



RF TEST REPORT

Report No.: SET2016-00303

Product Name: Connected Handheld RFID Reader

FCC ID: P65ALR-H450

Model No. : ALR-H450

Applicant: Alien Technology, LLC

Address 845 Embedded Way, San Jose, CA 95138-1030, United States

Dates of Testing: 10/08/2015 — 10/20/2015

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

Trade Name : ALIEN

Brand 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(Section 15.249): Radio
Frequency Devices
ANSI C63.10:2009
ANSI C63.4:2009

Test Result : PASS

Tested by

2016.01.08

Lu Lei, Test Engineer

Reviewed by

2016.01.08

Zhu Qi, Senior Engineer

Approved by

2016.01.08

Wu Li'an, Manager



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Change History		
Issue	Date	Reason for change
1.0	2016.01.08	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 Rang	920.625MHz~924.375MHz
Number of channel	16
Modulation Type	ASK
Antenna Type	PATCH Antenna
Antenna Gain	0dBi

Note 1: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

Note 2: The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

1.2 Test Standards and Results

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

No.	Identity	Document Title
1	47 CFR Part 15 Subpart C 2014	Radio Frequency Devices
2	ANSI C63.10 2009	American National Standard for Testing Unlicensed Wireless Devices
3	ANSI C63.4 2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

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

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliant
§15.207	Conduction Emission	Compliant
§15.215(c)	20 dB Occupied Bandwidth	Compliant
§15.249(a)	Field strength of the fundamental signal	Compliant
§15.249(a)/(d) §15.209	Radiated Spurious Emission	Compliant

1.3 Description of Test Mode

Channel	Frequency(MHz)	Channel	Frequency(MHz)
1	920.625	9	922.625
2	920.875	10	922.875
3	921.125	11	923.125
4	921.375	12	923.375
5	921.625	13	923.625
6	921.875	14	923.875
7	922.125	15	924.125
8	922.375	16	924.375

Test channel: 1channel , 8 channel, 16channel



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 (°C):	15°C - 35°C
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.

2.1.2 Antenna Information

Antenna Category: Integral antenna

Antenna General Information:

No.	EUT Model	Ant. Cat.	Gain(dBi)
1	ALR-H450	PATCH antenna	0

2.1.3 Result: comply

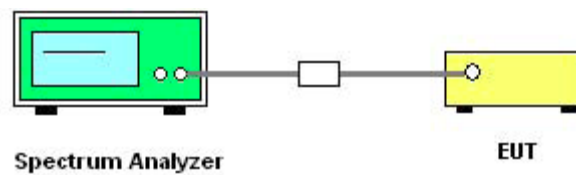
The EUT has a permanently antenna which complies with the Part 15.203. Please refer to the EUT internal photos.

2.2 20 dB Bandwidth Testing

2.2.1 Limit

Intentional radiators must be designed to ensure that the 20dB bandwidth of the emission in the specific band.

2.2.2 Test Description



- (1) The transmitter output(antenna port) was connected to the spectrum analyzer in peak hold mode.
- (2) The resolution bandwidth of 100 kHz and the video bandwidth of 100 kHz were used.
- (3) Measured the spectrum width with power higher than 20dB below carrier.

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> 20dB Bandwidth
RBW	30 kHz
VBW	100 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due Date
Spectrum Analyzer	Agilent	E7405A	US44210471	2015.07.07	2016.07.06

2.2.3 Test Result

Frequency	20dB Bandwidth (MHz)
920.625MHz	235.339
922.375MHz	232.494
924.375MHz	239.145



920.625MHz 20 dB Bandwidth



922.375MHz 20 dB Bandwidth



924.375MHz 20 dB Bandwidth

2.3 Conducted Emission

2.3.1 Requirement

According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network (LISN).

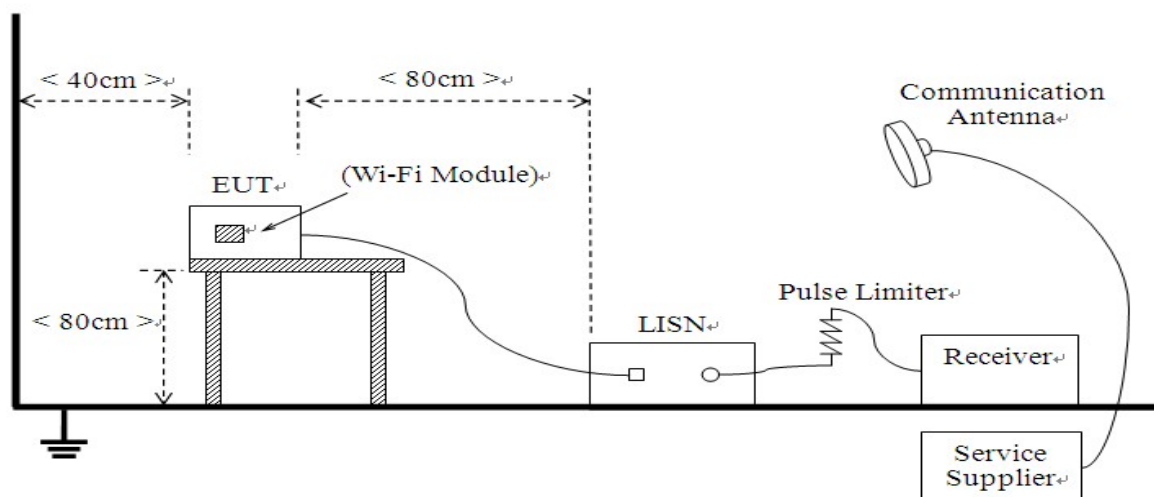
Frequency range (MHz)	Conducted Limit (dB μ V)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

NOTE:

- The lower limit shall apply at the band edges.
- The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.3.2 Test Description

A. Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10:2009

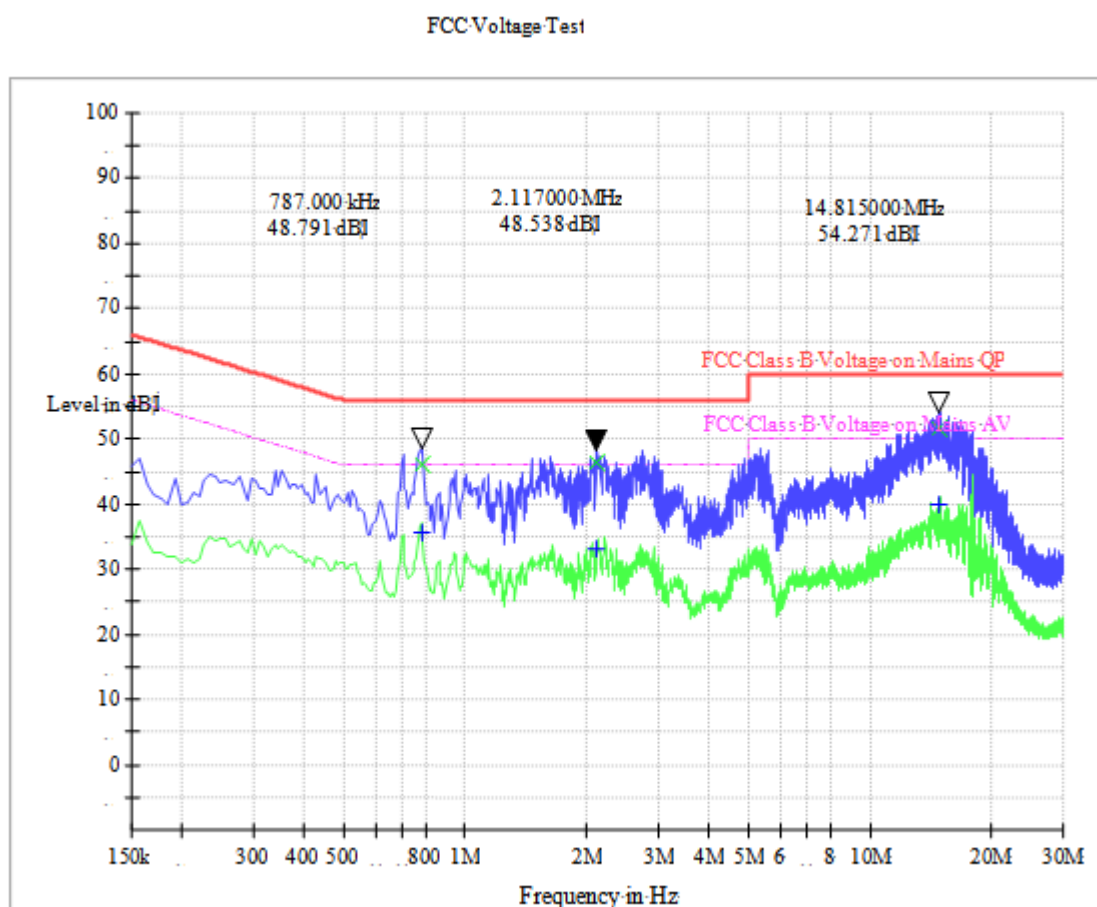
The EUT is powered by Battery. The factors of the site are calibrated to correct the reading. During the measurement.

**B. Equipments List:**

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due Date
Test Receiver	ROHDE&SCHWARZ	ESCS30	A0304260	2015.06.02	2016.06.01
LISN	ROHDE&SCHWARZ	ESH2-Z5	A0304221	2015.06.02	2016.06.01

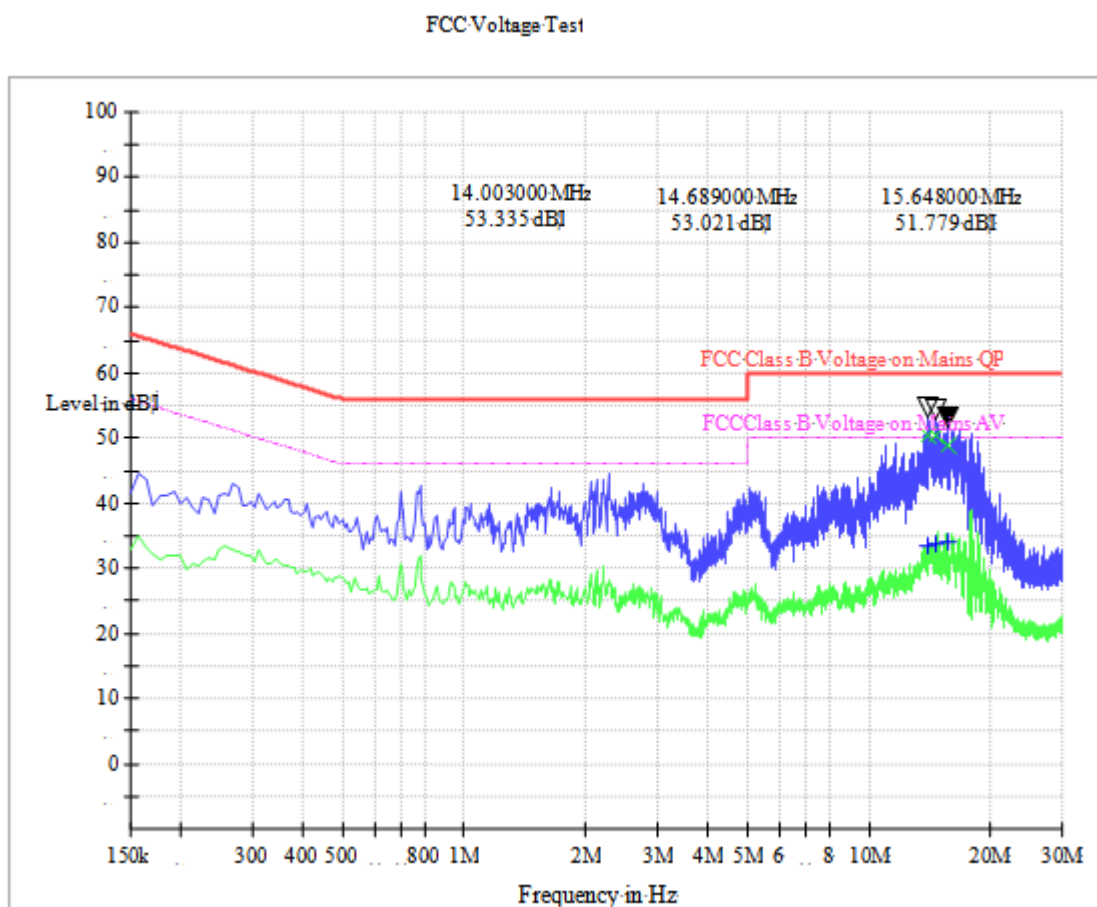
2.3.3 Test Result

The EUT configuration of the emission tests is RFID Link +Charging from Adapter.



(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

2.4 Field Strength of Fundamental Emissions and Radiated Spurious Emission

2.4.1 Limits

The field strength measured at 3 meters shall not exceed the limits in the following table:

Fundamental Frequencies(MHz)	Field Strength(millivolts/m)	
	Fundamental	Harmonics
902~928	50(94 dB μ V/m)	0.5(54 dB μ V/m)
2400~2483.5	50(94 dB μ V/m)	0.5(54 dB μ V/m)
5725~5875	50(94 dB μ V/m)	0.5(54 dB μ V/m)

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 902~928MHz, which is based on measurements using a CISPR quasi-peak detector.

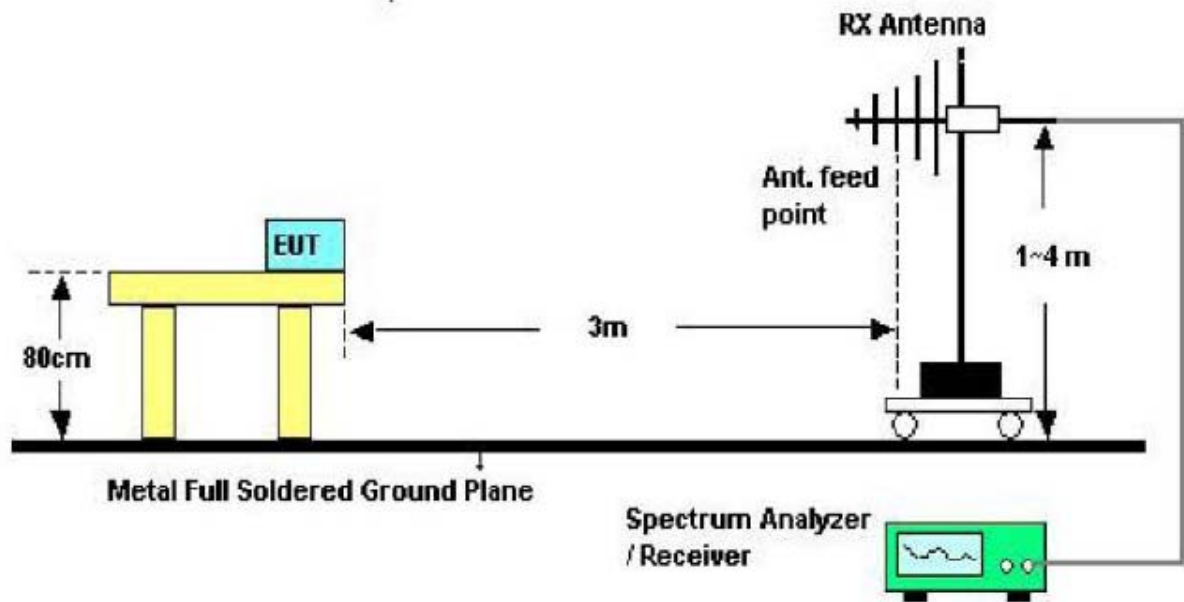
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB, below the level of the fundamental or to the general field strength limits listed in 15.209 as below, whichever is less stringent.

Frequency (MHz)	Field Strength (μ V/m)	Field Strength (dB μ V/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	20log(2400/F(KHz))+80	300
0.490 - 1.705	24000/F(kHz)	20log(24000/F(KHz))+40	30
1.705 - 30.0	30	20log(30)+40	30
30 - 88	100	40.0	3
88 - 216	150	43.5	3
216 - 960	200	46.0	3
Above 960	500	54.0	3

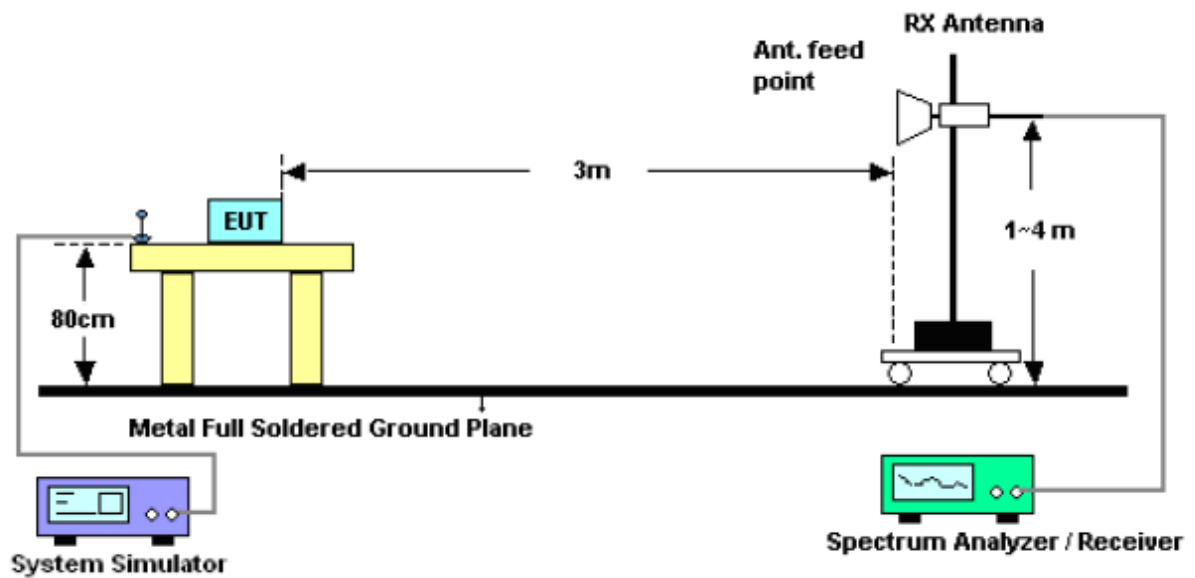
Note:

- (1) The tighter limit applies at the band edges.
- (2) Emission level(dBuV/m)=20log Emission level (uV/m).
- (3) For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

2.4.2 Test Description



Radiated emissions from 30MHz to 1GHz



Radiated emissions above 1GHz

Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Due Date
Receiver	R&S	ESIB26	A0304218	2015.06.02	2016.06.01
Full-Anechoic Chamber	Albatross	12.8m*6.8m*6.4m	A0412372	2015.06.02	2016.06.01
Test Antenna - Bi-Log	Schwarzbeck	VULB 9163	9163-274	2015.06.02	2016.06.01
Loop Antenna	Schwarzbeck	HFH2-Z2	0837.1866.54	2015.06.02	2016.06.01
Test Antenna - Horn	R&S	HF906	100150	2015.06.02	2016.06.01
Test Antenna – Horn (18-25GHz)	ETS	UG-596A/U	A0902607	2015.06.02	2016.06.01
Amplifier 1G~18GHz	R&S	MITEQ AFS42-00101 800	25-S-42	2015.06.02	2016.06.01
Amplifier 18G~40GHz	R&S	JS42-180026 00-28-5A	12111.0980.00	2015.06.02	2016.06.01
amplifier 20M~3GHz	R&S	PAP-0203H	22018	2015.06.02	2016.06.01

2.4.3 Test Procedure

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.
- New battery is used during test.



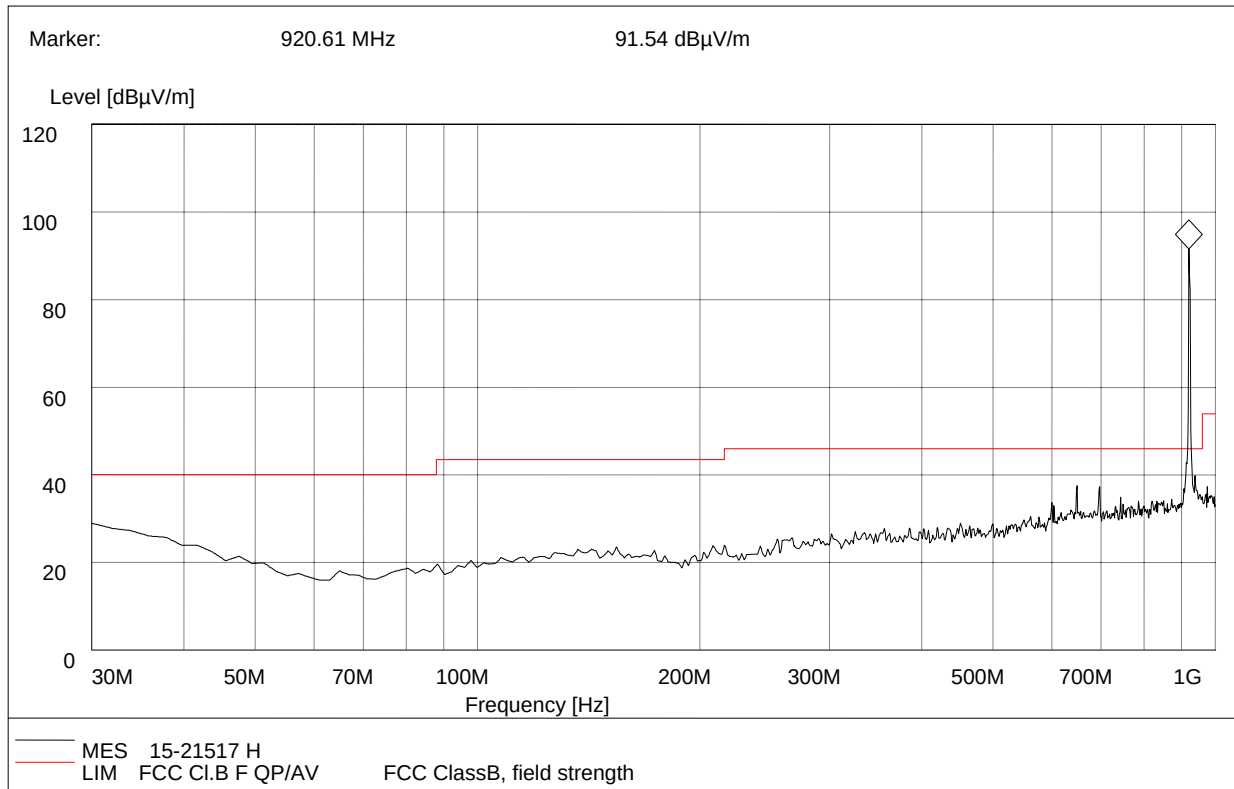
h) All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Note:

1. For emission measurements above 1 GHz, the EUT shall be placed at a height of 0.8 m above the ground at 3 meter chamber room for test.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (Duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor ($10 \log(1/\text{duty cycle})$).
5. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.
6. All modes of operation were investigated and the worst-case emissions are reported.
7. For above 1GHz, we investigated to the 10th harmonic and only provide some worst-case data at the report (The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported)

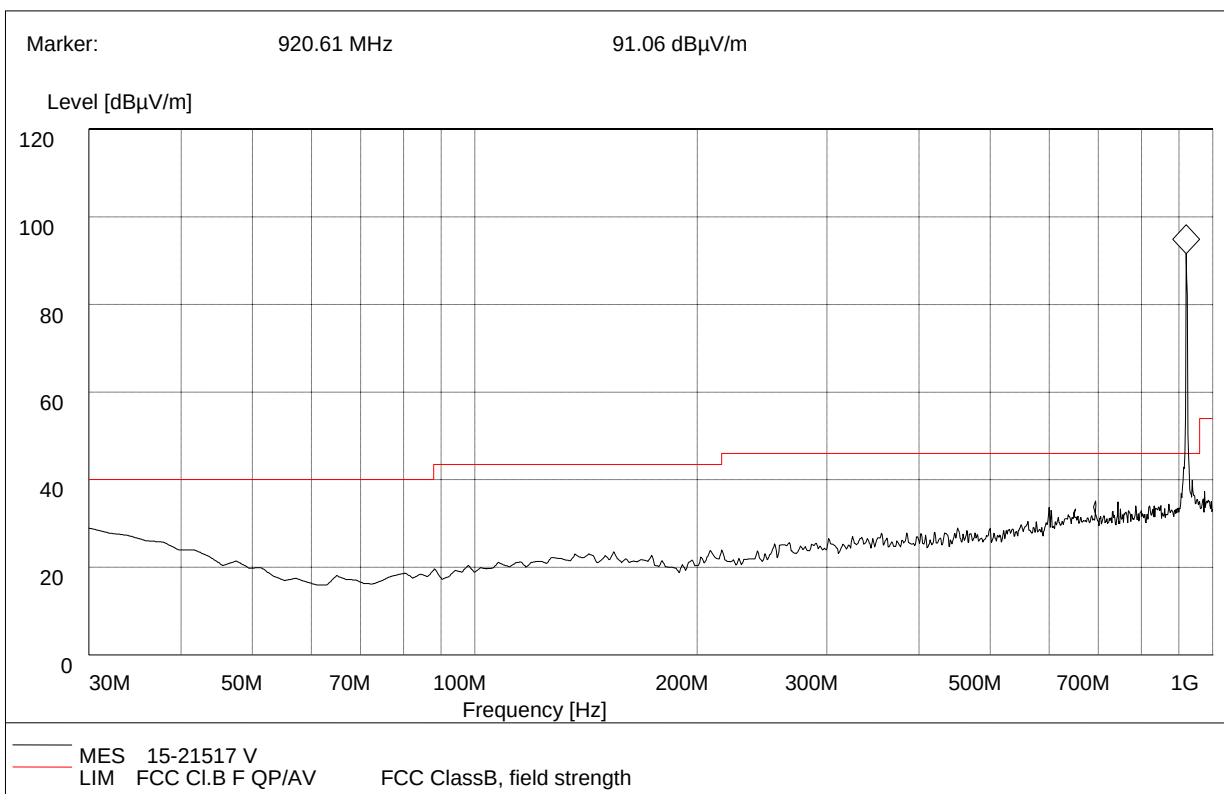
2.4.4 Test Result

Below 1GHz Data:



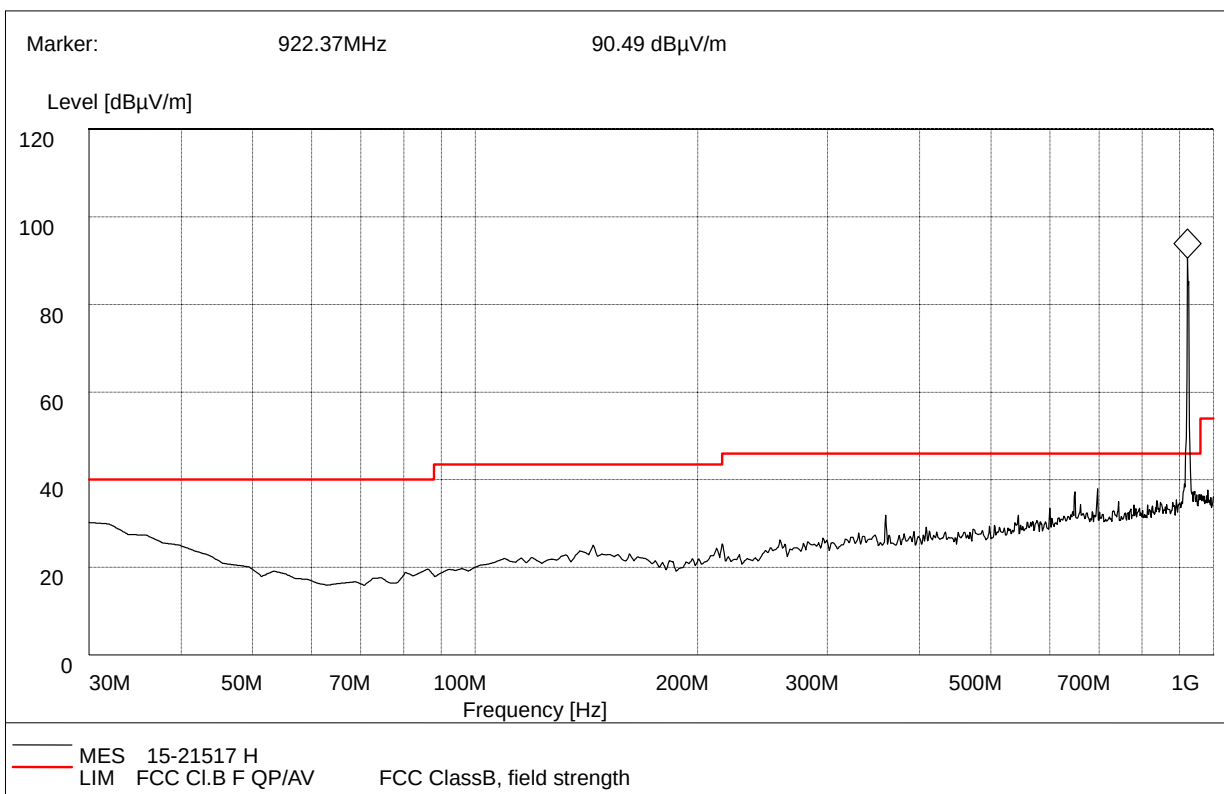
Frequency (MHz)	QuasiPeak (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Antenna	Verdict
30	29.72	120.000	100.0	40.0	Horizontal	Pass
920.61	91.54	120.000	100.0	94	Horizontal	Pass

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



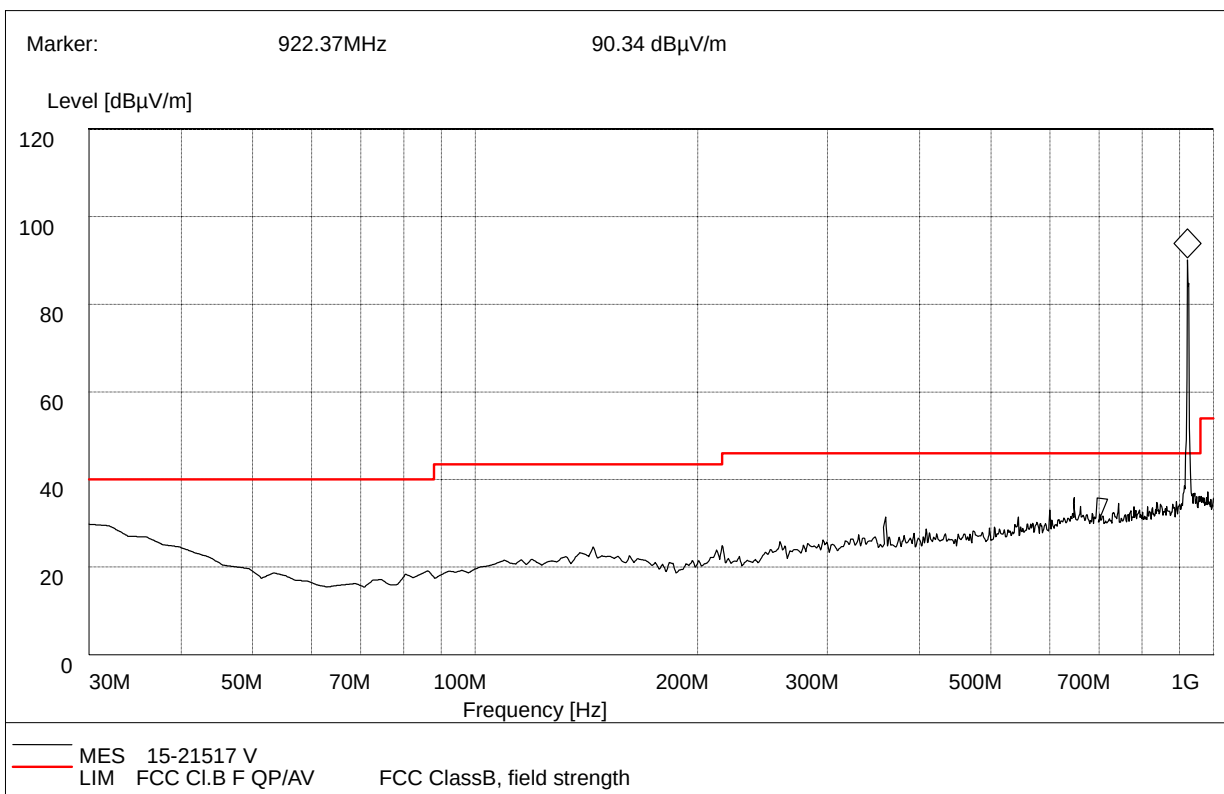
Frequency (MHz)	QuasiPeak (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Antenna	Verdict
30	29.72	120.000	100.0	40.0	Vertical	Pass
920.61	91.06	120.000	100.0	94	Vertical	Pass

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



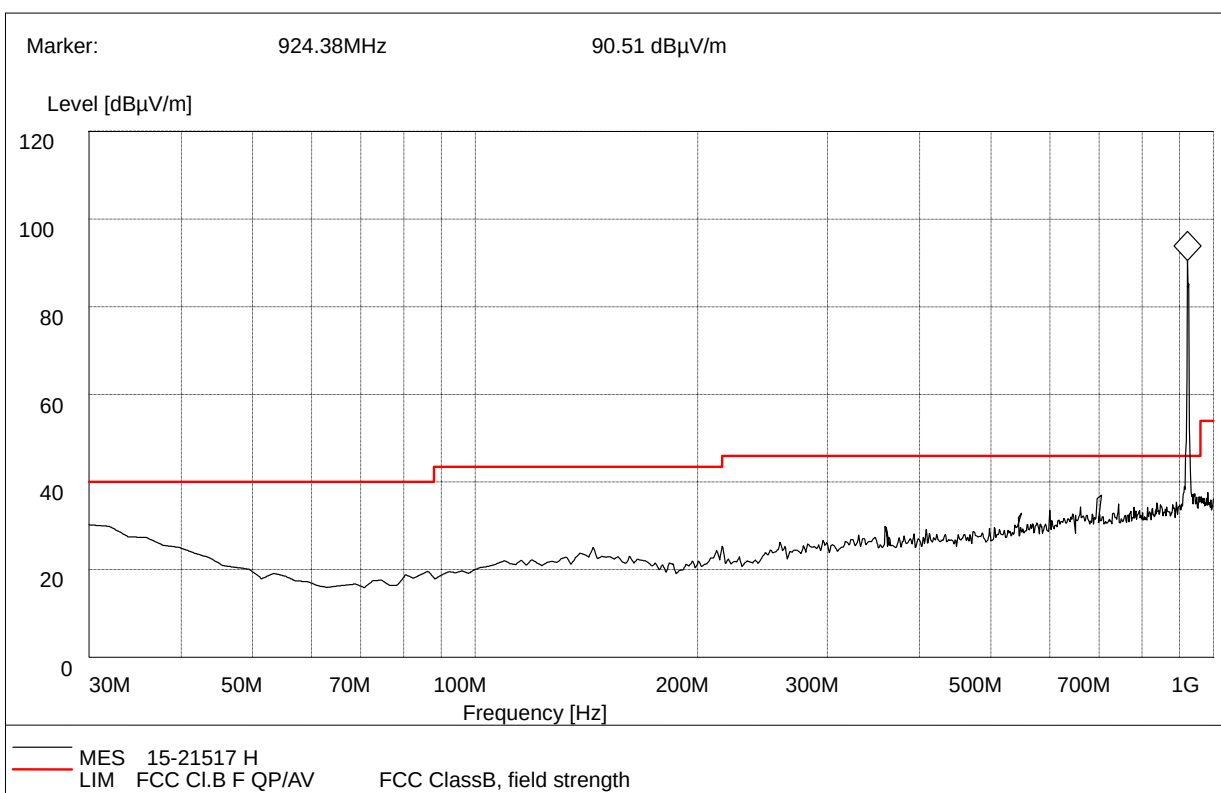
Frequency (MHz)	QuasiPeak (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Antenna	Verdict
30	29.68	120.000	100.0	40.0	Horizontal	Pass
922.37	90.49	120.000	100.0	94	Horizontal	Pass

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



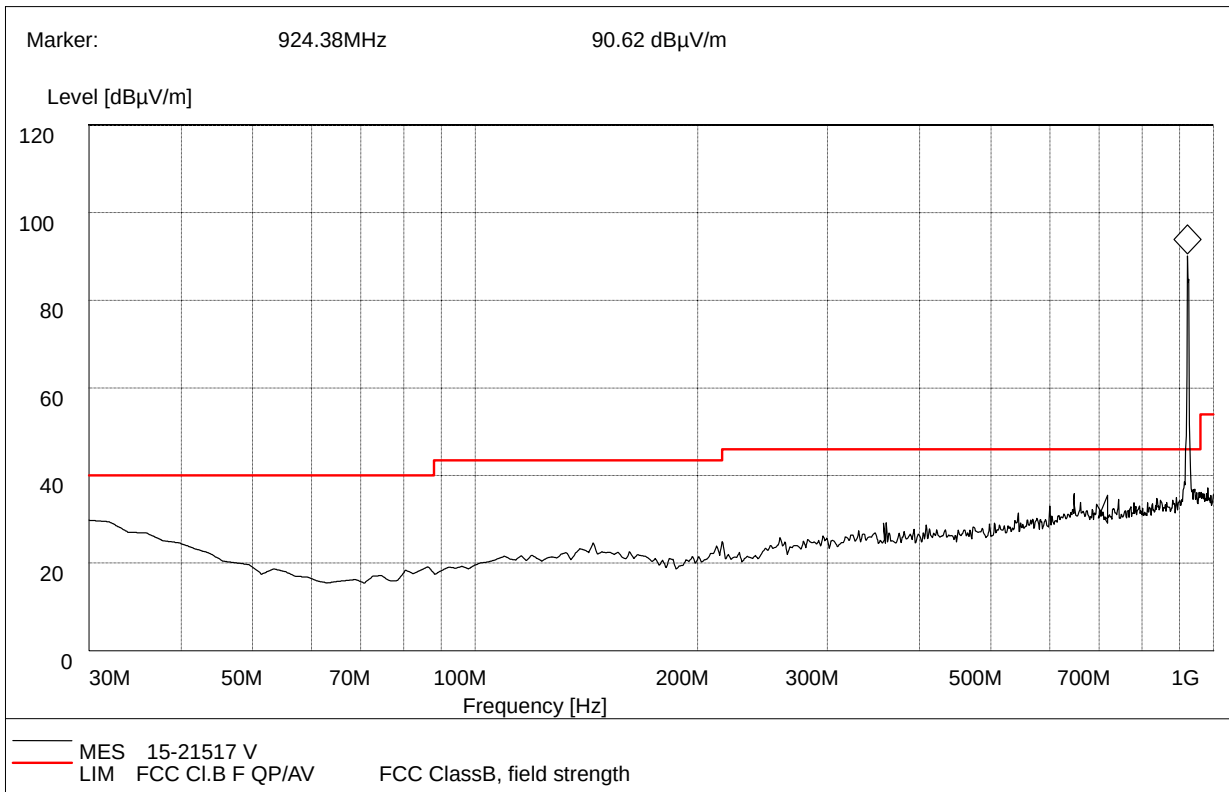
Frequency (MHz)	QuasiPeak (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Antenna	Verdict
30	29.68	120.000	100.0	40.0	Vertical	Pass
922.37	90.34	120.000	100.0	94	Vertical	Pass

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



Frequency (MHz)	QuasiPeak (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Antenna	Verdict
30	29.51	120.000	100.0	40.0	Horizontal	Pass
924.38	90.51	120.000	100.0	94	Horizontal	Pass

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



Frequency (MHz)	QuasiPeak (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Antenna	Verdict
30	29.77	120.000	100.0	40.0	Vertical	Pass
924.38	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)
Frequency Range	1GHz ~ 10GHz		Average(AV)

Antenna Polarity & Test Distance : Horizontal AT 3M

No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1841.25	46.9PK	74.0	-27.1	1.11H	141	51.61	-4.71
2	1841.25	34.6AV	54.0	-19.4	1.11H	141	39.31	-4.71
3	2761.88	46.3PK	74.0	-27.7	1.35H	145	48.44	-2.14
4	2761.88	34.0AV	54.0	-20.0	1.35H	145	36.14	-2.14
5	3682.50	46.5PK	74.0	-27.5	1.21H	133	42.78	3.72
6	3682.50	34.4AV	54.0	-19.6	1.21H	133	30.68	3.72

Antenna Polarity & Test Distance : Vertical AT 3M

No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1841.25	48.0PK	74.0	-26.0	2.48V	45	52.71	-4.71
2	1841.25	35.6AV	54.0	-18.4	2.48V	45	40.31	-4.71
3	2761.88	48.2PK	74.0	-25.8	1.03V	335	50.34	-2.14
4	2761.88	36.1AV	54.0	-17.9	1.03V	335	38.24	-2.14
5	3682.50	47.8PK	74.0	-26.2	1.20V	112	44.08	3.72
6	3682.50	35.2AV	54.0	-18.8	1.20V	112	31.48	3.72



Channel	TX Channel 8	Detector Function	Peak(PK)
Frequency Range	1GHz ~ 10GHz		Average(AV)

Antenna Polarity & Test Distance : Horizontal AT 3M

No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1844.75	46.2PK	74.0	-27.8	1.08H	150	50.80	-4.60
2	1844.75	34.0AV	54.0	-20.0	1.08H	150	38.60	-4.60
3	2767.13	46.0PK	74.0	-28.0	1.37H	137	47.89	-1.89
4	2767.13	33.3AV	54.0	-20.7	1.37H	137	35.19	-1.89
5	3689.50	47.0PK	74.0	-27.0	1.18H	130	43.17	3.83
6	3689.50	34.8AV	54.0	-19.2	1.18H	130	30.97	3.83

Antenna Polarity & Test Distance : Vertical AT 3M

No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1844.75	48.0PK	74.0	-26.0	2.48V	50	52.60	-4.60
2	1844.75	35.3AV	54.0	-18.7	2.48V	50	39.90	-4.60
3	2767.13	48.3PK	74.0	-25.7	1.20V	345	50.19	-1.89
4	2767.13	36.1AV	54.0	-17.9	1.20V	345	37.99	-1.89
5	3689.50	47.3PK	74.0	-26.7	1.00V	118	43.47	3.83
6	3689.50	35.0AV	54.0	-19.0	1.00V	118	31.17	3.83



Channel	TX Channel 16	Detector Function	Peak(PK)
Frequency Range	1GHz ~ 10GHz		Average(AV)

Antenna Polarity & Test Distance : Horizontal AT 3M

No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1848.75	46.0PK	74.0	-28.0	1.08H	130	50.50	-4.50
2	1848.75	34.0AV	54.0	-20.0	1.08H	130	38.50	-4.50
3	2773.13	46.0PK	74.0	-28.0	1.35H	142	47.66	-1.66
4	2773.13	33.7AV	54.0	-20.3	1.35H	142	35.36	-1.66
5	3697.50	46.1PK	74.0	-27.9	1.26H	118	42.31	3.79
6	3697.50	33.9AV	54.0	-20.1	1.26H	118	30.11	3.79

Antenna Polarity & Test Distance : Vertical AT 3M

No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1848.75	47.4PK	74.0	-26.6	2.07V	34	51.90	-4.50
2	1848.75	35.0AV	54.0	-19.0	2.07V	34	39.50	-4.50
3	2773.13	47.3PK	74.0	-26.7	1.00V	340	48.96	-1.66
4	2773.13	35.5AV	54.0	-18.5	1.00V	340	37.16	-1.66
5	3697.50	48.1PK	74.0	-25.9	1.05V	125	44.31	3.79
6	3697.50	35.2V	54.0	-18.8	1.05V	125	31.41	3.79

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.

** END OF REPORT **