RF TEST REPORT

Report No.:	SET2016-12622
Product Name:	Connected Handheld RFID Reader
FCC ID:	P65ALR-H450B
IC:	4370A-ALRH450B
Model No. :	ALR-H450
Applicant:	Alien Technology, LLC
Address：	845 Embedded Way, San Jose, CA 95138-1030, United States
Dates of Testing:	06/20/2016 — 06/29/2016
Issued by:	CCIC-SET
Lab Location:	Electronic Testing Building, Shahe Road, Xili, Nanshan District, Shenzhen, 518055, P. R. China **Tel:** 86 755 26627338 **Fax:** 86 755 26627238

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Test Report

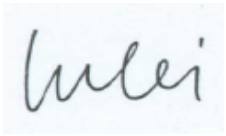
Product Name.....:	Connected Handheld RFID Reader
Brand Name.....:	ALIEN
Trade Name.....:	ALIEN®
Applicant.....:	Alien Technology, LLC
Applicant Address.....:	845 Embedded Way, San Jose, CA 95138-1030, United States
Manufacturer.....:	Alien Technology, LLC
Manufacturer Address .....:	845 Embedded Way, San Jose, CA 95138-1030, United States
Test Standards.....:	47 CFR Part 15 Subpart C 2013：Radio Frequency Devices ANSI C63.10:2013：American National Standard for Testing Unlicensed Wireless Devices RSS-247:Issue 1,December2015 / RSS-GEN Issue 4, November 2014 DA 00-705: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
Test Result.....:	PASS
Tested by .....:	 2016.06.30 Lu Lei， Test Engineer
Reviewed by .....:	 2016.06.30 Zhu Qi, Senior Engineer
Approved by .....:	 2016.06.30 Wu Li'an, Manager

Table of contents

Change History		
Issue	Date	Reason for change
1.0	2016.06.30	First edition

1. General Information

1.1. EUT Description

EUT Type	Connected Handheld RFID Reader
Hardware Version	C4050_MB_V5.0
Software Version	V1.0.0_10040006582_20151221
Power Supply	5.0Vdc(adapter or host equipment) 3.7Vdc(Li-ion battery)
Frequency Range	902MHz~928MHz
Operating Range	902.75MHz~927.25MHz
Number of channel	50
Modulation Type	PR-ASK
Antenna Type	PATCH Antenna
Antenna Gain	1.8dBi

1.2. Test Standards and Results

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

No.	Identity	Document Title
1	47 CFR Part 15 Subpart C 2013	Radio Frequency Devices
2	ANSI C63.10 2013	American National Standard for Testing Unlicensed Wireless Devices
3	RSS-GEN: Issue 4,November 2014	General Requirements and Information for the Certification of Radio Apparatus
4	RSS-247:Issue 1,December2015:	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

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

No.	Standard(s) Section		Description	Result
	FCC	IC		
1	15.203	8.3	Antenna Requirement	PASS
2	15.247(a)	RSS-247 Issue1 - 5.1	Number of Hopping Frequency	PASS
3	15.247(b)	RSS-247 Issue1 - 5.4	Peak Output Power	PASS
4	15.247(a)	RSS-247 Issue1 - 5.1	Bandwidth	PASS
5	15.247(a)	RSS-247 Issue1 - 5.1	Carrier Frequency Separation	PASS
6	15.247(a)	RSS-247 Issue1 - 5.1	Time of Occupancy (Dwell time)	PASS
7	15.247(d)	RSS-247 Issue1 - 5.5	Conducted Spurious Emission	PASS
8	15.247(d)	RSS-247 Issue1 - 5.5 RSS - Gen	Conducted Band Edge	PASS
9	15.207	RSS-GEN	Conducted Emission	PASS
10	15.209 15.247(c)	RSS-247 Issue1 - 5.5 RSS - Gen	Radiated Band Edges and Spurious Emission	PASS

Note 1: The test of Radiated Emission was performed according to the method of measurements prescribed in ANSI C63.10 2013.

1.3. Description of Test Mode

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

Test channel: 1channel, 26 channel, 50channel

1.4. Facilities and Accreditations

1.4.1. Facilities

CNAS-Lab Code: L1659

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. CCIC is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L1659. A 12.8*6.8*6.4 (m) fully anechoic chamber was used for the radiated spurious emissions test.

FCC-Registration No.: 406086

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 406086, valid time is until October 28, 2017.

IC-Registration No.: 11185A-1

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 11185A-1 on July. 15, 2013, valid time is until July. 15, 2016.

1.4.2. Test Environment Conditions

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

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

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.

And according to FCC 47 CFR Section 15.247(c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

2.1.2. Antenna Information

Antenna Category: PATCH Antenna

A PATCH Antenna was soldered to the antenna port of EUT via an adaptor cable, can't be removed.

Antenna General Information:

No.	EUT	Ant. Type	Gain(dBi)
1	Connected Handheld RFID Reader	Internal	1.8

2.1.3. Result: comply

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

2.2. Number of Hopping Frequency

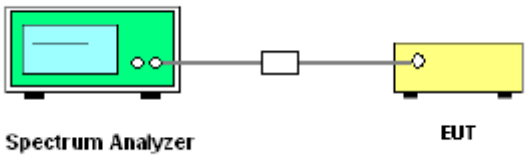
2.2.1. Limit of Number of Hopping Frequency

Frequency hopping systems operating in the 902MHz to 928MHz bands shall use at least 50 hopping frequencies.

2.2.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.2.3. Test Setup



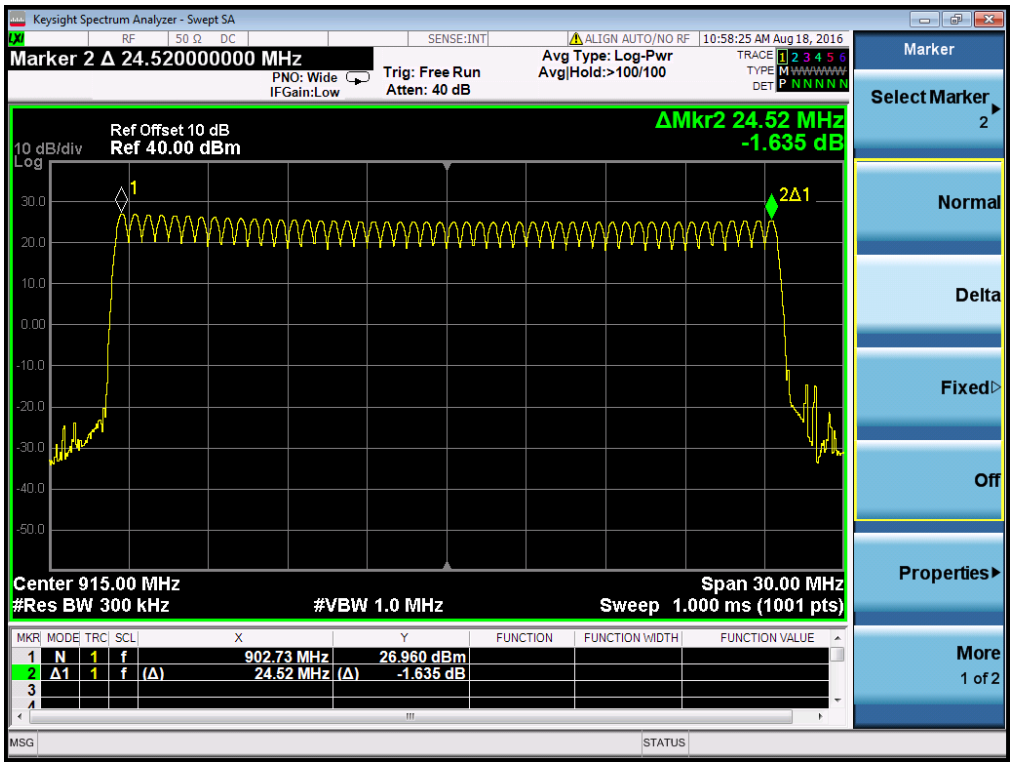
2.2.4. Test Procedure

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = the frequency band of operation; RBW≥100KHz; VBW≥RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. The number of hopping frequency used is defined as the number of total channel.
7. Record the measurement data derived from spectrum analyzer.

2.2.5. Test Results of Number of Hopping Frequency

Frequency (MHz)	Measured Channel Numbers	Min. Limit	Verdict
902 - 928	50	50	PASS

2.2.6. Test Results (plots) of Number of Hopping Frequency



2.3. Peak Output Power

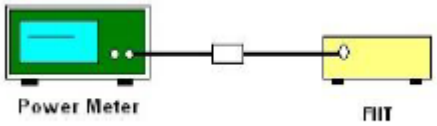
2.3.1. Limit of Peak Output Power

Section 15.247 (B)(2) For frequency hopping systems operating in the 902~928MHz band:1watt for systems employing at least 50 hopping channels.

2.3.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.3.3. Test Setup

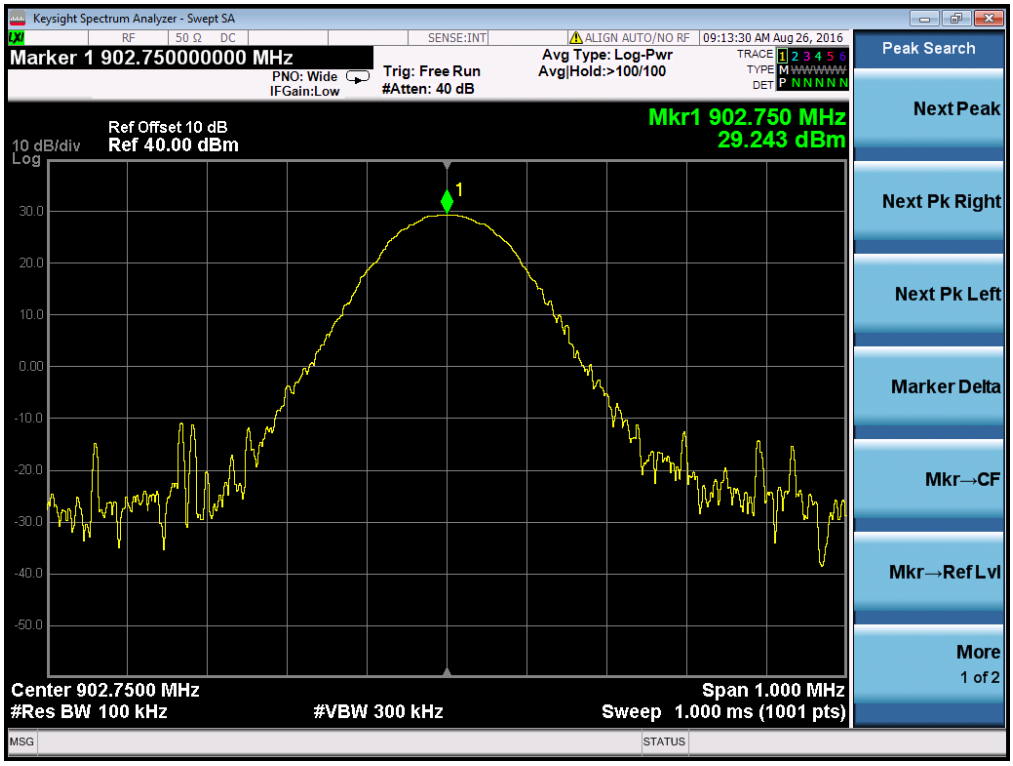


2.3.4. Test Procedures

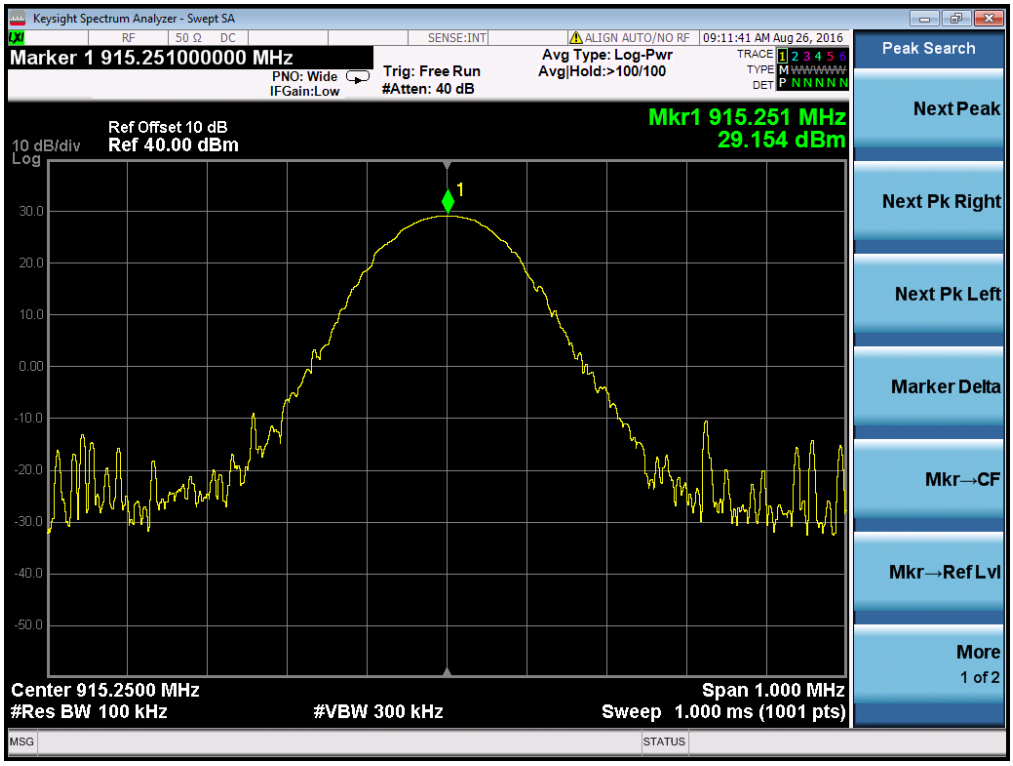
1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power with cable loss and record the results in the test report.
5. Measure and record the results in the test report.

2.3.5. Test Result of Output Power

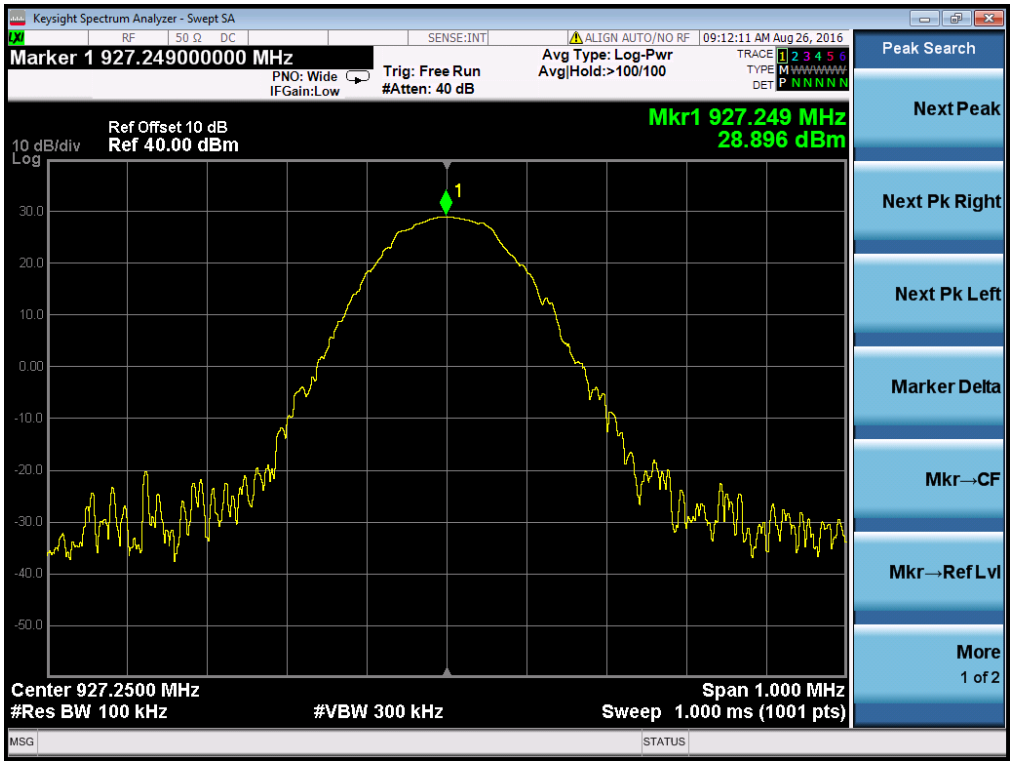
Channel	Frequency (MHz)	Measured Output Peak Power (dBm)	Limit (dBm)	Verdict
1	902.75	29.243	30	PASS
26	915.25	29.154		PASS
50	927.25	28.896		PASS



1 channel



26 channel



50 channel

2.4. Bandwidth

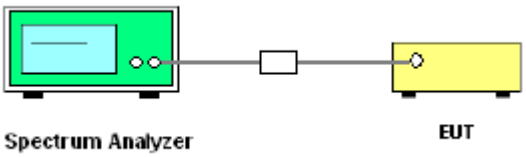
2.4.1. Definition

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.

2.4.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.4.3. Test Setup



2.4.4. Test Procedure

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.

   Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel;

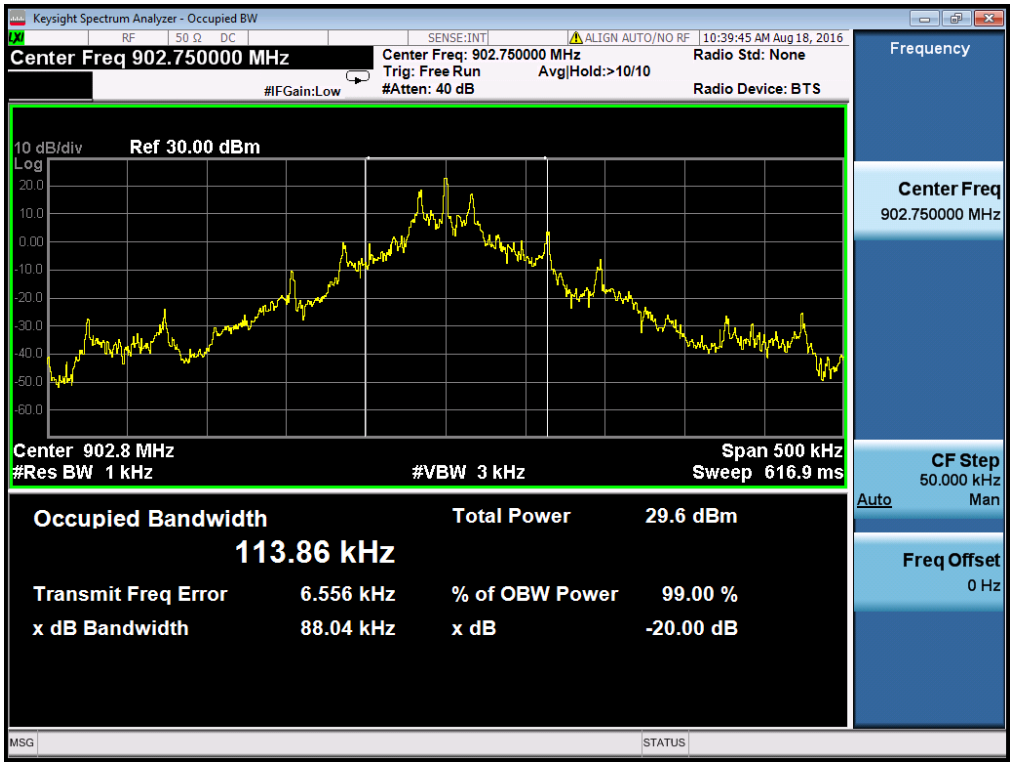
   RBW≥1% of the 20 dB bandwidth; VBW≥RBW; Sweep = auto; Detector function = peak;

   Trace = max hold.
5. Measure and record the results in the test report.

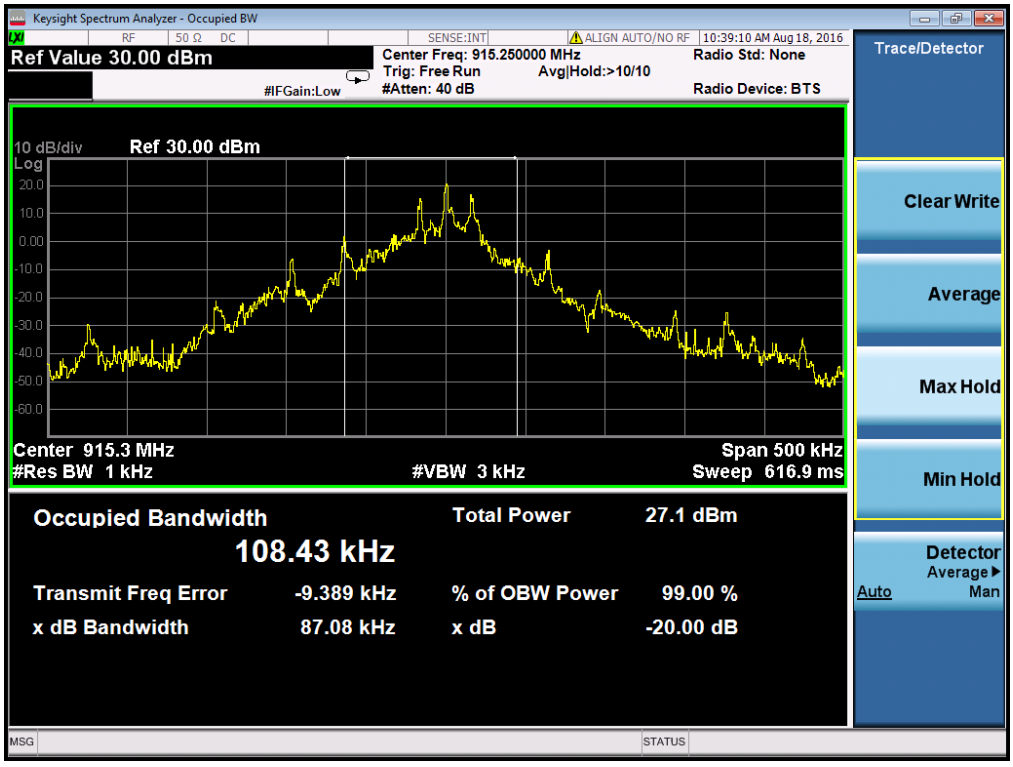
2.4.5. Test Results of 20dB Bandwidth

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% bandwidth (MHz)
1	902.75	88.04	113.86
26	915.25	87.08	108.43
50	927.25	85.40	111.06

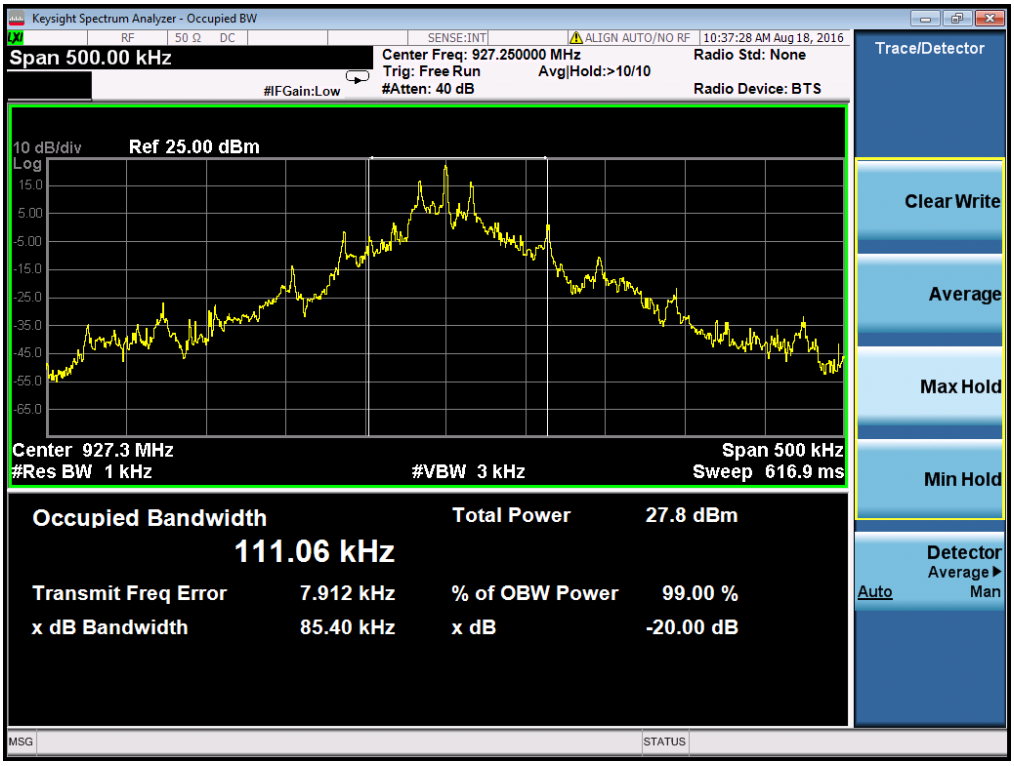
2.4.6. Test Results (plots) of Bandwidth



1 channel



26 channel


Keysight Spectrum Analyzer - Occupied BW
RF
50 Ω DC
SENSE:INT
ALIGN AUTO/NO RF
10:37:28 AM Aug 18, 2016
Span 500.00 kHz
Center Freq: 927.250000 MHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 40 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
Trace/Detector
10 dB/div
Log
Ref 25.00 dBm
15.0
5.00
-5.00
-15.0
-25.0
-35.0
-45.0
-55.0
-65.0
Center 927.3 MHz
#Res BW 1 kHz
#VBW 3 kHz
Span 500 kHz
Sweep 616.9 ms
Occupied Bandwidth
111.06 kHz
Total Power
27.8 dBm
Transmit Freq Error
7.912 kHz
% of OBW Power
99.00 %
x dB Bandwidth
85.40 kHz
x dB
-20.00 dB
Clear Write
Average
Max Hold
Min Hold
Detector
Average
Auto
Man
MSG
STATUS

50 channel

2.5. Carried Frequency Separation

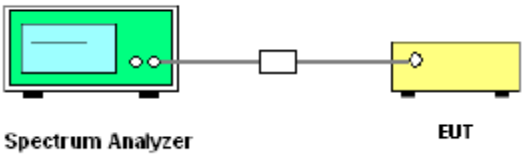
2.5.1. Limit of Carried Frequency Separation

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.

2.5.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.5.3. Test Setup



2.5.4. Test Procedure

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.

2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

3. Set to the maximum power setting and enable the EUT transmit continuously.

4. Enable the EUT hopping function.

5. Use the following spectrum analyzer settings:

   Span = wide enough to capture the peaks of two adjacent channels; RBW≥1% of the span;

   VBW≥RBW; Sweep = auto; Detector function = peak; Trace = max hold.

6. Measure and record the results in the test report.

2.5.5. Test Results of Carried Frequency Separation

Frequency Separation(kHz)	(2/3 of 20dB BW) Limits (kHz)	Verdict
500	58.69	PASS
500	58.05	PASS
500	56.93	PASS

2.5.6. Test Results (plots) of Carried Frequency Separation

L channel

M channel

H channel

2.6. Dwell time

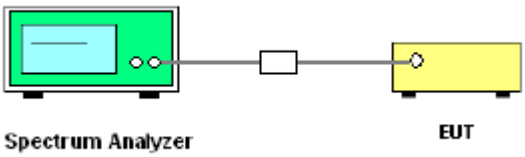
2.6.1. Limit of Dwell Time

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

2.6.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.6.3. Test Setup



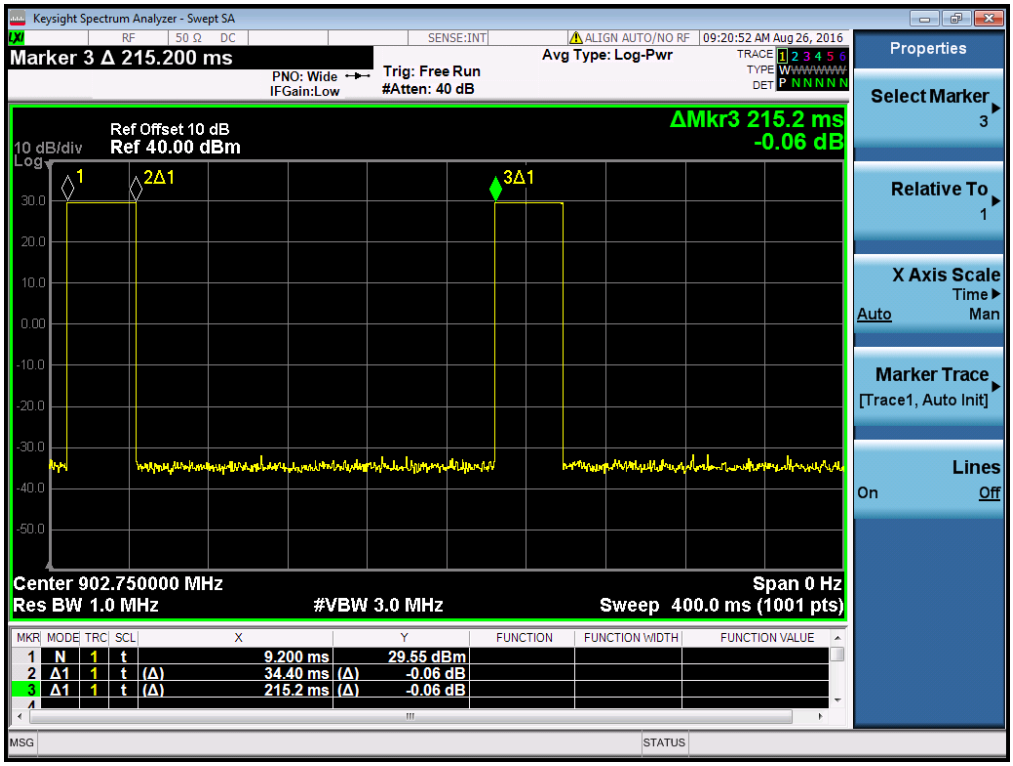
2.6.4. Test Procedure

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW = 1 MHz; VBW≥RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

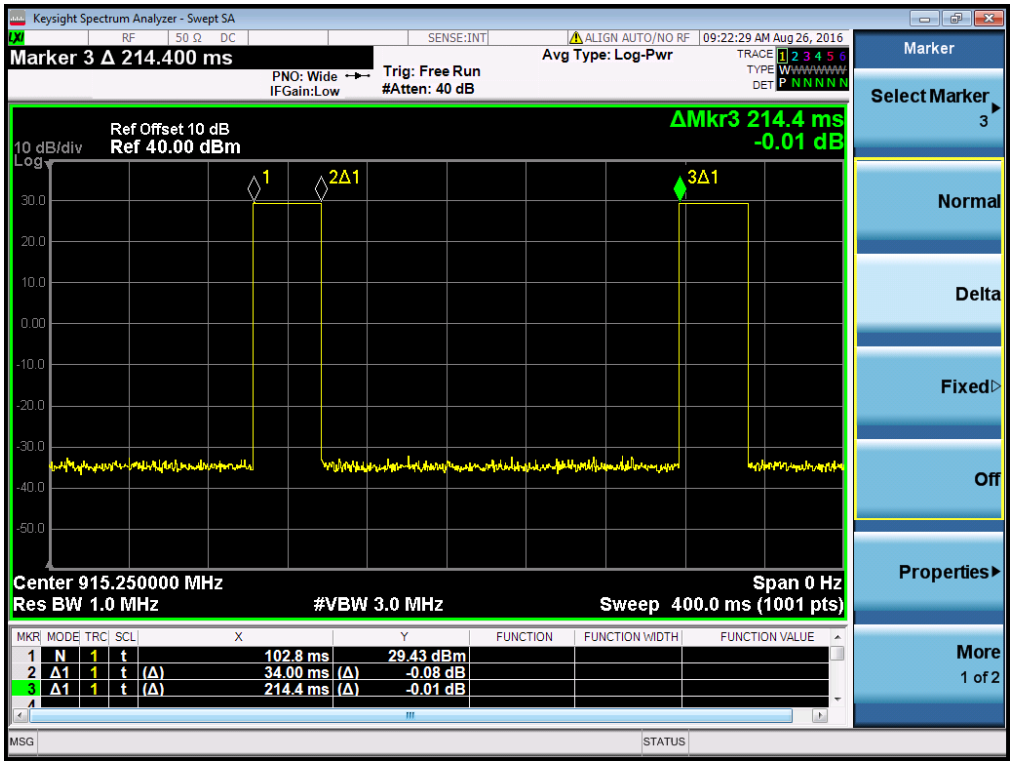
2.6.5. Test Results of Dwell Time

Modulation	Frequency（MHz）	Dwell Time (ms)	Limit (ms)	Verdict
FHSS	902.75	34.40	400	PASS
	915.25	34.00		PASS
	927.25	34.00		PASS

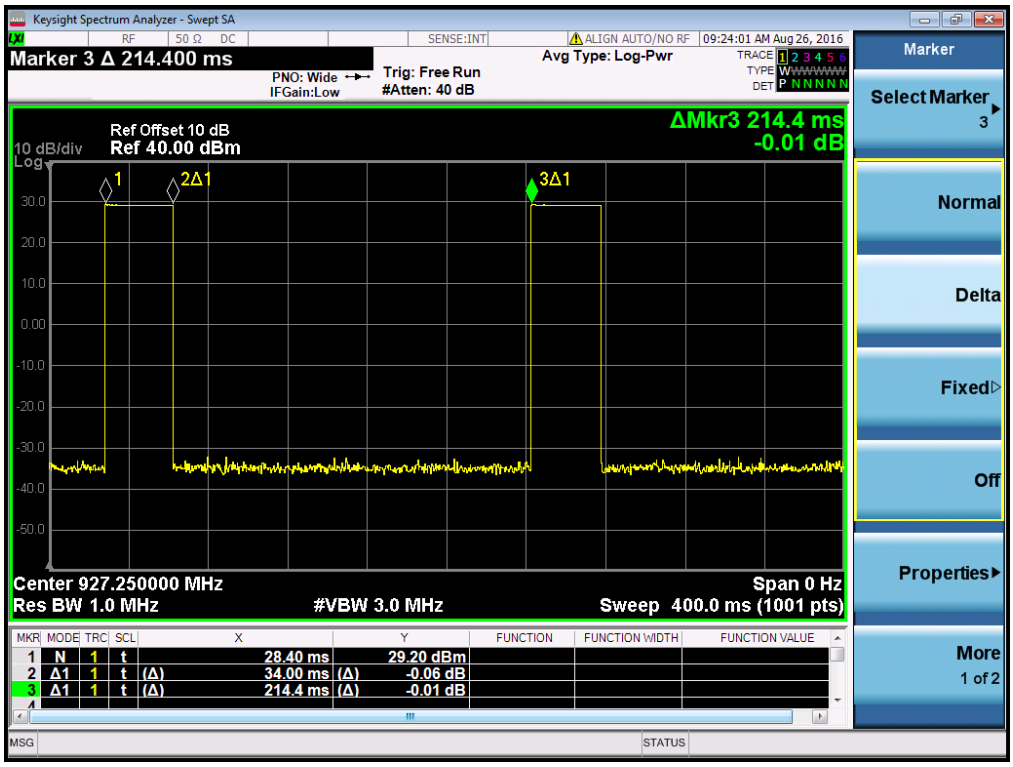
2.6.6. Test Results (plots) of Dwell Time



L channel



M channel


Keysight Spectrum Analyzer - Swept SA
Marker 3 Δ 214.400 ms
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 40 dB
Avg Type: Log-Pwr
09:24:01 AM Aug 26, 2016
Ref Offset 10 dB
10 dB/div
Ref 40.00 dBm
ΔMkr3 214.4 ms
-0.01 dB
Center 927.250000 MHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 400.0 ms (1001 pts)
1 N 1 t 28.40 ms 29.20 dBm
2 Δ1 1 t (Δ) 34.00 ms (Δ) -0.06 dB
3 Δ1 1 t (Δ) 214.4 ms (Δ) -0.01 dB
Marker
Select Marker 3
Normal
Delta
Fixed
Off
Properties
More 1 of 2

H channel

2.7. Conducted Spurious Emissions

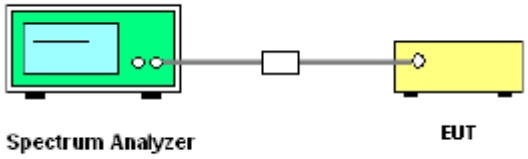
2.7.1. Limit of Spurious Emission

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

2.7.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.7.3. Test Setup



2.7.4. Test Procedure

1. The testing follows the guidelines in Spurious RF Conducted Emissions of FCC Public Notice DA 00-705 Measurement Guidelines

2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

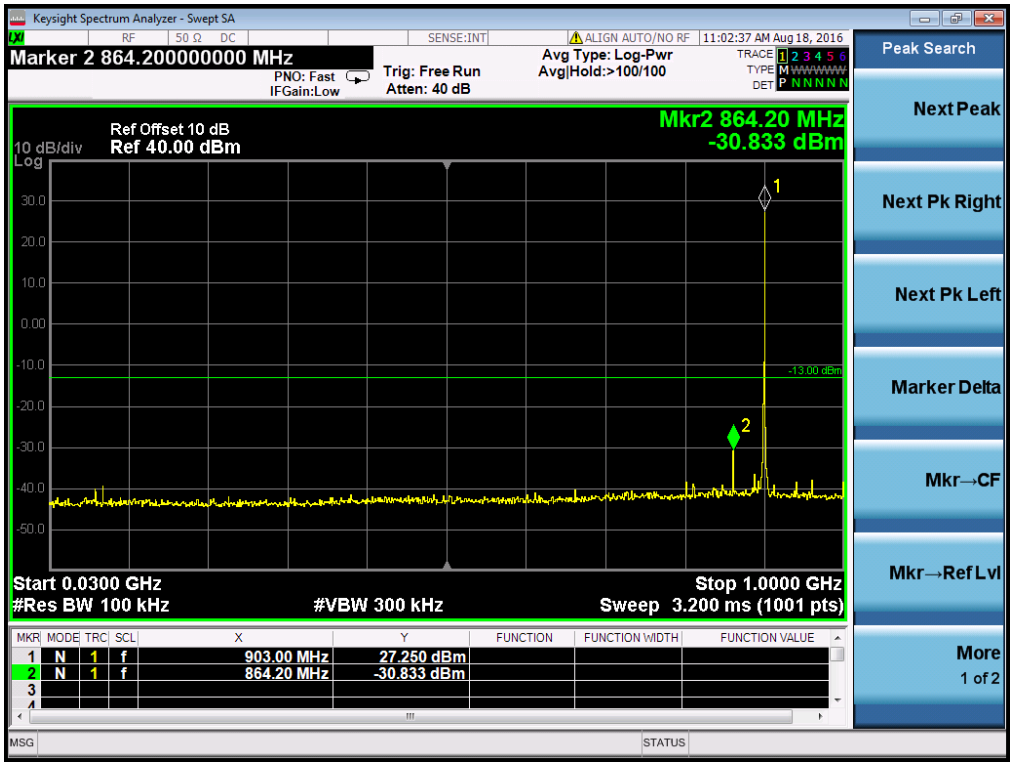
3. Set to the maximum power setting and enable the EUT transmit continuously.

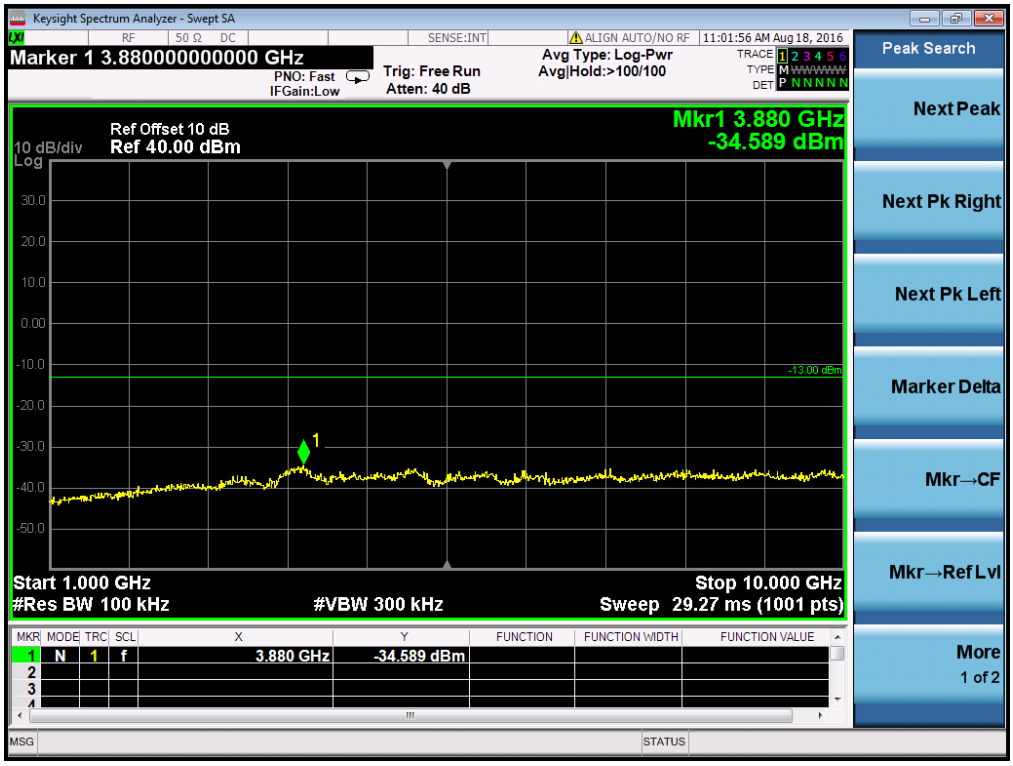
4. Set RBW = 100 kHz, VBW = 300 kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.

5. Measure and record the results in the test report.

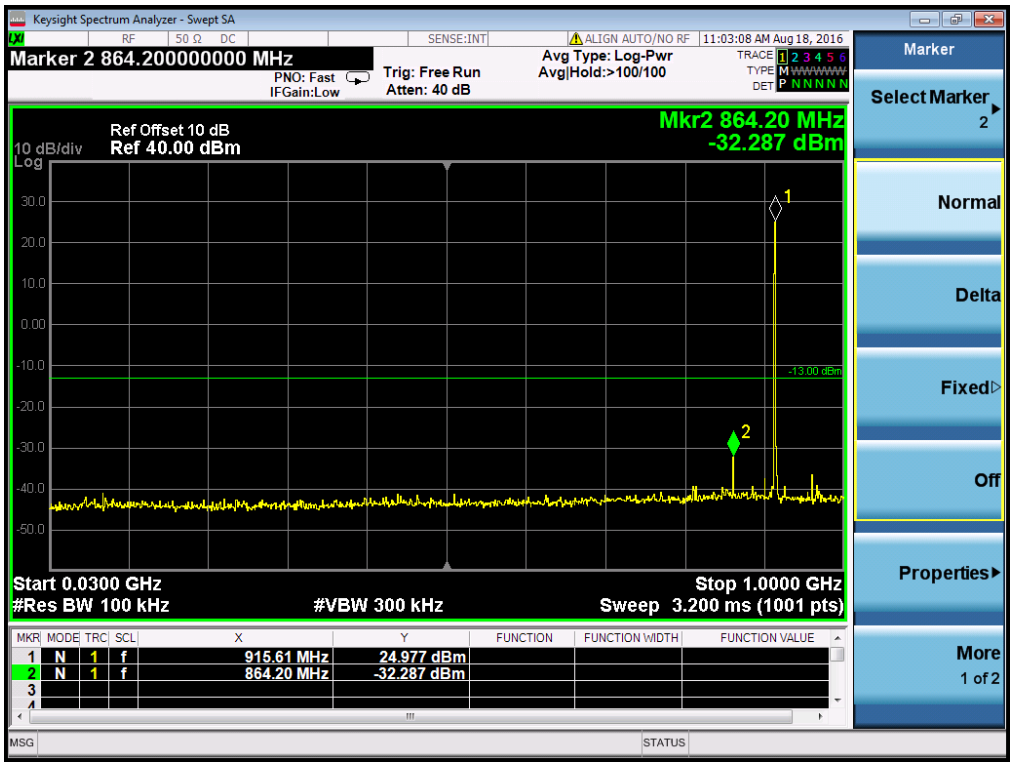
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

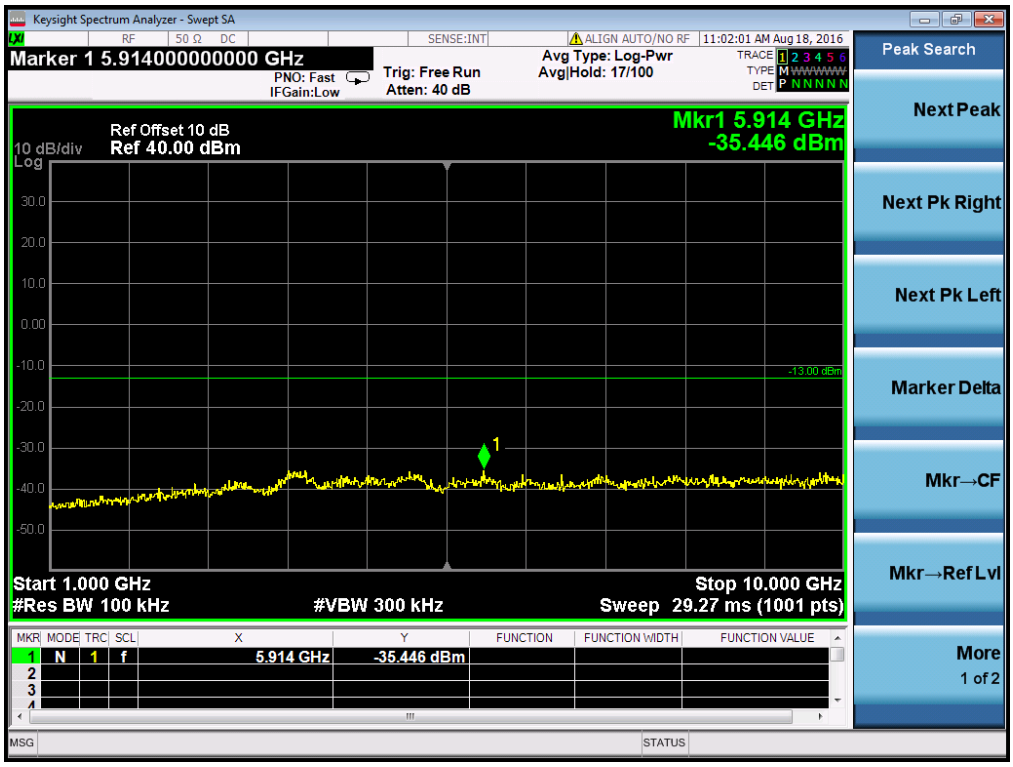
2.7.5. Test Results of Conducted Spurious Emissions



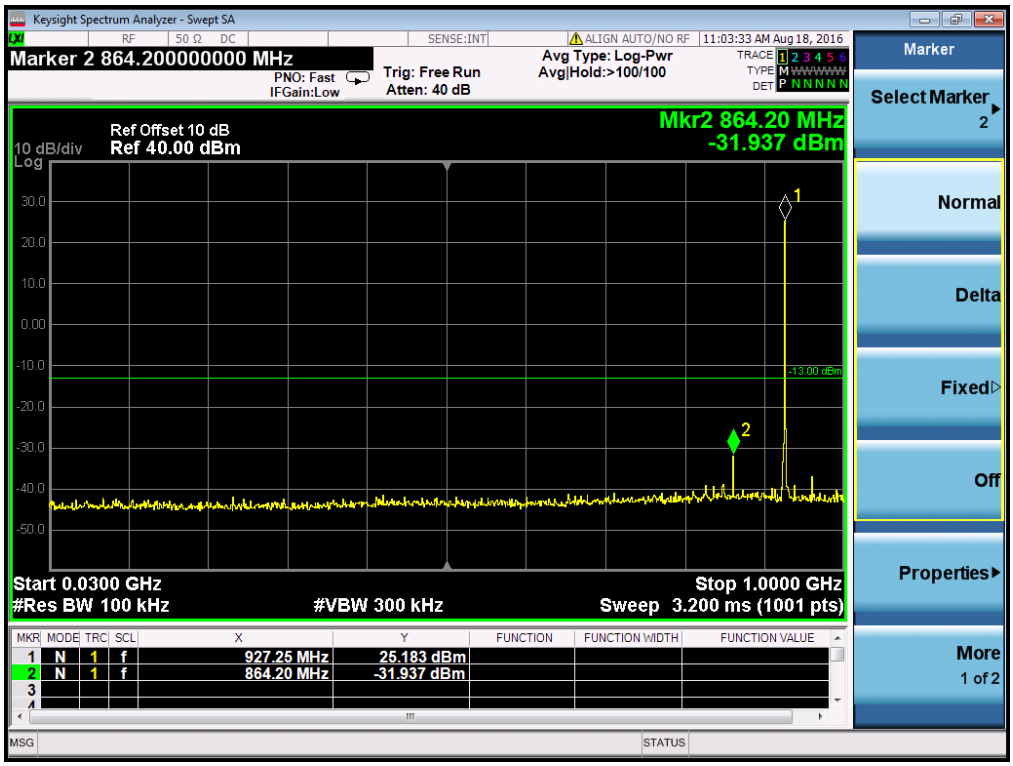


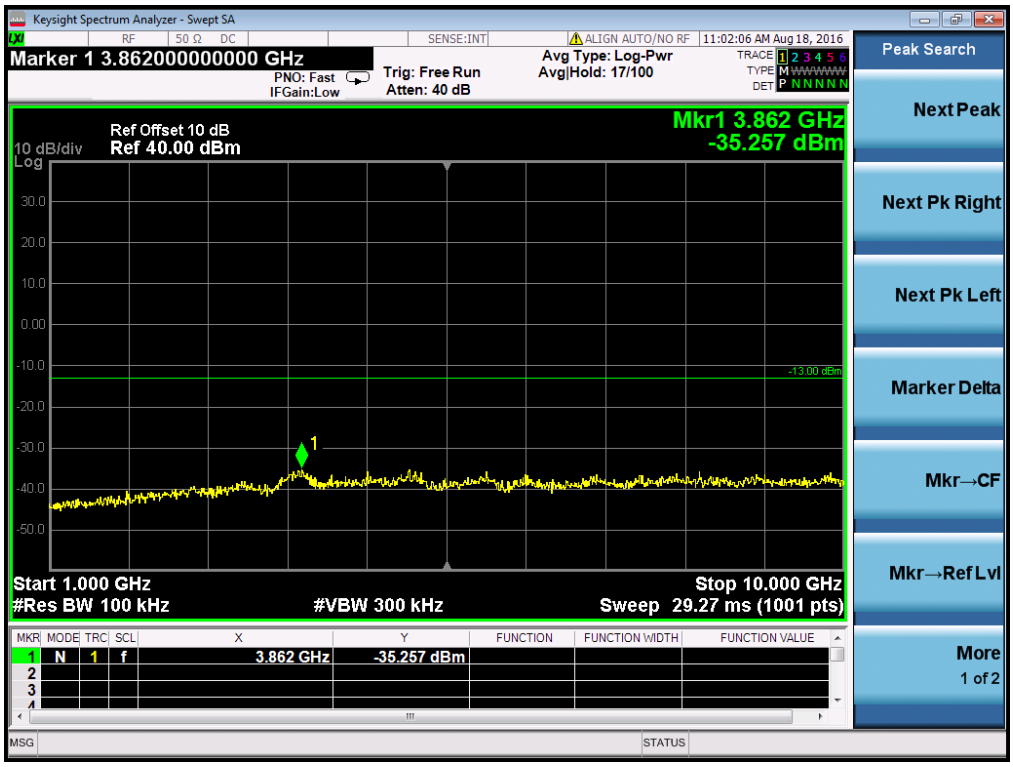
L channel


Keysight Spectrum Analyzer - Swept SA
Marker 2 864.200000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:03:08 AM Aug 18, 2016
Ref Offset 10 dB
10 dB/div
Ref 40.00 dBm
Log
Mkr2 864.20 MHz
-32.287 dBm
-13.00 dBm
Start 0.0300 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1.0000 GHz
Sweep 3.200 ms (1001 pts)
1 N 1 f 915.61 MHz 24.977 dBm
2 N 1 f 864.20 MHz -32.287 dBm
Marker
Select Marker 2
Normal
Delta
Fixed
Off
Properties
More 1 of 2


Keysight Spectrum Analyzer - Swept SA
Marker 1 5.914000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold: 17/100
11:02:01 AM Aug 18, 2016
Ref Offset 10 dB
10 dB/div
Ref 40.00 dBm
Log
Mkr1 5.914 GHz
-35.446 dBm
-13.00 dBm
Start 1.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 10.000 GHz
Sweep 29.27 ms (1001 pts)
1 N 1 f 5.914 GHz -35.446 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More 1 of 2

M channel


Keysight Spectrum Analyzer - Swept SA
Marker 2 864.200000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:03:33 AM Aug 18, 2016
Ref Offset 10 dB
10 dB/div
Ref 40.00 dBm
Log
Mkr2 864.20 MHz
-31.937 dBm
-13.00 dBm
Start 0.0300 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1.0000 GHz
Sweep 3.200 ms (1001 pts)
1 N 1 f 927.25 MHz 25.183 dBm
2 N 1 f 864.20 MHz -31.937 dBm
Marker
Select Marker 2
Normal
Delta
Fixed
Off
Properties
More 1 of 2


Keysight Spectrum Analyzer - Swept SA
Marker 1 3.862000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold: 17/100
11:02:06 AM Aug 18, 2016
Ref Offset 10 dB
10 dB/div
Ref 40.00 dBm
Log
Mkr1 3.862 GHz
-35.257 dBm
-13.00 dBm
Start 1.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 10.000 GHz
Sweep 29.27 ms (1001 pts)
1 N 1 f 3.862 GHz -35.257 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More 1 of 2

H channel

2.8. Conducted Band Edge

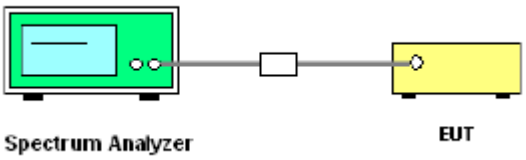
2.8.1. Limit of Band Edges

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

2.8.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.8.3. Test Setup



2.8.1. Test Procedure

1. The testing follows the guidelines in Band-edge Compliance of RF Conducted Emissions of FCC Public Notice DA 00-705 Measurement Guidelines.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100kHz (≥1% span=10MHz), VBW = 300kHz (≥RBW). Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.
4. Enable hopping function of the EUT and then repeat step 2. and 3.
5. Measure and record the results in the test report.

2.8.2. Test Results of Conducted Band Edge

L channel

H channel

2.9. Conducted Emission

2.9.1. Limit of Conducted Emission

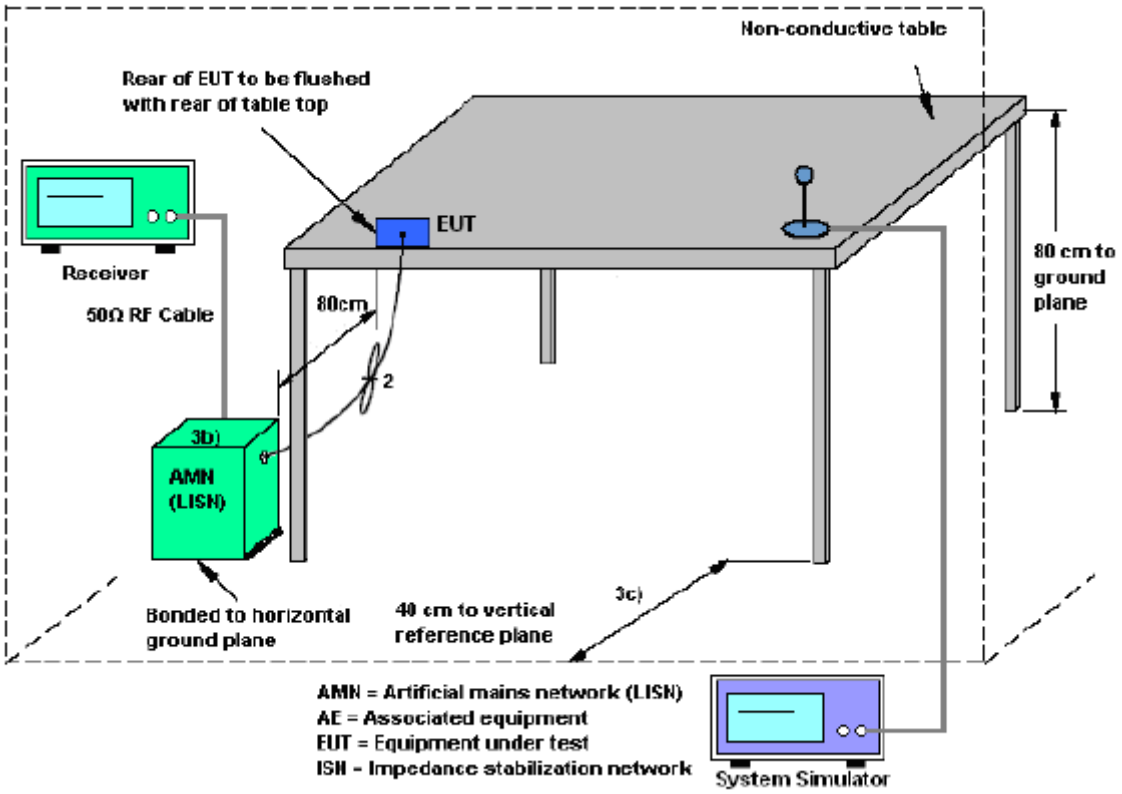
For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

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

2.9.2. Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

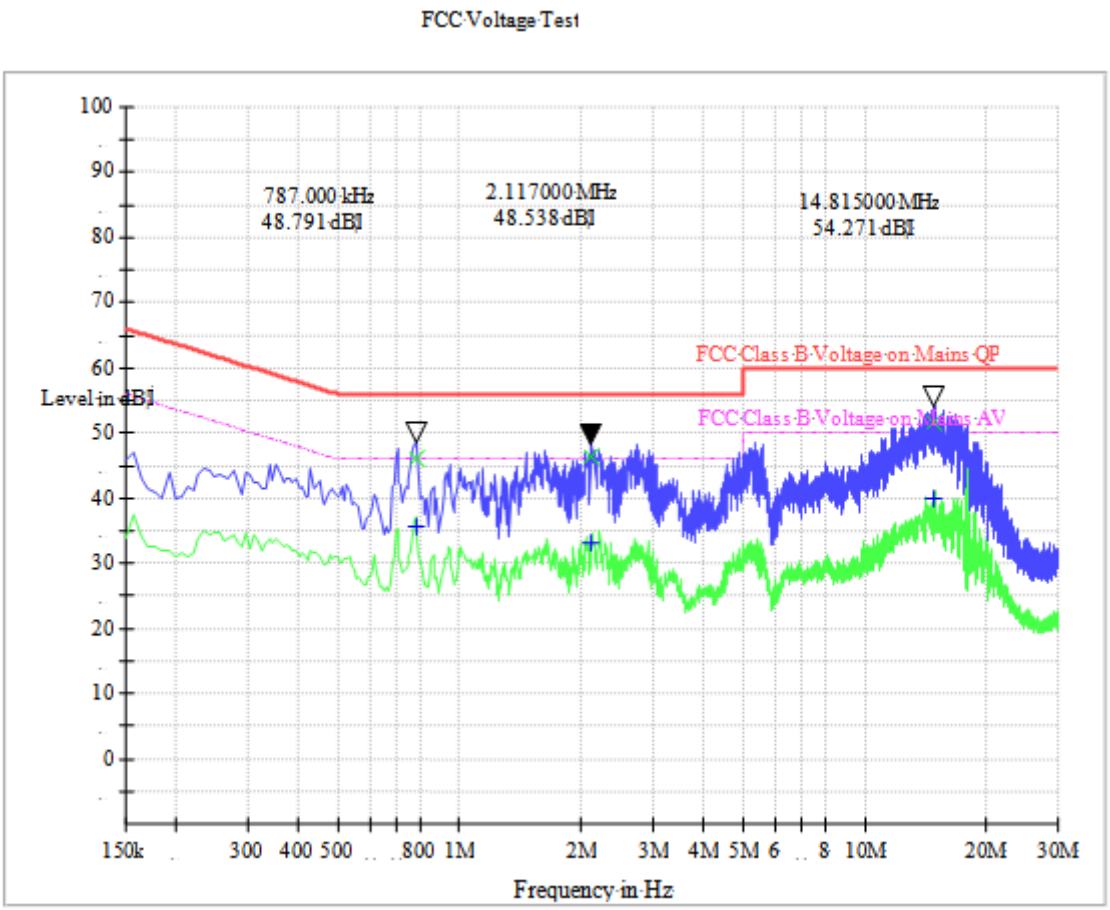
2.9.3. Test Setup



2.9.4. Test Procedures

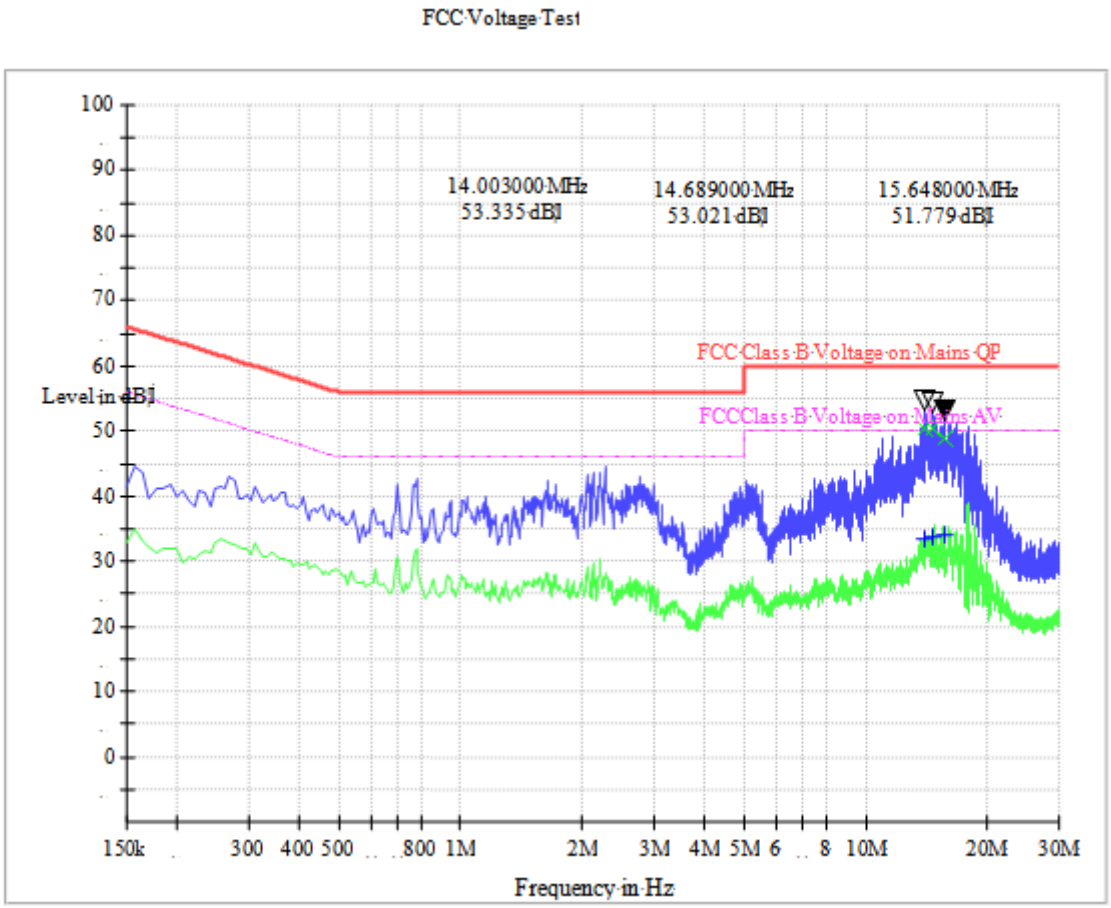
1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 micrometry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

2.9.3. Test Results of Conducted Emission



(Plot A: L Phase)

Conducted Disturbance at Mains Terminals					
L Test Data					
QP			AV		
Frequency (MHz)	Limits (dBµV)	Measurement Value (dBµV)	Frequency (MHz)	Limits (dBµV)	Measurement Value (dBµV)
0.787	56.0	48.791	0.787	46.0	35.73
2.117	56.0	48.538	2.117	46.0	33.17
14.815	60.0	54.271	14.815	50.0	39.81



(Plot B: N Phase)

Conducted Disturbance at Mains Terminals					
N Test Data					
QP			AV		
Frequency (MHz)	Limits (dBµV)	Measurement Value (dBµV)	Frequency (MHz)	Limits (dBµV)	Measurement Value (dBµV)
14.003	60.0	53.335	14.003	50.0	33.50
14.689	60.0	53.021	14.689	50.0	33.68
15.648	60.0	51.779	15.648	50.0	34.21

Test Result: PASS

2.10. Radiated Band Edges and Spurious Emission

2.10.1. Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

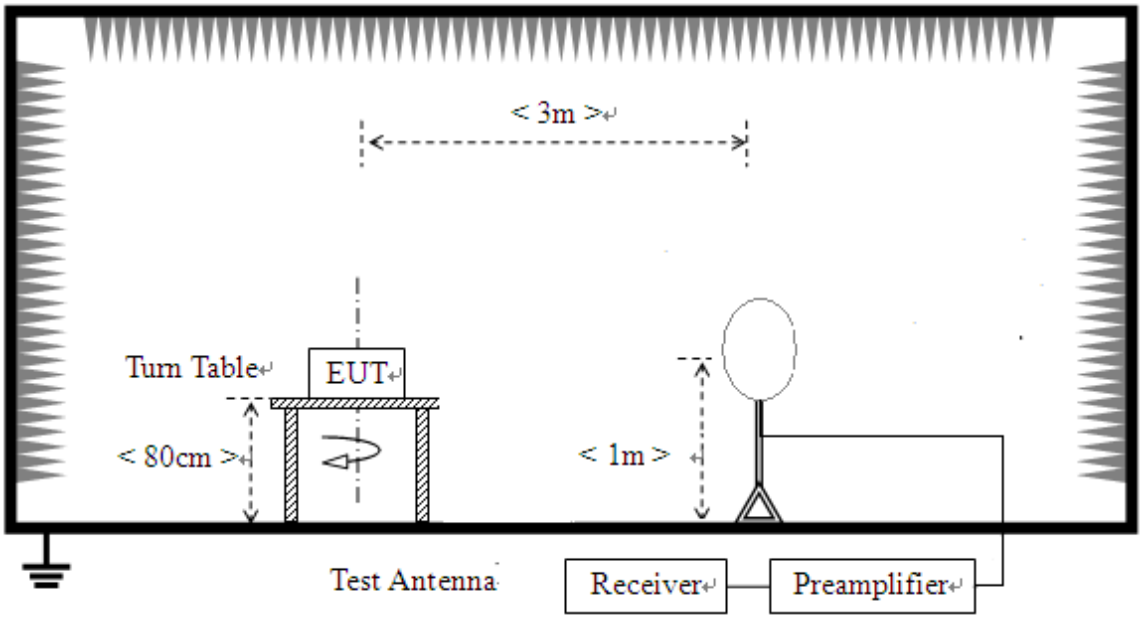
Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

2.10.2. Measuring Instruments

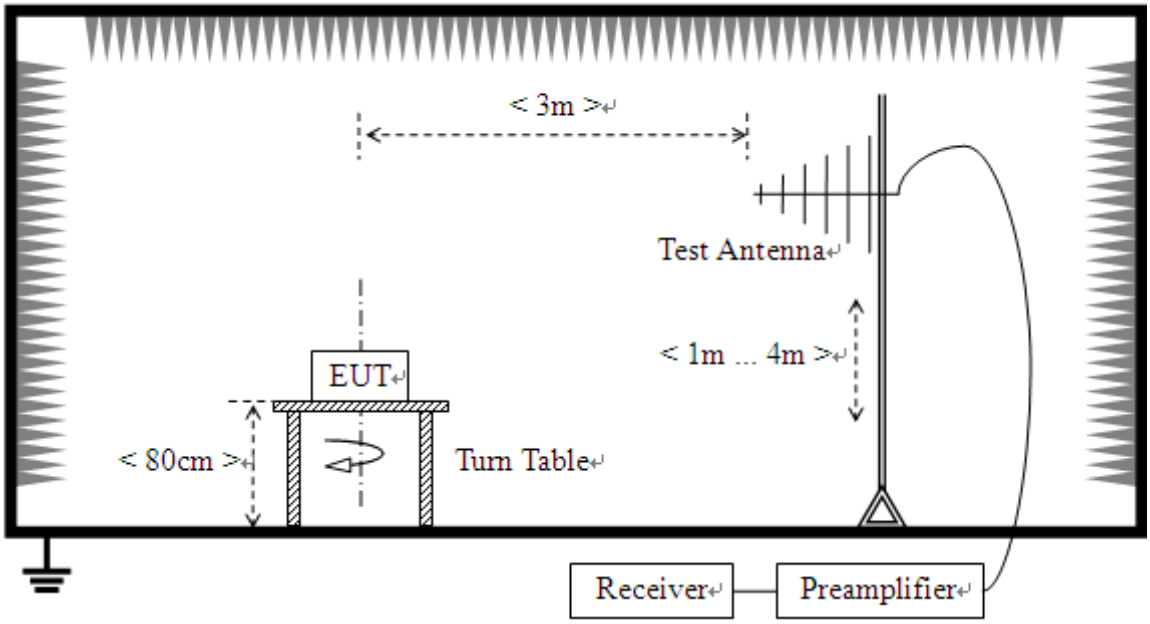
The measuring equipment is listed in the section 3 of this test report.

2.10.3. Test Setup

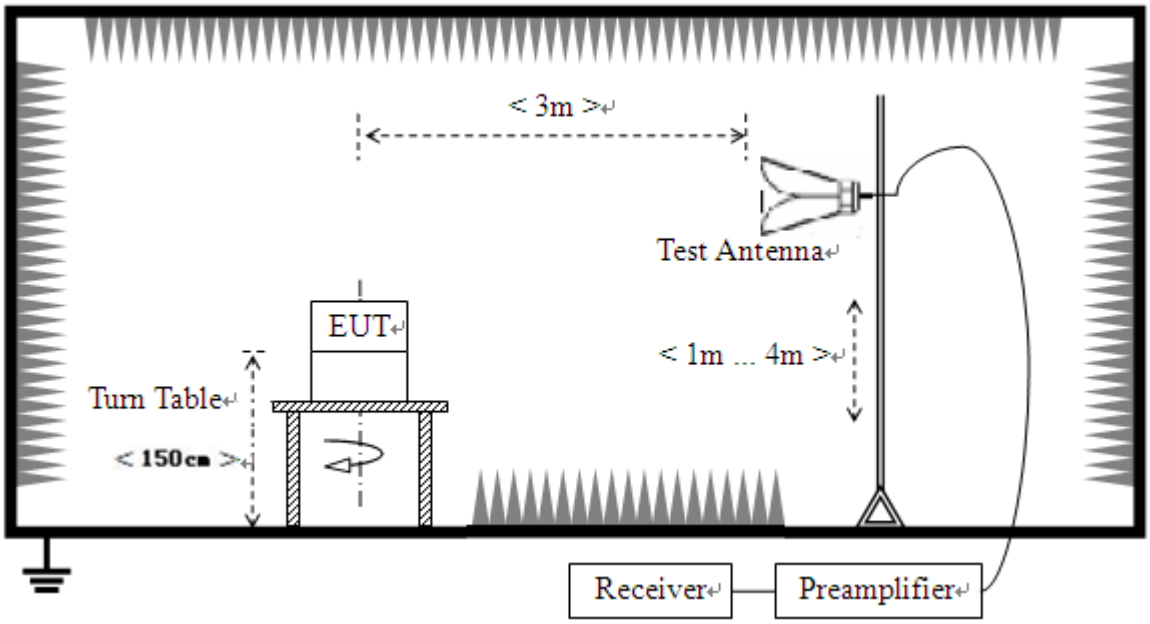
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



2.10.4. Test Procedure

1. The testing follows the guidelines in Spurious Radiated Emissions of FCC Public Notice DA 00-705 Measurement Guidelines.
2. The EUT was placed on a turntable with 0.8 meter above ground.
3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings:

(1) Span shall wide enough to fully capture the emission being measured;

(2) Set RBW=100 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW≥RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak

(3) For average measurement: use duty cycle correction factor method per 15.35(c).

Duty cycle = On time/100 milliseconds

On time = $N_1*L_1+N_2*L_2+...+N_{n-1}*LN_{n-1}+Nn*Ln$

Where N_1 is number of type 1 pulses, L1 is length of type 1 pulses, etc.

Average Emission Level = Peak Emission Level + 20*log(Duty cycle)

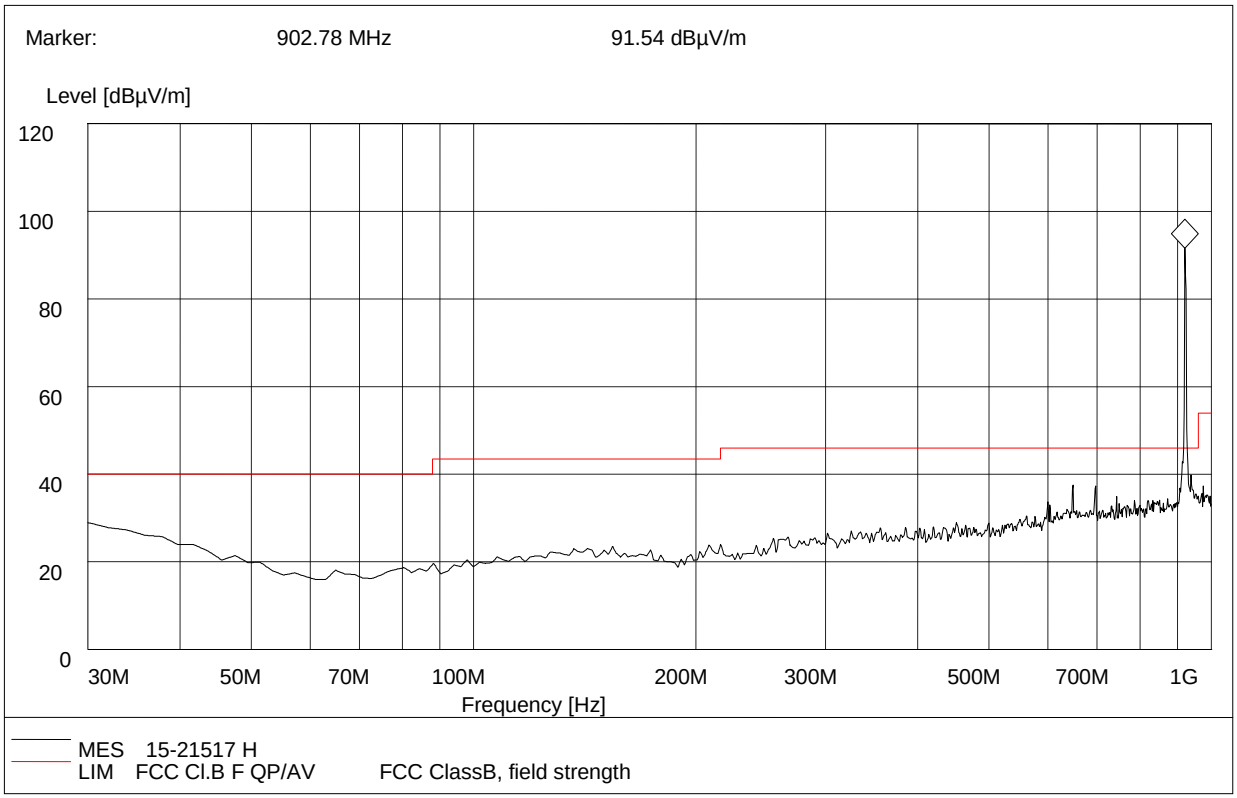
7. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

2.10.5. Test Results of Radiated Band Edge and Spurious Emission

For 9 KHz to 30MHz

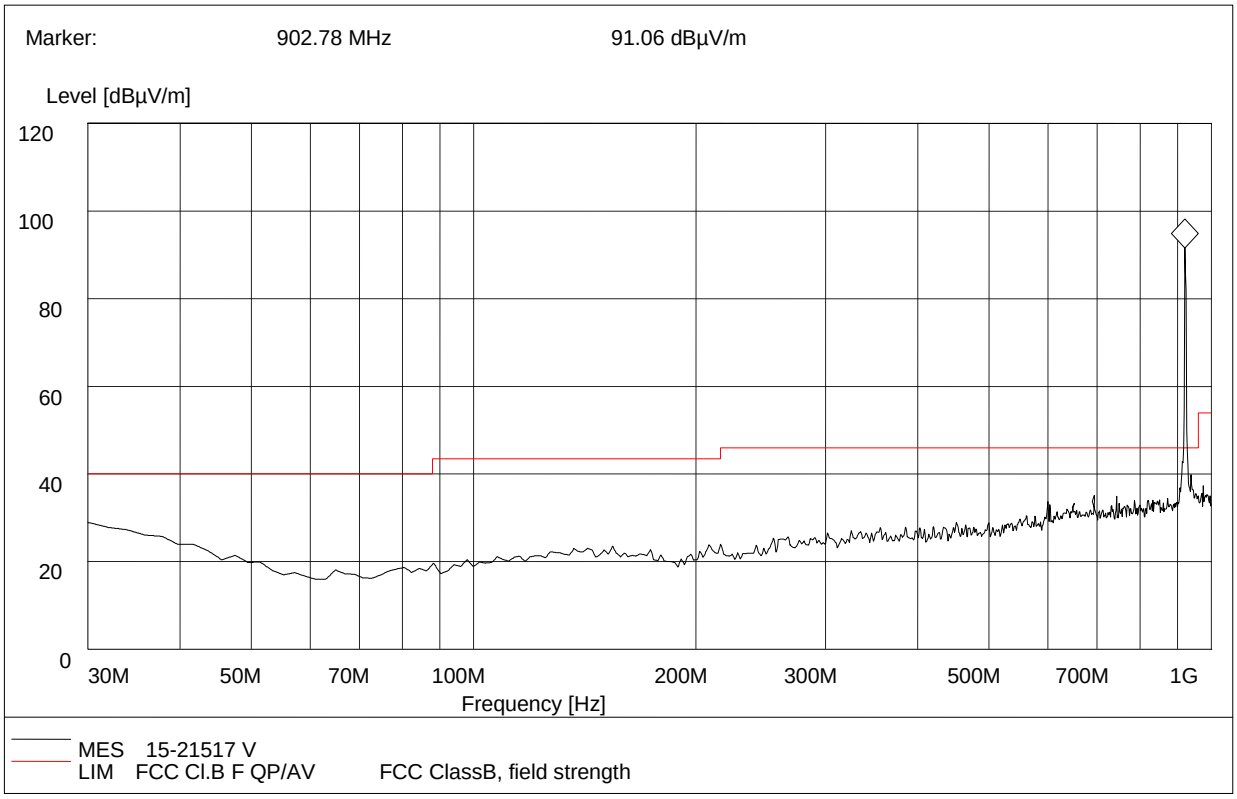
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

For 30MHz to 1000MHz



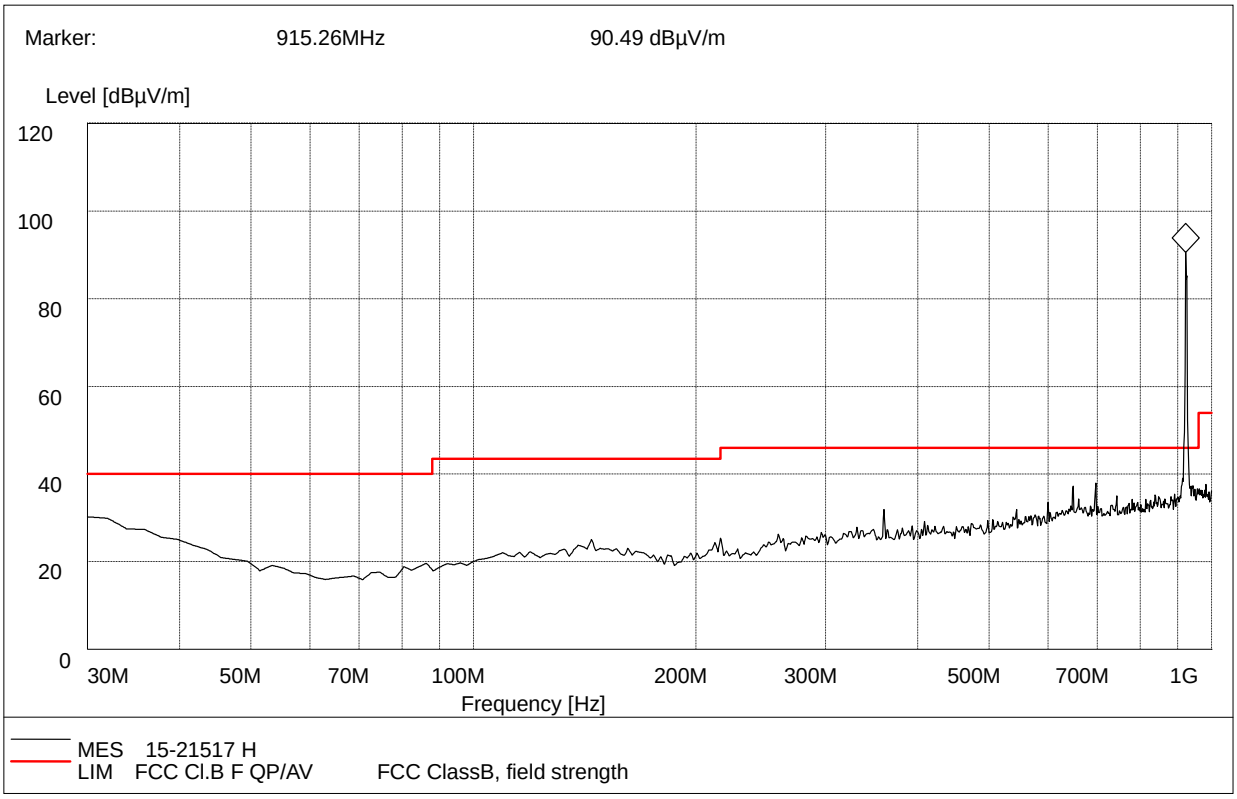
Frequency (MHz)	QuasiPeak (dBµ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dBµ V/m)	Antenna	Verdict
30	29.72	120.000	100.0	40.0	Horizontal	Pass
902.78	91.54	120.000	100.0	94	Horizontal	Pass

(Low Channel, 30MHz to 1GHz, Antenna Horizontal)



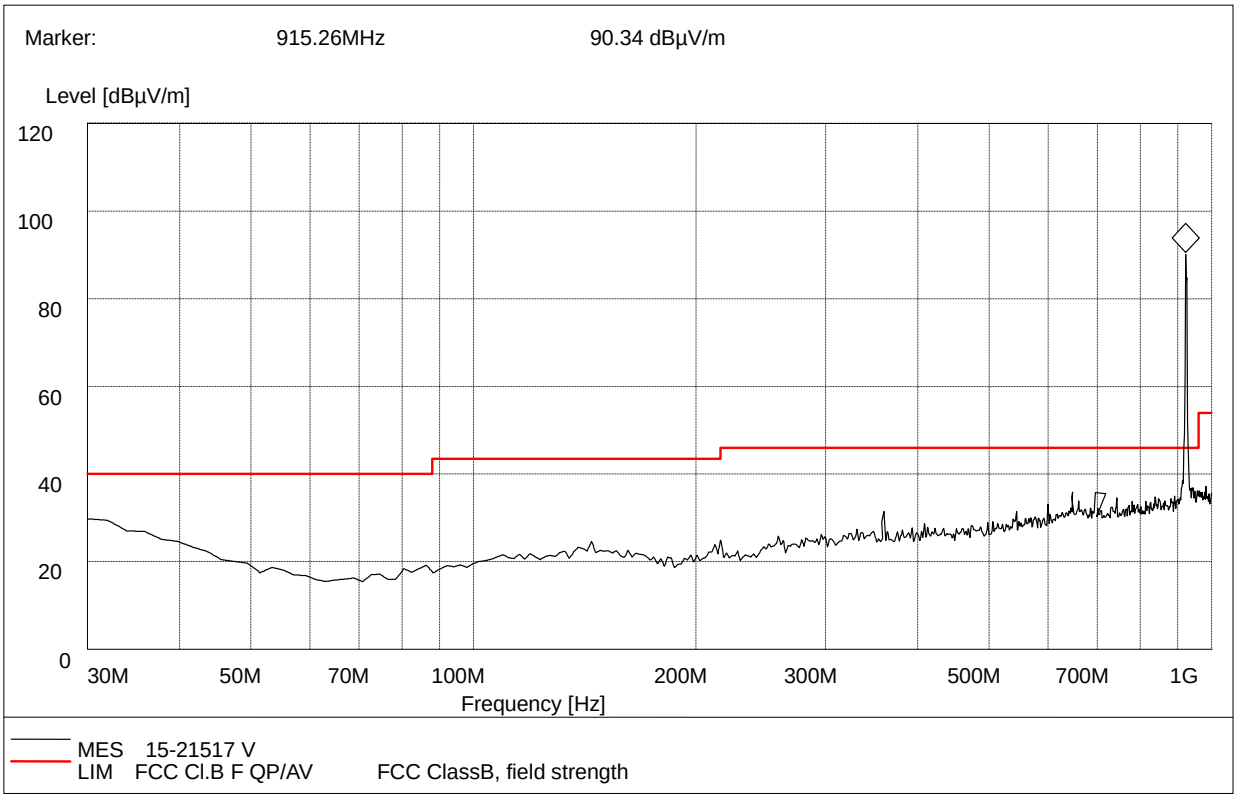
Frequency (MHz)	QuasiPeak (dBµ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dBµ V/m)	Antenna	Verdict
30	29.72	120.000	100.0	40.0	Vertical	Pass
902.78	91.06	120.000	100.0	94	Vertical	Pass

(Low Channel, 30MHz to 1GHz, Antenna Vertical)



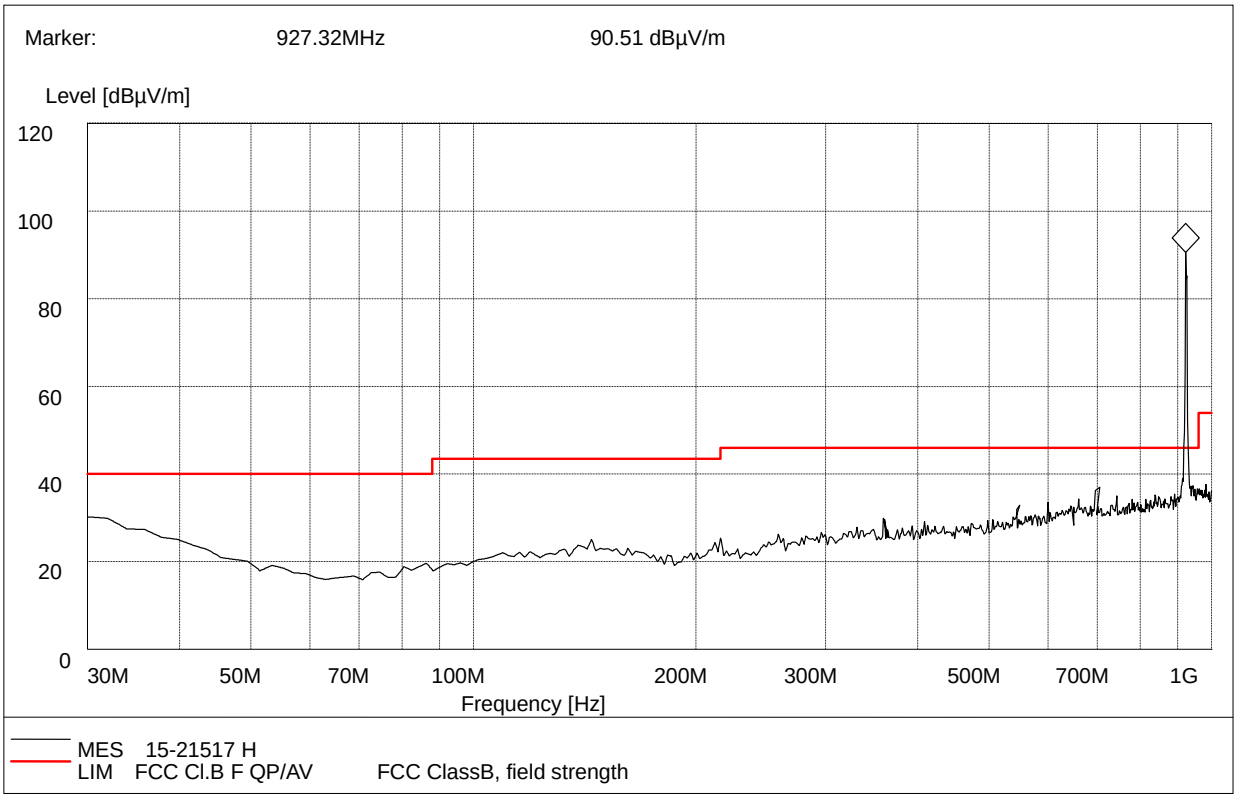
Frequency (MHz)	QuasiPeak (dBµ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dBµ V/m)	Antenna	Verdict
30	29.68	120.000	100.0	40.0	Horizontal	Pass
915.26	90.49	120.000	100.0	94	Horizontal	Pass

(Middle Channel, 30MHz to 1GHz, Antenna Horizontal)



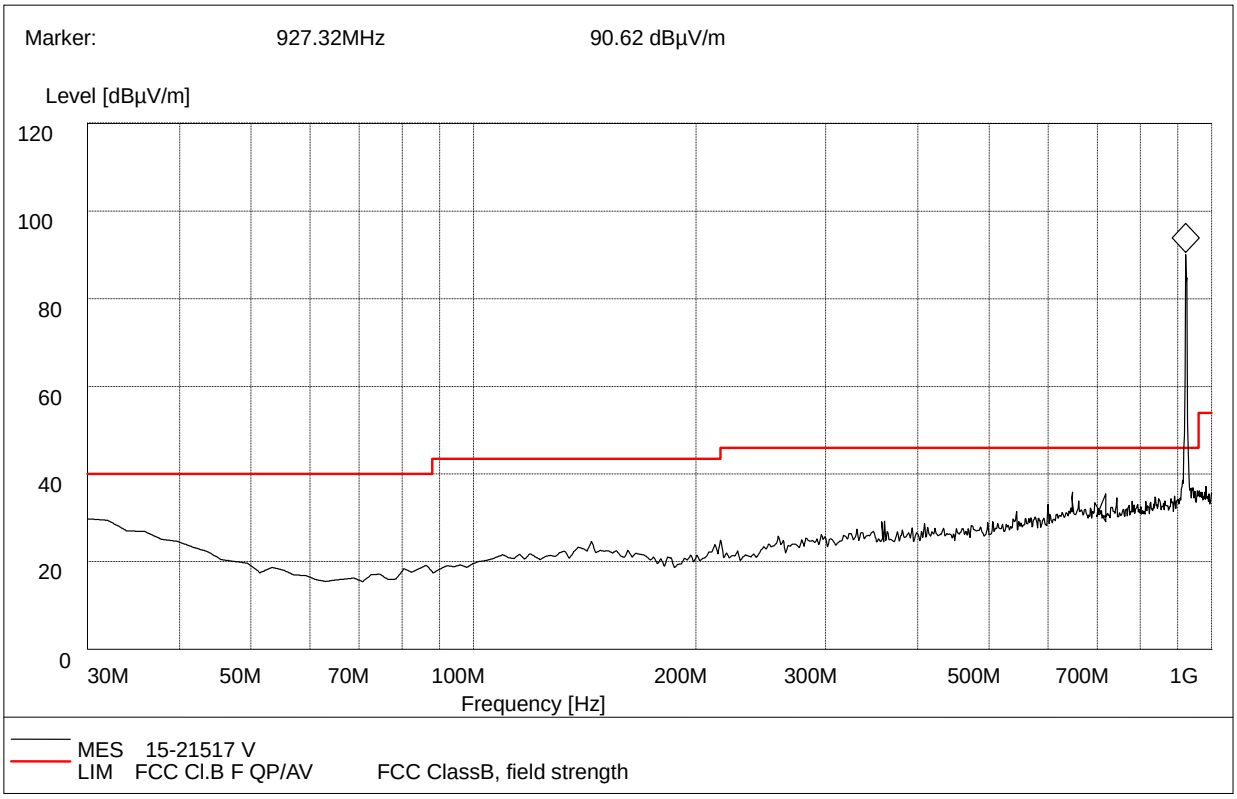
Frequency (MHz)	QuasiPeak (dBµ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dBµ V/m)	Antenna	Verdict
30	29.68	120.000	100.0	40.0	Vertical	Pass
915.26	90.34	120.000	100.0	94	Vertical	Pass

(Middle Channel, 30MHz to 1GHz, Antenna Vertical)



Frequency (MHz)	QuasiPeak (dBµ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dBµ V/m)	Antenna	Verdict
30	29.51	120.000	100.0	40.0	Horizontal	Pass
927.32	90.51	120.000	100.0	94	Horizontal	Pass

(High Channel, 30MHz to 1GHz, Antenna Horizontal)



Frequency (MHz)	QuasiPeak (dBµ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dBµ V/m)	Antenna	Verdict
30	29.77	120.000	100.0	40.0	Vertical	Pass
927.32	90.62	120.000	100.0	94	Vertical	Pass

(High Channel, 30MHz to 1GHz, Antenna Vertical)

Above 1GHz Data:

Channel	TX Channel 1	Detector Function	Peak(PK) Average(AV)
Frequency Range	1GHz ~ 10GHz		

Antenna Polarity & Test Distance : Horizontal AT 3M											
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-amplifier (dB)
1	1805.50	52.46	PK	74.0	-21.54	1.11H	141	50.35	31.74	0.97	30.60
2	1805.50	42.62	AV	54.0	-11.38	1.11H	141	40.51	31.74	0.97	30.60
3	2708.25	53.72	PK	74.0	-20.28	1.35H	145	51.37	32.51	1.14	31.30
4	2708.25	43.57	AV	54.0	-10.43	1.35H	145	41.22	32.51	1.14	31.30
5	3611.00	54.40	PK	74.0	-19.60	1.21H	133	51.84	33.13	1.23	31.80
6	3611.00	44.31	AV	54.0	-9.69	1.21H	133	41.75	33.13	1.23	31.80

Antenna Polarity & Test Distance : Vertical AT 3M											
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-amplifier (dB)
1	1805.50	52.69	PK	74.00	-21.31	2.48V	45	50.58	31.74	0.97	30.60
2	1805.50	42.80	AV	54.00	-11.20	2.48V	45	40.69	31.74	0.97	30.60
3	2708.25	53.86	PK	74.00	-20.14	1.03V	335	51.51	32.51	1.14	31.30
4	2708.25	43.84	AV	54.00	-10.16	1.03V	335	41.49	32.51	1.14	31.30
5	3611.00	54.50	PK	74.00	-19.50	1.20V	112	51.94	33.13	1.23	31.80
6	3611.00	44.34	AV	54.00	-9.66	1.20V	112	41.78	33.13	1.23	31.80

Channel	TX Channel 26	Detector Function	Peak(PK) Average(AV)
Frequency Range	1GHz ~ 10GHz		

Antenna Polarity & Test Distance : Horizontal AT 3M											
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-amplifier (dB)
1	1830.50	52.20	PK	74.0	-21.80	1.08H	150	50.19	31.74	0.97	30.70
2	1830.50	42.66	AV	54.0	-11.34	1.08H	150	40.65	31.74	0.97	30.70
3	2745.75	53.73	PK	74.0	-20.27	1.37H	137	51.48	32.51	1.14	31.40
4	2745.75	43.60	AV	54.0	-10.40	1.37H	137	41.35	32.51	1.14	31.40
5	3661.00	54.74	PK	74.0	-19.26	1.18H	130	52.38	33.13	1.23	32.00
6	3661.00	43.85	AV	54.0	-10.15	1.18H	130	41.49	33.13	1.23	32.00

Antenna Polarity & Test Distance : Vertical AT 3M											
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-amplifier (dB)
1	1830.50	52.48	PK	74.00	-21.52	2.48V	50	50.47	31.74	0.97	30.70
2	1830.50	42.83	AV	54.00	-11.17	2.48V	50	40.82	31.74	0.97	30.70
3	2745.75	53.52	PK	74.00	-20.48	1.20V	345	51.27	32.51	1.14	31.40
4	2745.75	43.50	AV	54.00	-10.50	1.20V	345	41.25	32.51	1.14	31.40
5	3661.00	54.01	PK	74.00	-19.99	1.00V	118	51.65	33.13	1.23	32.00
6	3661.00	43.73	AV	54.00	-10.27	1.00V	118	41.37	33.13	1.23	32.00

Channel	TX Channel 50	Detector Function	Peak(PK) Average(AV)
Frequency Range	1GHz ~ 10GHz		

Antenna Polarity & Test Distance : Horizontal AT 3M											
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-amplifier (dB)
1	1854.50	52.32	PK	74.0	-21.68	1.08H	130	50.37	31.74	1.01	30.80
2	1854.50	42.44	AV	54.0	-11.56	1.08H	130	40.49	31.74	1.01	30.80
3	2781.75	53.41	PK	74.0	-20.59	1.35H	142	51.24	32.51	1.16	31.50
4	2781.75	43.36	AV	54.0	-10.64	1.35H	142	41.19	32.51	1.16	31.50
5	3709.00	54.35	PK	74.0	-19.65	1.26H	118	52.07	33.13	1.25	32.10
6	3709.00	43.72	AV	54.0	-10.28	1.26H	118	41.44	33.13	1.25	32.10

Antenna Polarity & Test Distance : Vertical AT 3M											
No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-amplifier (dB)
1	1854.50	52.23	PK	74.00	-21.77	2.07V	34	50.28	31.74	1.01	30.80
2	1854.50	42.59	AV	54.00	-11.41	2.07V	34	40.64	31.74	1.01	30.80
3	2781.75	53.68	PK	74.00	-20.32	1.00V	340	51.51	32.51	1.16	31.50
4	2781.75	43.62	AV	54.00	-10.38	1.00V	340	41.45	32.51	1.16	31.50
5	3709.00	54.17	PK	74.00	-19.83	1.05V	125	51.89	33.13	1.25	32.10
6	3709.00	43.85	AV	54.00	-10.15	1.05V	125	41.57	33.13	1.25	32.10

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. This device tested in a engineer ‘steady-state’ CW mode.

3. List of measuring equipment

Description	Manufacturer	Model	Serial No.	Test Date	Due Date	Remark
EMI Test Receiver	R&S	ESIB26	A0304218	2016.06.02	2017.06.01	Radiation
Full-Anechoic Chamber	Albatross	12.8m*6.8m*6.4m	A0412372	2016.06.02	2017.06.01	Radiation
Loop Antenna	Schwarz beck	HFH2-Z2	100047	2016.06.02	2017.06.01	Radiation
Bilog Antenna	Schwarzbeck	VULB 9163	9163-274	2016.06.02	2017.06.01	Radiation
Double ridge horn antenna	R&S	HF906	100150	2016.06.02	2017.06.01	Radiation
Ultra-wideband antenna	R&S	HL562	100089	2016.06.02	2017.06.01	Radiation
Test Antenna – Horn (18-26.5GHz)	ETS	3160-09	A0902607	2016.06.02	2017.06.01	Radiation
Amplifier 20M~3GHz	R&S	PAP-0203H	22018	2016.06.02	2017.06.01	Radiation
Ampilier 1G~18GHz	R&S	MITEQ AFS42-00101800	25-S-42	2016.06.02	2017.06.01	Radiation
Ampilier 18G~40GHz	R&S	JS42-18002600-28-5A	12111.0980.00	2016.06.02	2017.06.01	Radiation
Spectrum Analyzer	KEYSIGHT	N9030A	MY55410524	2016.05.05	2017.05.04	Conducted
Power Meter	R&S	NRVS	1020.1809.02	2016.06.02	2017.06.01	Conducted
Power Sensor	R&S	NRV-Z4	823.3618.03	2016.06.02	2017.06.01	Conducted
LISN	ROHDE&SCHWARZ	ESH2-Z5	A0304221	2016.06.02	2017.06.01	Conducted
Test Receiver	R&S	ESCS30	A0304260	2016.06.02	2017.06.01	Conducted
Cable	SUNHNER	SUCOFLEX 100	/	2016.06.02	2017.06.01	Radiation
Cable	SUNHNER	SUCOFLEX 104	/	2016.06.02	2017.06.01	Radiation

4. Uncertainty of Evaluation

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

Measurement	Frequency	Uncertainty
Conducted emissions	9kHz~30MHz	2.35dB
Radiated emissions	30MHz~1000MHz	2.45dB
	1G~18GHz	2.21dB
	18G~40GHz	1.96dB

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

** END OF REPORT **