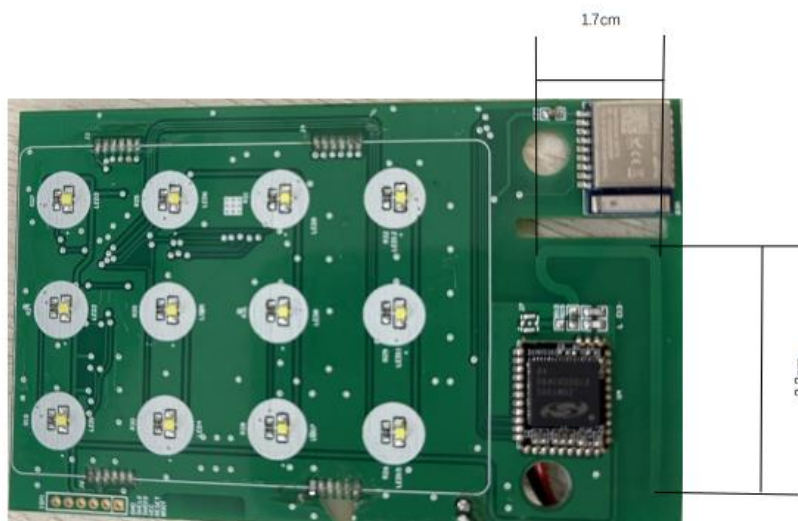
For intentional device. According to 15.203 an intentional radiator shall be designed to Ensure that no antenna other than that furnished by the responsible party shall be used with the device.

EUT Antenna

The antenna is an integral antenna and no consideration of replacement.



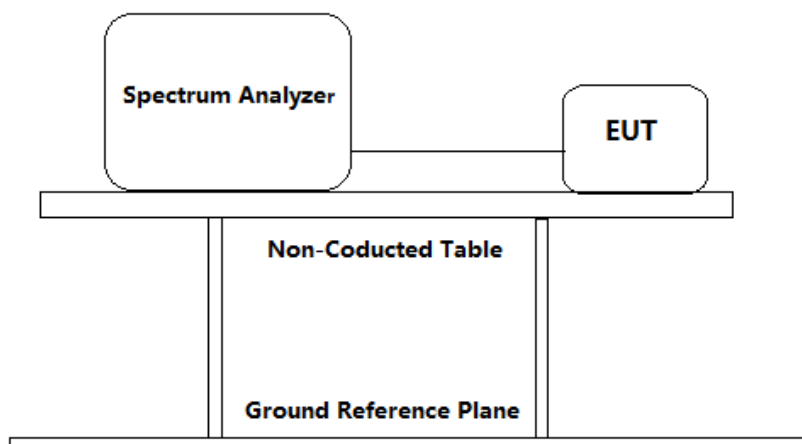
Antenna design:



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### 4.2 Occupied Bandwidth

Test Requirement:	FCC PART 15 C section 15.215(c)  (c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure  that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is  operated
Test Method:	ANSI C63.10: Clause 6.9
Test Status:	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). The highest, middle and the lowest channels were selected for the final test as listed below.
Test Configuration:	



#### Test Procedure:

The transmitter was operated at its maximum carrier power measured under normal test conditions.

- The instrument center frequency was set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer was between 1.5 times and 5.0 times the OBW(20 dB Bandwidth).
- The nominal IF filter bandwidth (3 dB RBW) was in the range of 1% to 5% of the OBW, and VBW was approximately three times the RBW.
- Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope was more than  $[10 \log (OBW/RBW)]$  below the reference level.

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- d) Step a) through step c) might require iteration to adjust within the specified range.
- e) The dynamic range of the instrument at the selected RBW was more than 10 dB below the target “-20 dB down” requirement; that is, if the requirement calls for measuring the -20 dB OBW, the instrument noise floor at the selected RBW was at least 30 dB below the reference value.
- f) Peak detection and max hold mode (until the trace stabilizes) was used.
- g) Used the 20dB bandwidth function of the instrument and reported the measured bandwidth.
- h) The occupied bandwidth was reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division was clearly labeled. Tabular data was reported in addition to the plot(s).

### Used Test Equipment List

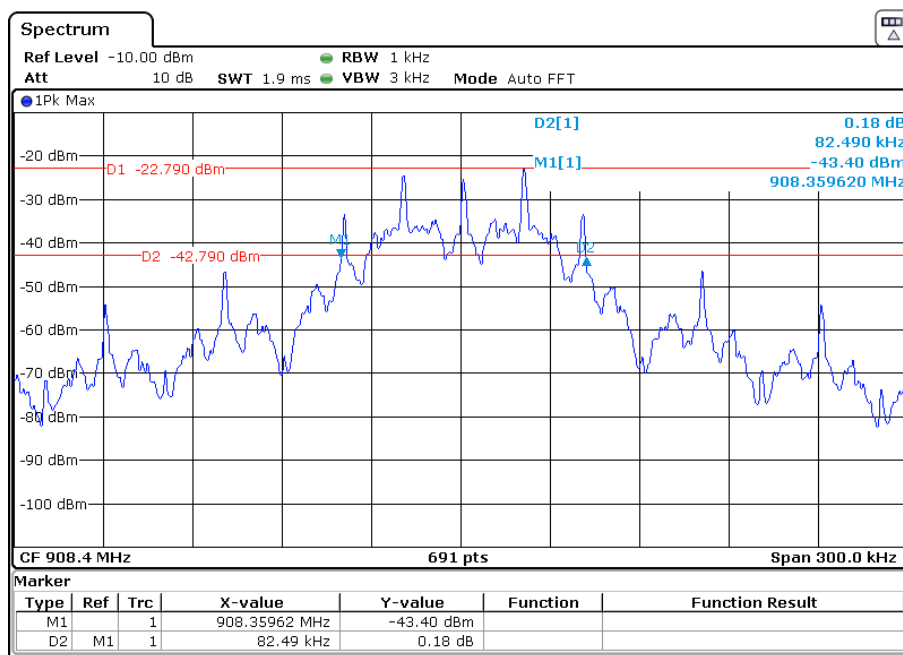
Spectrum Analyzer. Refer to Clause 5 Test Equipment List for details.

20 dB bandwidth:

Channel No.	Frequency (MHz)	Measured 20dB bandwidth (kHz)	Limit (kHz)	Result
0	908.4	82.5	/	Pass
1	908.42	97.3		Pass
2	916.0	108.1		Pass

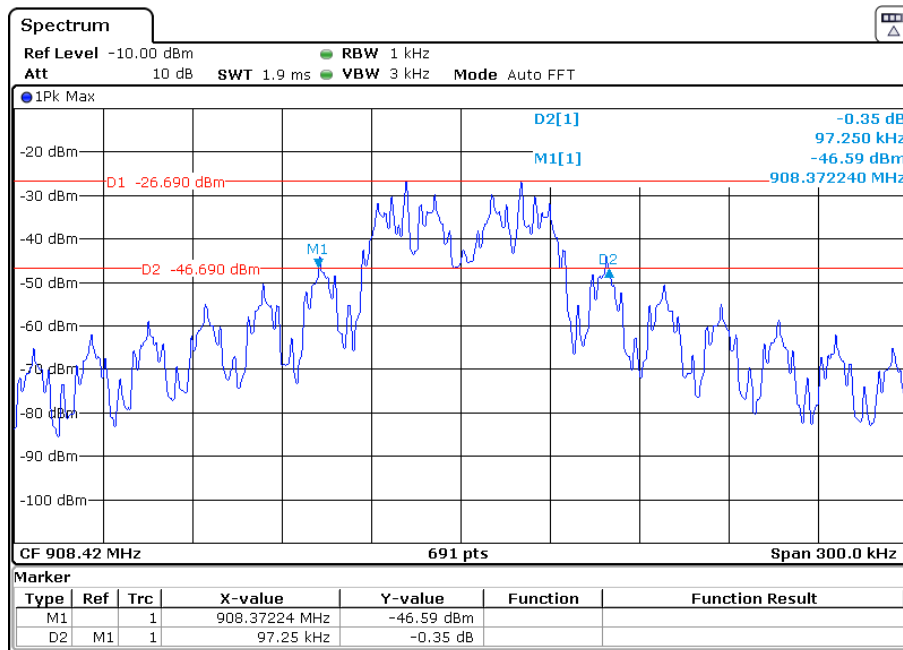
### Result plot as follows:

Lowest Channel(908.4 MHz):

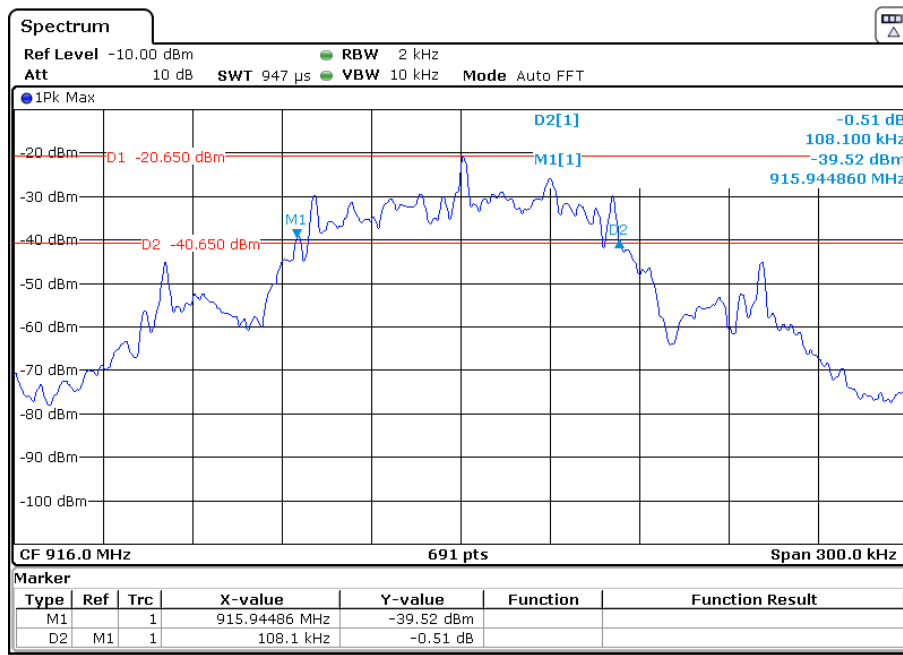


Middle Channel(908.42 MHz):

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Highest Channel(916 MHz):



### 4.3 Radiated Emission

Test Requirement: FCC PART 15 C section 15.249 (a), (d)  
(a) Except as provided in paragraph (b) of this section, the field

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strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (dB $\mu$ V/m @ 3m)	Field Strength of Harmonics (dB $\mu$ V/m @ 3m)
902 to 928	94.0	54.0
2400 to 2483.5	94.0	54.0
5725 to 5875	94.0	54.0

Note: The limits shown in the above table are based on measurements using an average detector, except for the fundamental emission in the frequency band 902-928 MHz, which is based on measurements using a CISPR quasi-peak detector.

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

Test Method:

ANSI C63.10: Clause 6.4, 6.5 and 6.6

Test Status:

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). The lowest, middle and the lowest channels were selected for the final test as listed below.

Test site:

Measurement Distance: 3m (Semi-Anechoic Chamber)

Limit:

The field strength of radiated emission outside of the specified frequency bands, except for harmonics at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Field Strength (dB $\mu$ V/m @ 3m)
30-88	40.0
88-216	43.5
216-960	46.0
Above 960	54.0

Detector:

For Peak and Quasi-Peak value:

200 Hz for 9 kHz to 150 kHz

9 kHz for 150 kHz to 30 MHz

120 kHz for 30 MHz to 1GHz

RBW = 1 MHz for  $f \geq 1$  GHz

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak for  $f \geq 1$  GHz, QP for  $f < 1$  GHz

Trace = max hold

According 15.35(c), when the field strength (or envelope power)

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is not constant or it is in pulses, and an average detector is specified to be used, the value of field strength or power shall be determined by averaging over one complete pulse train, including blanking intervals within the pulse train, as long as the pulse train does not exceed 0.1 seconds. In cases where the pulse train exceeds 0.1 second, the average value of field strength or output power shall be determined during a 0.1 second interval during which the field strength or power is at its maximum value.

The average correction factor was computed by analyzing the on time in 100ms over one complete pulse train. Analysis of the remote transmitter on time in one complete pulse train, therefore the average value of fundamental frequency was: Average = Peak value + 20log (Duty cycle), where the duty factor is calculated from following formula:

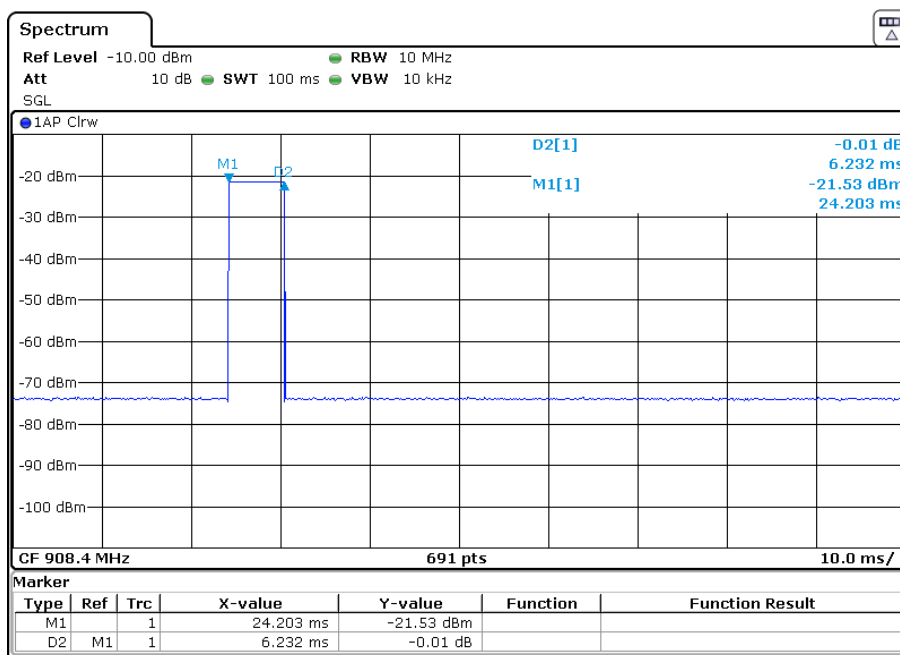
The duration of one cycle =100ms

Effective period of the cycle =6.232 ms

DC =6.232/100=0.06232 or 6.232%

Therefore, the averaging factor is found by  $20\lg 0.06232 = -24.1$

Please refer to below plots for more details.



Field Strength  
Calculation:

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below:

$$FS = RA + AF + CF - AG + PD + AV$$

$$FS = RA + \text{Correct Factor} + AV$$

$$FS = \text{Field Strength in dB}\mu\text{V/m}$$

$$RA = \text{Receiver Amplitude (including preamplifier) in dB}\mu\text{V}$$

$$AF = \text{Antenna Factor in dB}$$

$$CF = \text{Cable Attenuation Factor in dB}$$

Where:

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AG = Amplifier Gain in dB

PD = Pulse Desensitization in dB

AV = Average Factor in -dB

Correct Factor = AF + CF - AG + PD

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

$FS = RA + AF + CF - AG + PD + AV$

Assume a receiver reading of 62.0 dB $\mu$ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 dB $\mu$ V/m.

RA = 62.0 dB $\mu$ V

AF = 7.4 dB

CF = 1.6 dB

AG = 29.0 dB

PD = 0 dB

AV = -10 dB

Correct Factor = 7.4 + 1.6 - 29.0 + 0 = -20 dB

$FS = 62 + (-20) + (-10) = 32 \text{ dB}\mu\text{V/m}$

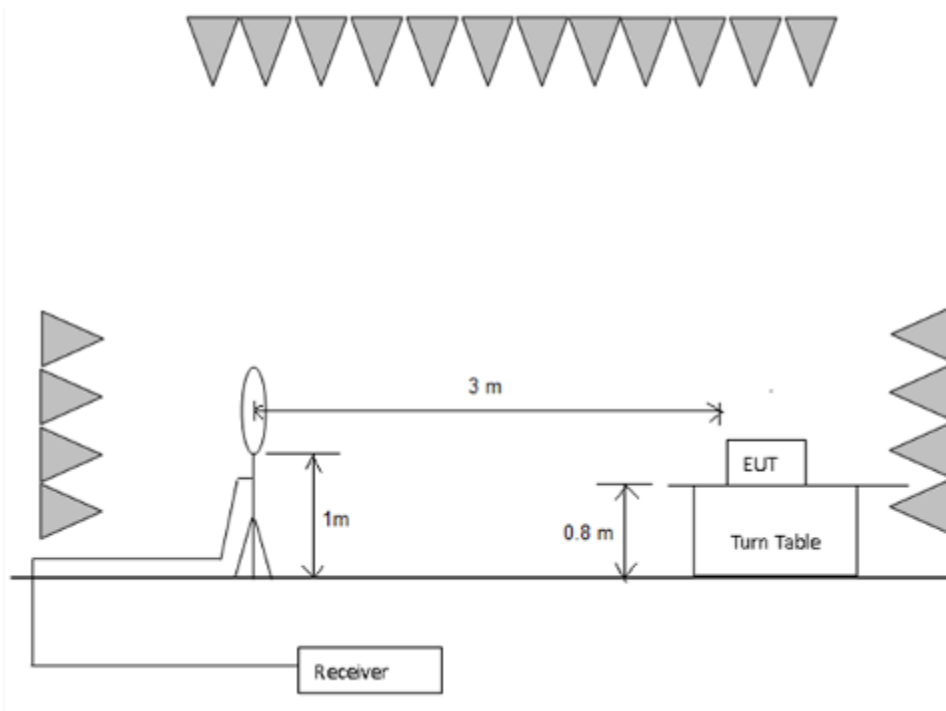
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Section 15.205 Restricted bands of operation.

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
10.495 - 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 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	
13.36 - 13.41	322 - 335.4		

Test Configuration:

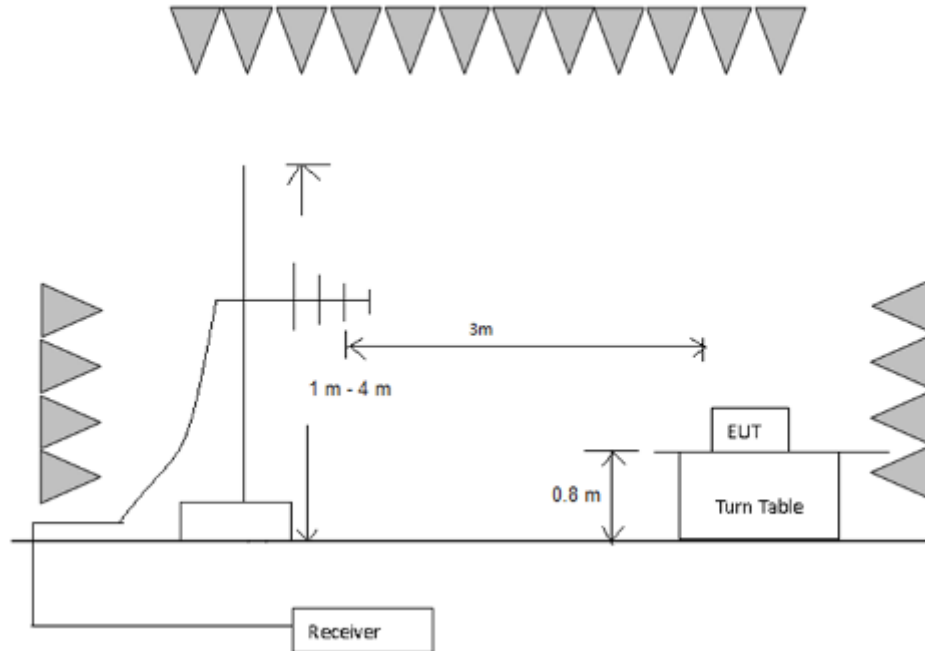
1) 9 kHz to 30 MHz emissions:



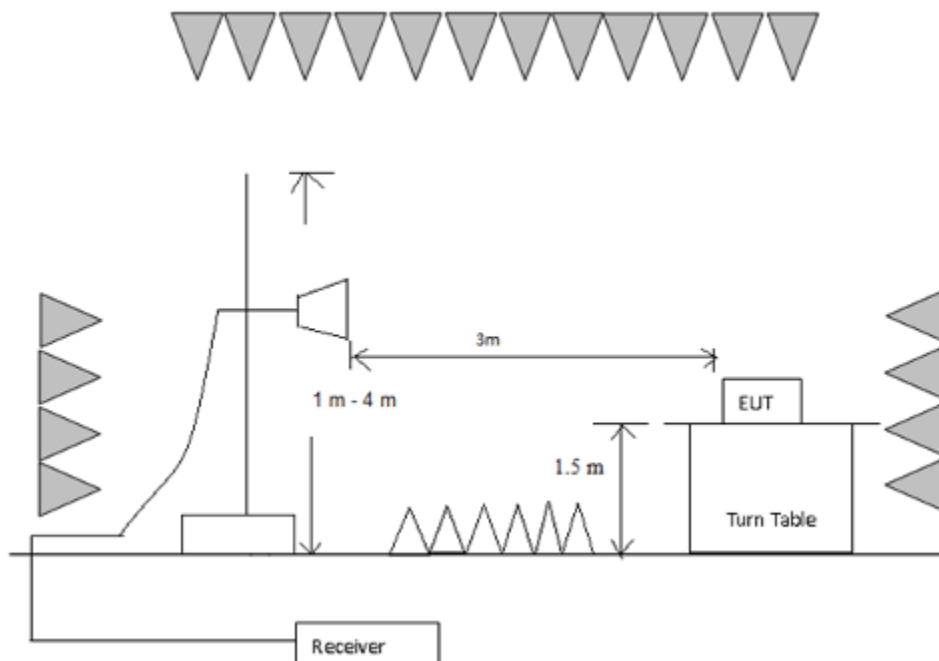


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### 2) 30 MHz to 1 GHz emissions:



### 3) 1 GHz to 40 GHz emissions:



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### Test Procedure:

#### 1) 9 kHz to 30 MHz emissions:

For testing performed with the loop antenna. The lowest of the loop was positioned 1 m above the ground and positioned with its plane vertical at the special distance from the EUT. During testing the loop was rotated about its vertical axis for maximum response at each azimuth and also investigated with the loop positioned in the horizontal plane.

#### 2) 30 MHz to 1 GHz emissions:

For testing performed with the bi-log type antenna. The measurement is performed with the EUT rotated 360°, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurement for both the horizontal and vertical antenna polarizations.

#### 3) 1 GHz to 25 GHz emissions:

Test site with RF absorbing material covering the ground plane that met the site validation criterion called out in CISPR 16-1-4:2010 was used to perform radiated emission test above 1 GHz.

For testing performed with the horn antenna. The measurement is performed with the EUT rotated 360°, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurement for both the horizontal and vertical antenna polarizations.

#### 4) The receiver was scanned from 9 kHz to 25 GHz. When an emission was found, the table was rotated to produce the maximum signal strength. An initial pre-scan was performed for in peak detection mode using the receiver. The EUT was measured for both the Horizontal and Vertical polarities and performed a pre-test three orthogonal planes. For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. The worst case emissions were reported.

### Used Test Equipment List:

3m Semi-Anechoic Chamber, EMI Test Receiver (9 kHz~7 GHz), Signal and Spectrum Analyzer (10 Hz~40 GHz), Loop antenna (9 kHz-30 MHz). TRILOG Super Broadband test Antenna(30 MHz-3 GHz) (RX), Bouble-Ridged Waveguide Horn Antenna (800 MHz-18 GHz)(RX) and High Frequency Antenna & preamplifier(18 GHz~26.5 GHz) (RX). Refer to Clause 5 Test Equipment List for details.

### 9 kHz~30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement

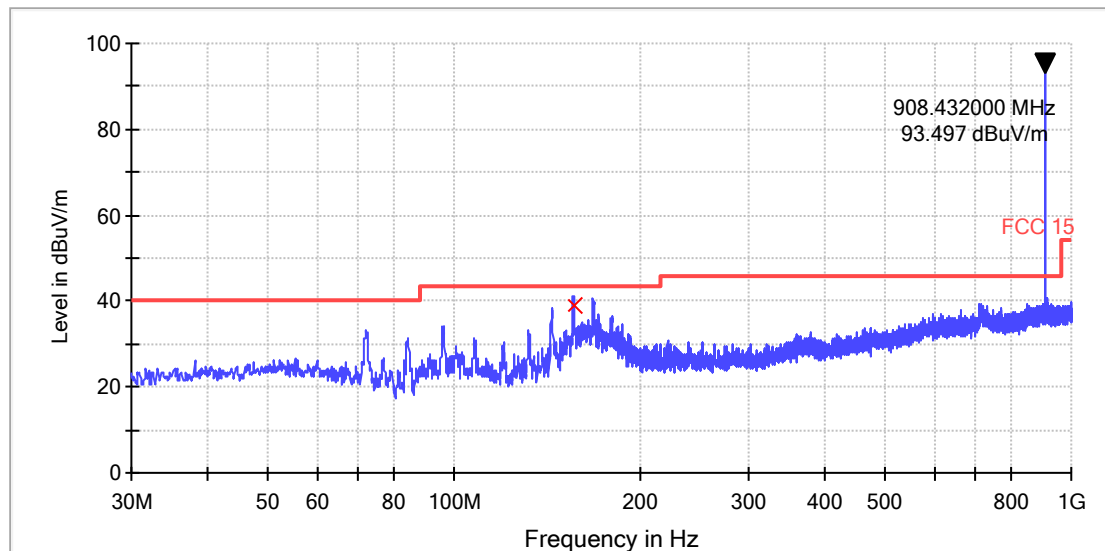
The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report.

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### Radiated Emissions (Below 1GHz)

Operation Frequency: 908.4MHz

Horizontal



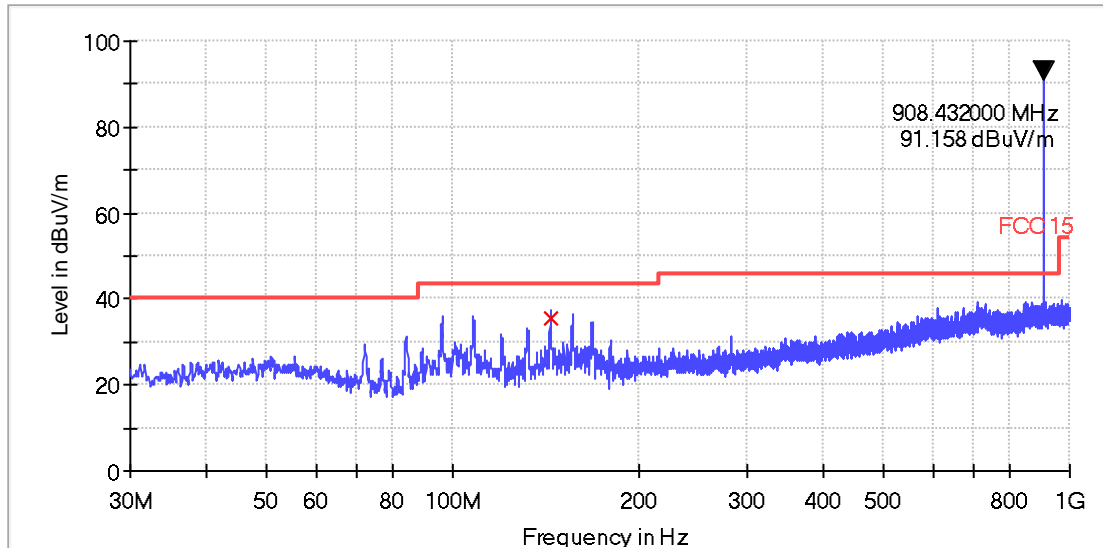
Frequency (MHz)	QP Reading (dBμV)	Correction Factor (dB)	QP Net at 3m (dBμV/m)	QP Limit at 3m (dBμV/m)	Margin (dB)
156.00	23.4	15.5	38.9	43.5	-4.6

Frequency (MHz)	PK Reading (dBμV)	Correction Factor (dB)	PK Net at 3m (dBμV/m)	QP Limit at 3m (dBμV/m)	Margin (dB)
908.43	62.3	31.3	93.5	94.0	-0.5

1. All measurements were made at 3 meter.
2. Negative value in the margin column shows emission below limit.
3. When Peak emission level was below QP limit, the QP emission level was not recorded.
4. Corr. (dB) = Antenna Factor (dB) + Cable Loss (dB)
5. Quasi Peak (dBμV/m) = Corr. (dB) + Read Level (dBμV)
6. Margin (dB) = Peak/QP (dBμV/m)-Limit QPK (dBμV/m)

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Vertical



Frequency (MHz)	QP Reading (dBμV)	Correction Factor (dB)	QP Net at 3m (dBμV/m)	QP Limit at 3m (dBμV/m)	Margin (dB)
143.96	20.1	15.5	35.6	43.5	-7.9

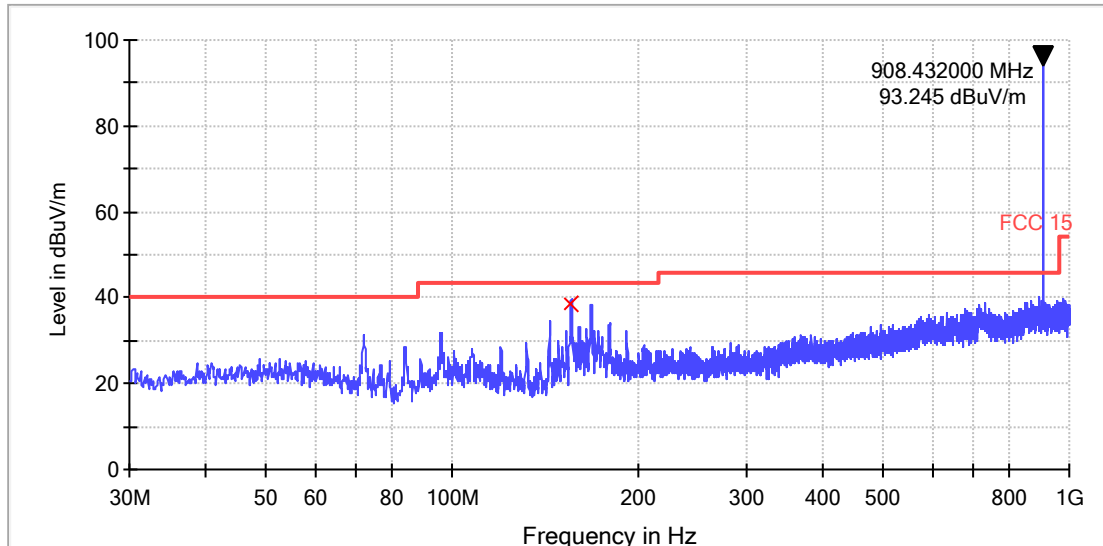
Frequency (MHz)	PK Reading (dBμV)	Correction Factor (dB)	PK Net at 3m (dBμV/m)	QP Limit at 3m (dBμV/m)	Margin (dB)
908.43	59.9	31.3	91.2	94.0	-2.8

1. All measurements were made at 3 meter.
2. Negative value in the margin column shows emission below limit.
3. When Peak emission level was below QP limit, the QP emission level was not recorded.
4. Corr. (dB) = Antenna Factor (dB) + Cable Loss (dB)
5. Quasi Peak (dBμV/m) = Corr. (dB) + Read Level (dBμV)
6. Margin (dB) = Peak/QP (dBμV/m)-Limit QPK (dBμV/m)

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Operation Frequency: 908.42MHz

Horizontal



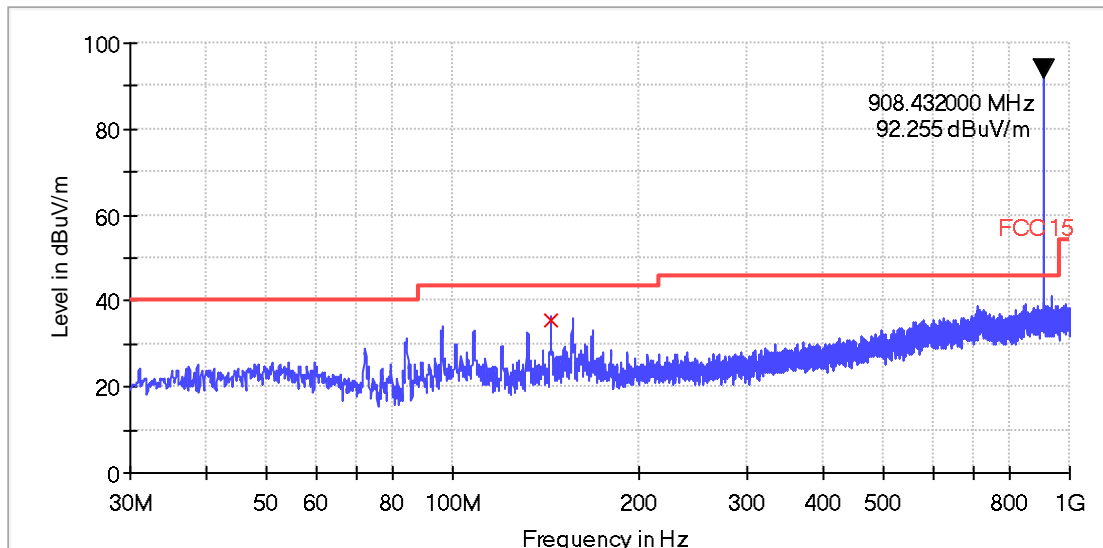
Frequency (MHz)	QP Reading (dBμV)	Correction Factor (dB)	QP Net at 3m (dBμV/m)	QP Limit at 3m (dBμV/m)	Margin (dB)
155.92	23.5	15.5	39.0	43.5	-4.5

Frequency (MHz)	PK Reading (dBμV)	Correction Factor (dB)	PK Net at 3m (dBμV/m)	QP Limit at 3m (dBμV/m)	Margin (dB)
908.43	61.9	31.3	93.2	94.0	-0.8

1. All measurements were made at 3 meter.
2. Negative value in the margin column shows emission below limit.
3. When Peak emission level was below QP limit, the QP emission level was not recorded.
4. Corr. (dB) = Antenna Factor (dB) + Cable Loss (dB)
5. Quasi Peak (dBμV/m) = Corr. (dB) + Read Level (dBμV)
6. Margin (dB) = Peak/QP (dBμV/m)-Limit QPK (dBμV/m)

## TEST REPORT

Vertical



Frequency (MHz)	QP Reading (dBμV)	Correction Factor (dB)	QP Net at 3m (dBμV/m)	QP Limit at 3m (dBμV/m)	Margin (dB)
144.28	20.5	15.1	35.6	43.5	-7.9

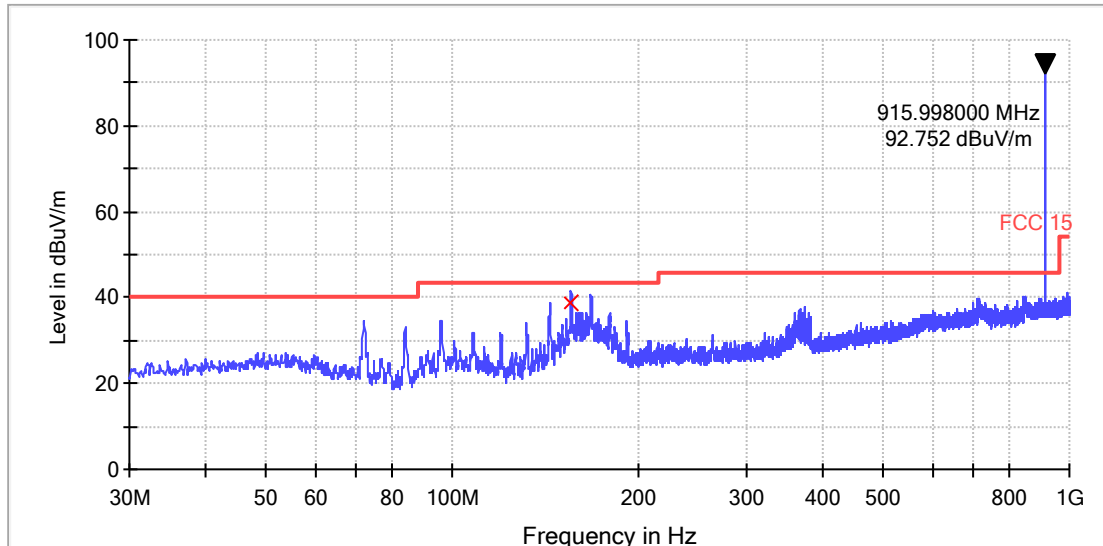
Frequency (MHz)	PK Reading (dBμV)	Correction Factor (dB)	PK Net at 3m (dBμV/m)	QP Limit at 3m (dBμV/m)	Margin (dB)
908.43	61.0	31.3	92.3	94.0	-1.7

1. All measurements were made at 3 meter.
2. Negative value in the margin column shows emission below limit.
3. When Peak emission level was below QP limit, the QP emission level was not recorded.
4. Corr. (dB) = Antenna Factor (dB) + Cable Loss (dB)
5. Quasi Peak (dBμV/m) = Corr. (dB) + Read Level (dBμV)
6. Margin (dB) = Peak/QP (dBμV/m)-Limit QPK (dBμV/m)

## TEST REPORT

Operation Frequency: 916.00MHz

Horizontal



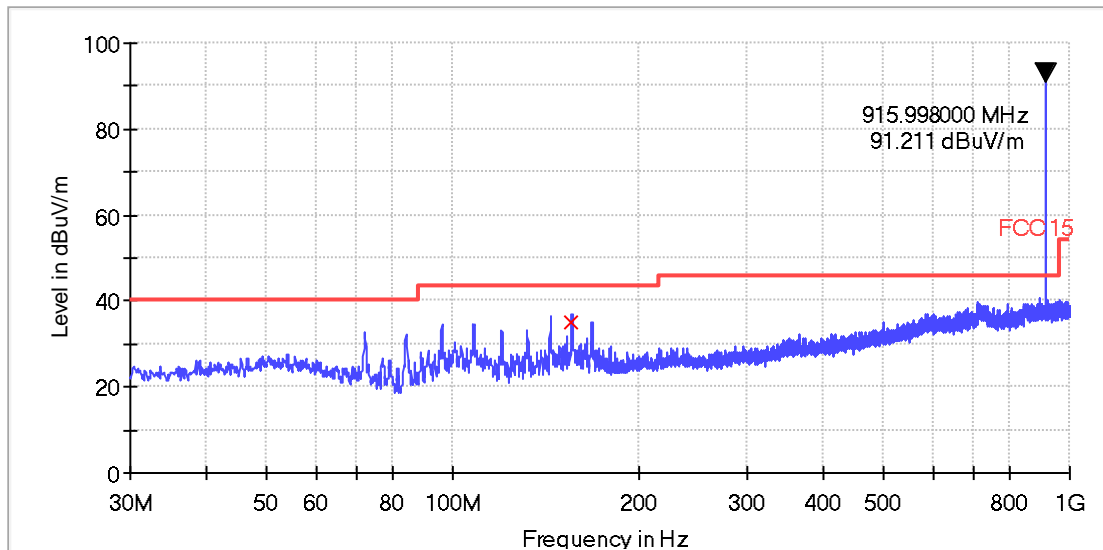
Frequency (MHz)	QP Reading (dBμV)	Correction Factor (dB)	QP Net at 3m (dBμV/m)	QP Limit at 3m (dBμV/m)	Margin (dB)
155.80	23.5	15.5	39.0	43.5	-4.5

Frequency (MHz)	PK Reading (dBμV)	Correction Factor (dB)	PK Net at 3m (dBμV/m)	QP Limit at 3m (dBμV/m)	Margin (dB)
916.00	61.4	31.4	92.8	94.0	-1.2

1. All measurements were made at 3 meter.
2. Negative value in the margin column shows emission below limit.
3. When Peak emission level was below QP limit, the QP emission level was not recorded.
4. Corr. (dB) = Antenna Factor (dB) + Cable Loss (dB)
5. Quasi Peak (dBμV/m) = Corr. (dB) + Read Level (dBμV)
6. Margin (dB) = Peak/QP (dBμV/m)-Limit QPK (dBμV/m)

## TEST REPORT

Vertical



Frequency (MHz)	QP Reading (dBμV)	Correction Factor (dB)	QP Net at 3m (dBμV/m)	QP Limit at 3m (dBμV/m)	Margin (dB)
155.92	19.3	15.5	34.8	43.5	-8.7

Frequency (MHz)	PK Reading (dBμV)	Correction Factor (dB)	PK Net at 3m (dBμV/m)	QP Limit at 3m (dBμV/m)	Margin (dB)
916.00	59.8	31.4	91.2	94.0	-2.8

1. All measurements were made at 3 meter.
2. Negative value in the margin column shows emission below limit.
3. When Peak emission level was below QP limit, the QP emission level was not recorded.
4. Corr. (dB) = Antenna Factor (dB) + Cable Loss (dB)
5. Quasi Peak (dBμV/m) = Corr. (dB) + Read Level (dBμV)
6. Margin (dB) = Peak/QP (dBμV/m)-Limit QPK (dBμV/m)



## TEST REPORT

### Radiated Emissions (Above 1GHz)

Operation Frequency: 908.4MHz:

Polarization	Frequency (MHz)	PK Reading (dBμV)	Correction Factor (dB)	PK Net at 3m (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	1816.800	77.5	-10.4	67.1	74.0	-6.9
Horizontal	2724.600	79.2	-6.9	72.3	74.0	-1.7
Horizontal	3633.600	67.5	-3.7	63.8	74.0	-10.2
Vertical	1816.800	97.5	-10.4	87.1	74.0	13.1
Vertical	2724.600	60.3	-6.9	53.4	74.0	-20.6

Polarization	Frequency (MHz)	PK Net at 3m (dBμV)	Correction Factor (dB)	QP Net at 3m (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	1816.800	67.1	-24.1	43.0	54.0	-11.0
Horizontal	2724.600	72.3	-24.1	48.2	54.0	-5.8
Horizontal	3633.600	63.8	-24.1	39.7	54.0	-14.3
Vertical	1816.800	87.1	-24.1	63.0	54.0	9.0
Vertical	2724.600	53.4	-24.1	29.3	54.0	-24.7

Operation Frequency: 908.42MHz:

Polarization	Frequency (MHz)	PK Reading (dBμV)	Correction Factor (dB)	PK Net at 3m (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	1816.800	77.5	-10.4	67.1	74.0	-6.9
Horizontal	2724.600	69.7	-6.9	62.8	74.0	-11.2
Horizontal	3633.600	60.2	-3.7	56.5	74.0	-17.5
Vertical	1816.800	75.7	-10.4	65.3	74.0	-8.7
Vertical	2724.600	63.3	-6.9	56.4	74.0	-17.6

Polarization	Frequency (MHz)	PK Net at 3m (dBμV)	Correction Factor (dB)	QP Net at 3m (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	1816.800	67.1	-24.1	43.0	54.0	-11.0
Horizontal	2724.600	62.8	-24.1	38.7	54.0	-15.3
Horizontal	3633.600	56.5	-24.1	32.4	54.0	-21.6
Vertical	1816.800	65.3	-24.1	41.2	54.0	-12.8
Vertical	2724.600	56.4	-24.1	32.3	54.0	-21.7

## TEST REPORT

Operation Frequency: 916MHz:

Polarization	Frequency (MHz)	PK Reading (dBμV)	Correction Factor (dB)	PK Net at 3m (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	1831.400	16.6	-10.4	6.2	74.0	-67.8
Horizontal	2747.100	52.6	-6.8	45.8	74.0	-28.2
Horizontal	3664.000	53.1	-3.6	49.5	74.0	-24.5
Vertical	1831.300	67.8	-10.4	57.4	74.0	-16.6
Vertical	5498.900	50.2	0.0	50.2	74.0	-23.8

Polarization	Frequency (MHz)	PK Net at 3m (dBμV)	Correction Factor (dB)	QP Net at 3m (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
Horizontal	1831.400	6.2	-24.1	-17.9	54.0	-71.9
Horizontal	2747.100	45.8	-24.1	21.7	54.0	-32.3
Horizontal	3664.000	49.5	-24.1	25.4	54.0	-28.6
Vertical	1831.300	57.4	-24.1	33.3	54.0	-20.7
Vertical	5498.900	50.2	-24.1	26.1	54.0	-27.9

- Notes:
1. AT frequencies equal to or less than 1000MHz, quasi-peak detector was used, above 1000MHz, Peak detector was used.
  2. All measurements were made at 3 meter.
  3. Negative value in the margin column shows emission below limit.
  4. Horn antenna is used for the emission over 1000MHz.

### 4.4 Band Edges Requirement

Test Requirement: FCC PART 15 C section 15.249 (d)  
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

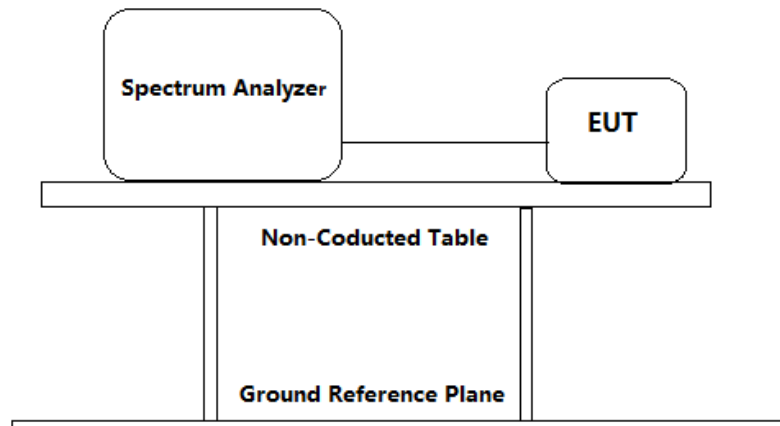
Frequency Band: 902 MHz to 928 MHz

Test Method: ANSI C63.10: Clause 6.10

Test Status: Pre-Scan has been radiated to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). The lowest, middle and the highest channels were selected for the final test as listed below.

Test Configuration:

## TEST REPORT



### Used Test Equipment List:

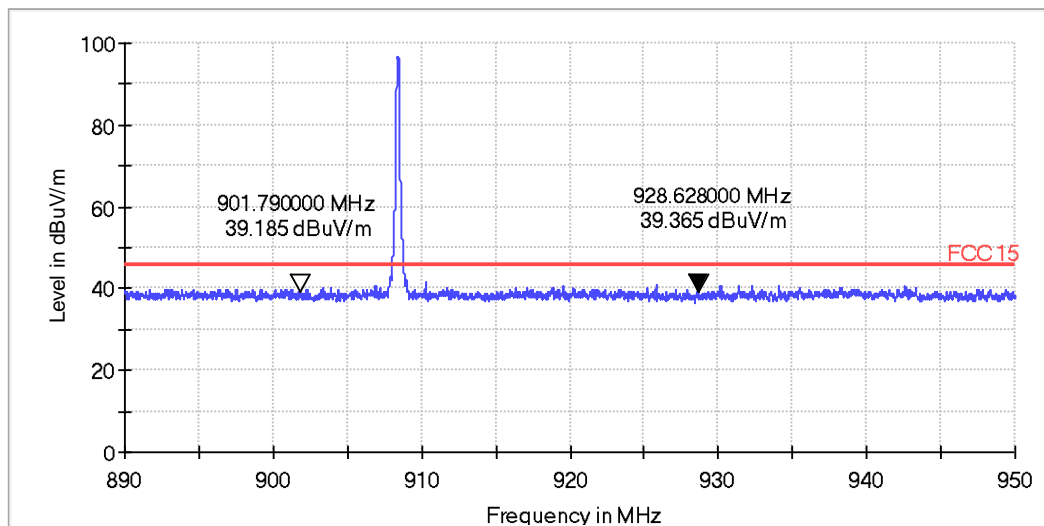
3m Semi-Anechoic Chamber, EMI Test Receiver (9 kHz~7 GHz), Signal and Spectrum Analyzer (10 Hz~40 GHz), Loop antenna (9 kHz-30 MHz). TRILOG Super Broadband test Antenna(30 MHz-3 GHz) (RX), Double-Ridged Waveguide Horn Antenna (800 MHz-18 GHz)(RX) and High Frequency Antenna & preamplifier(18 GHz~26.5 GHz) (RX). Refer to Clause 5 Test Equipment List for details.

## TEST REPORT

Test result with plots as follows:

Operation Frequency (908.4 MHz):

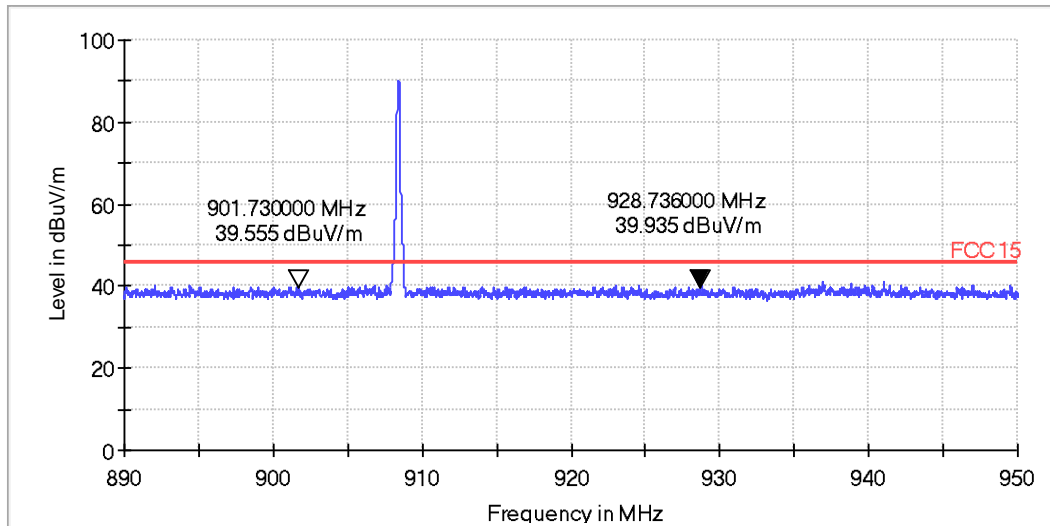
Horizontal



Frequency (MHz)	PK Reading (dBμV)	Correction Factor (dB)	PK Net at 3m (dBμV/m)	QP Limit at 3m (dBμV/m)	Margin (dB)
901.79	7.9	31.3	39.2	46.0	-6.8
928.63	8.0	31.4	39.4	46.0	-6.6

## TEST REPORT

Vertical

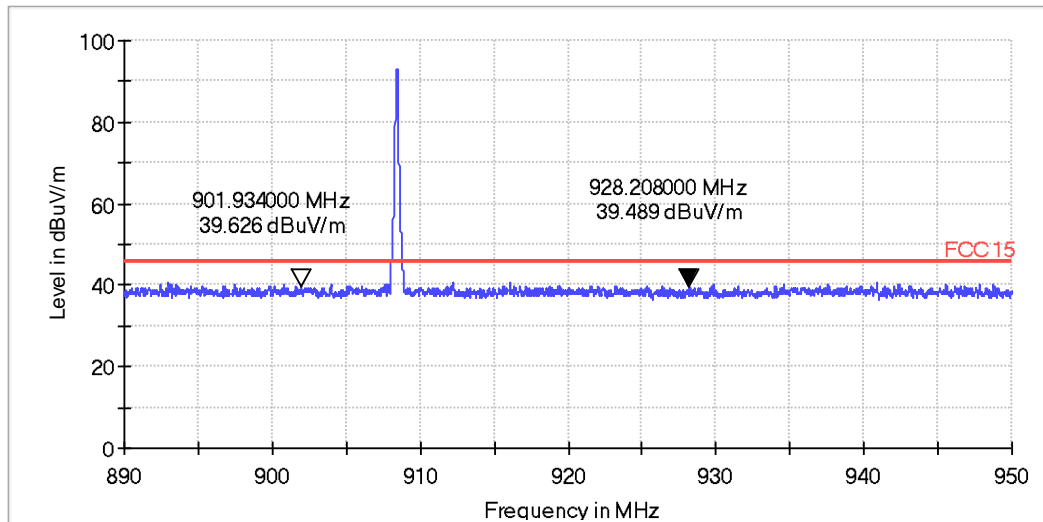


Frequency (MHz)	PK Reading (dBμV)	Correction Factor (dB)	PK Net at 3m (dBμV/m)	QP Limit at 3m (dBμV/m)	Margin (dB)
901.73	8.3	31.3	39.6	46.0	-6.4
928.74	6.1	31.4	39.9	46.0	-6.1

## TEST REPORT

Operation Frequency (908.42 MHz):

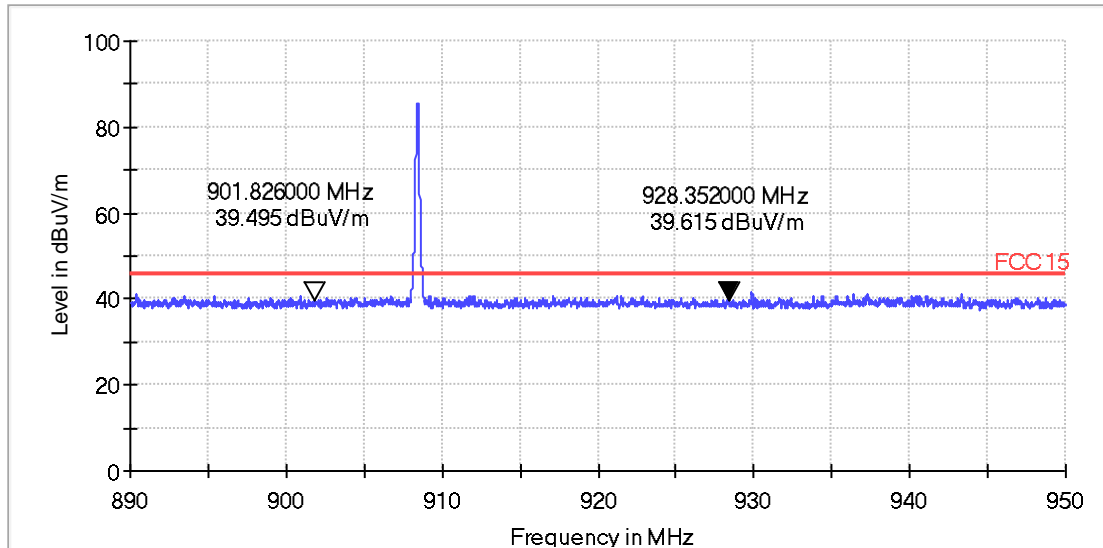
Horizontal



Frequency (MHz)	PK Reading (dBμV)	Correction Factor (dB)	PK Net at 3m (dBμV/m)	QP Limit at 3m (dBμV/m)	Margin (dB)
901.93	8.3	31.3	39.6	46.0	-6.4
928.21	8.1	31.4	39.5	46.0	-6.5

## TEST REPORT

Vertical

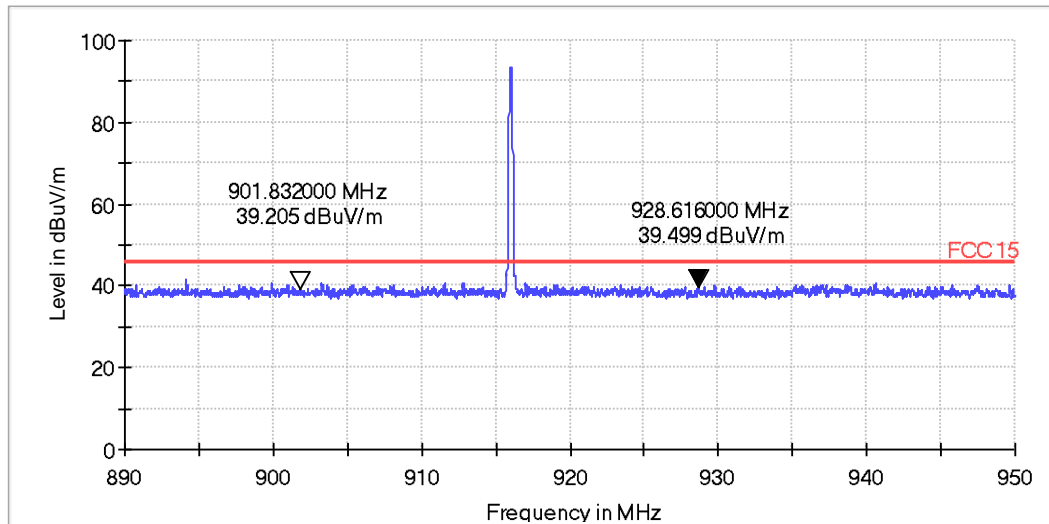


Frequency (MHz)	PK Reading (dBμV)	Correction Factor (dB)	PK Net at 3m (dBμV/m)	QP Limit at 3m (dBμV/m)	Margin (dB)
901.83	8.2	31.3	39.5	46.0	-6.5
928.35	8.2	31.4	39.6	46.0	-6.4

## TEST REPORT

Operation Frequency (916 MHz):

Horizontal

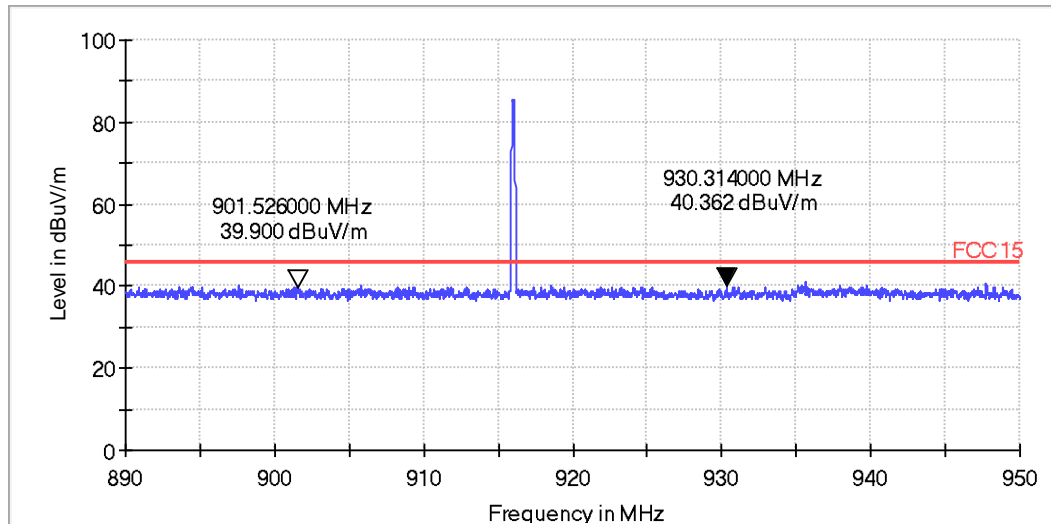


Frequency (MHz)	PK Reading (dBμV)	Correction Factor (dB)	PK Net at 3m (dBμV/m)	QP Limit at 3m (dBμV/m)	Margin (dB)
901.83	7.9	31.3	39.2	46.0	-6.8
928.62	8.1	31.4	39.5	46.0	-6.5



## TEST REPORT

Vertical



Frequency (MHz)	PK Reading (dBμV)	Correction Factor (dB)	PK Net at 3m (dBμV/m)	QP Limit at 3m (dBμV/m)	Margin (dB)
901.53	8.6	31.3	39.9	46.0	-6.1
930.31	9.0	31.4	40.4	46.0	-5.6

1. All measurements were made at 3 meter.
2. Negative value in the margin column shows emission below limit.
3. When Peak emission level was below QP limit, the QP emission level was not recorded.
4. Corr. (dB) = Antenna Factor (dB) + Cable Loss (dB)
5. Peak (dBμV/m) = Corr. (dB) + Read Level (dBμV)
6. Margin (dB) = Peak (dBμV/m)-Limit QPK (dBμV/m)

### 4.5 Conducted Emissions at Mains Terminals

Test result:N/A

## TEST REPORT

### 5.0 Test Equipment List

#### Radiated Emission/Radio

Equipment No.	Equipment	Model	Manufacturer	Cal. Due date (YYYY-MM-DD)	Calibration Interval
EM030-04	3m Semi-Anechoic Chamber	9×6×6 m <sup>3</sup>	ETS•LINDGRE N	2024-04-10	1Y
EM031-02	EMI Test Receiver (9 kHz~7 GHz)	R&S ESR7	R&S	2023-11-15	1Y
EM031-03	Signal and Spectrum Analyzer (10 Hz~40 GHz)	R&S FSV40	R&S	2023-11-15	1Y
EM011-04	Loop antenna (9 kHz-30 MHz)	HFH2-Z2	R&S	2023-06-27	1Y
EM061-03	TRILOG Super Broadband test Antenna (30 MHz-1.5 GHz) (TX)	VULB 9161	SCHWARZBECK	2024-05-14	1Y
EM033-01	TRILOG Super Broadband test Antenna(30 MHz-3 GHz) (RX)	VULB 9163	SCHWARZBECK	2023-12-04	1Y
EM033-02	Bouble-Ridged Waveguide Horn Antenna (800 MHz-18 GHz)(RX)	R&S HF907	R&S	2023-06-26	1Y
EM033-03	High Frequency Antenna & preamplifier(18 GHz~26.5 GHz) (RX)	R&S SCU-26	R&S	2024-04-22	1Y
EM033-04	High Frequency Antenna & preamplifier (26 GHz-40 GHz)	R&S SCU-40	R&S	2024-04-22	1Y
EM031-02-01	Coaxial cable(9 kHz-1 GHz)	N/A	R&S	2024-04-10	1Y
EM033-02-02	Coaxial cable(1 GHz-18 GHz)	N/A	R&S	2024-04-10	1Y
EM033-04-02	Coaxial cable(18 GHz~40 GHz)	N/A	R&S	2024-04-22	1Y
EM031-01	Signal Generator (9 kHz~6 GHz)	SMB100A	R&S	2023-07-17	1Y
EM040-01	Band Reject/Notch Filter	WRHFV	Wainwright	N/A	1Y
EM040-02	Band Reject/Notch Filter	WRCGV	Wainwright	N/A	1Y
EM040-03	Band Reject/Notch Filter	WRCGV	Wainwright	N/A	1Y
EM022-03	2.45 GHz Filter	BRM50702	Micro-Tronics	2024-05-09	1Y
SA016-29	Climatic Test Chamber	MHU-80L	JIANQIAO	2024-01-03	1Y
SA012-74	Digital Multimeter	FLUKE175	FLUKE	2023-10-07	1Y
EM010-01	Regulated DC Power supply	PAB-3003A	GUANHUA	N/A	1Y
SA040-22	Regulated DC Power supply	IT6721	ITECH	2023-09-04	1Y
EM046-05	Power meter	NPR6A	R&S	2024-04-19	1Y
EM046-06	Power meter	NPR6A	R&S	2024-04-19	1Y
EM045-01-01	EMC32 software (RE/RS)	V10.01.00	R&S	N/A	N/A
EM045-01-09	EMC32 software (328/893)	V9.26.01	R&S	N/A	N/A

\*\*\*\*\*End of the test report\*\*\*\*\*