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MEASUREMENT REPORT

FCC Part 15B / ICES-003

FCC ID: O9C-BJNGABB0038
IC: 2299L-BJNGABB0038
APPLICANT: Hewlett Packard Company

Application Type: Certification
Product: HPE MSR954-W 1GbE+SFP LTE (AM) Rtr
Model No.: BJNGA-BB0038
Trademark: Hewlett Packard Enterprise
FCC Classification: FCC Class B Digital Device (JBP)
FCC Rule Part(s): FCC Part 15 Subpart B
IC Specification(s): ICES-003 Issue 5: 2012 Class B
Test Procedure(s): ANSI C63.4: 2014
Test Date: April 08 ~ 25, 2015

Reviewed By : Robin Wu
(Robin Wu)
Approved By : Marlin Chen
(Marlin Chen)



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2014. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date
1504RSU00603	Rev. 01	Initial report	10-08-2015

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§2.1033 General Information

Applicant:	Hewlett Packard Company
Applicant Address:	153 Taylor Street Littleton Massachusetts, United States 01460-1407
Manufacturer:	Hewlett Packard Company
Manufacturer Address:	153 Taylor Street Littleton Massachusetts, United States 01460-1407
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
MRT FCC Registration No.:	809388
MRT IC Registration No.:	11384A
Model No.:	BJNGA-BB0038
FCC ID:	O9C-BJNGABB0038
IC:	2299L-BJNGABB0038
Test Device Serial No.:	N/A ☐ Production ☒ Pre-Production ☐ Engineering
FCC Classification:	FCC Class B Digital Device (JBP)

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- MRT facility is a FCC registered (MRT Reg. No. 809388) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules.
- MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.
- MRT facility is a VCCI registered (R-4179, G-814, C-4664, T-2206) test laboratory with the site description on file at VCCI Council.
- MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications and Radio testing for FCC, Industry Canada, EU and TELEC Rules.



1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2009 on September 30, 2013.



2. PRODUCT INFORMATION

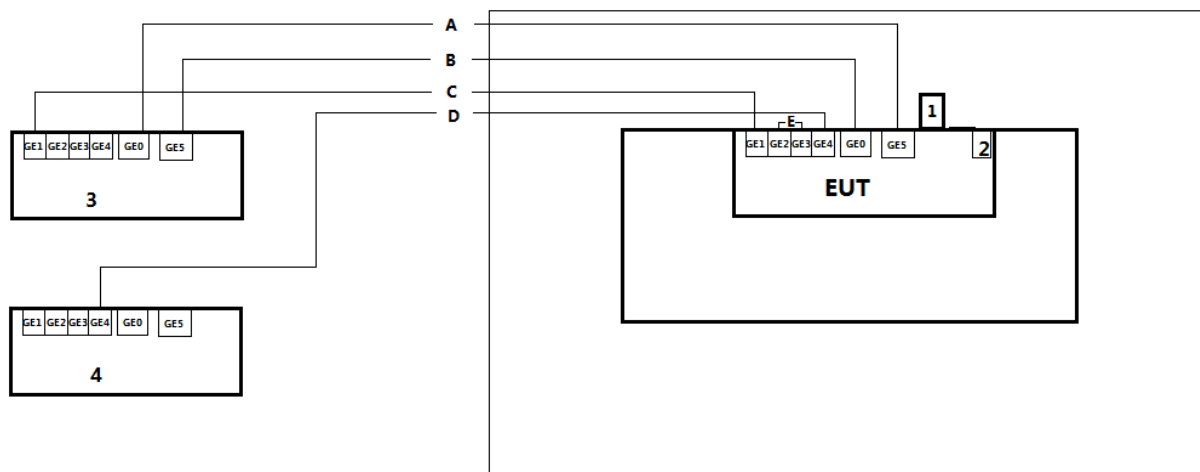
2.1. Equipment Description

Product Name	HPE MSR954-W 1GbE+SFP LTE (AM) Rtr
Model No.	BJNGA-BB0038
Brand Name	Hewlett Packard Enterprise
Wi-Fi Specification	
Frequency Range	802.11b/g/n: 2412 ~ 2462 MHz
Type of Modulation	802.11b: DSSS 802.11g/n: OFDM
Data Rate	802.11b: 1/2/5.5/11Mbps 802.11g: 6/9/12/18/24/36/48/54Mbps 802.11n: up to 300Mbps
Antenna Type	External Antenna
Antenna Gain	3.0dBi
MC7354 Module Specification	
FCC ID	N7NMC7355
IC	2417C-MC7355
Supported Bands	GPRS/EDGE 850/1900 WCDMA Band II/V CDMA2000 BC0/BC1/BC10 LTE Band 2/4/5/13/17/25

2.2. Test Configuration

The HPE MSR954-W 1GbE+SFP LTE (AM) Rtr FCC ID: O9C-BJNGABB0038 was tested per the guidance FCC Part 15 Subpart B: 2014 and ANSI C63.4: 2014 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

Connection Diagram



Signal Cable Type		Signal cable Description
A	LAN Cable	Non-shielding, >10m
B	LAN Cable	Non-shielding, >10m
C	LAN Cable	Non-shielding, >10m
D	LAN Cable	Non-shielding, >10m
E	LAN Cable	Non-shielding, 1m

Note: IP address as below.

For EUT:

	GE0 Port	GE1 Port	GE5 Port
EUT	192.168.2.1	---	192.168.3.1
HP MSR954 Router 4#	192.168.2.10	192.168.1.2	192.168.3.10
HP MSR954 Router 5#	---	192.168.1.3	---

Note: When we configured the EUT set-up, the console port didn't connect some peripherals, which was used to do software upgrade for the professional installers.

2.3. Test System Details

The types for all equipments, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
1	USB Disk	SanDisk	D33724	N/A
2	Micro-SD Card	Kingston	N/A	N/A
3	HP MSR954 Router	HP	BJNGA-BB0038	N/A
4	HP MSR954 Router	HP	BJNGA-BB0038	N/A

2.4. Test Software

1	Setup the EUT and simulators as shown on above.
2	Make the HP MSR954 router 4# communicate with HP MSR954 router 5# by PING (Input some commands in hyper-terminal through the console port).
3	Make the USB Disk or Micro-SD Card download data from EUT continuously (Input some commands in hyper-terminal through the console port).

2.5. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.6. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase.

However, when the device is so small wherein placement of the label with specified statement is not practical, only the trade name and FCC ID must be displayed on the device per Section 15.19(a)(5).

Please see attachment for FCC ID label and label location.

3. DESCRIPTION OF TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-2014) was used in the measurement of the **HPE MSR954-W 1GbE+SFP LTE (AM) Rtr FCC ID: O9C-BJNGABB0038**.

Deviation from measurement procedure.....None

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150 kHz to 30 MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or resolution, clock or data exchange speed, scrolling H pattern to the EUT and/or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions are used for final measurements on the same test site. Line conducted emissions test results are shown in Section 6.2.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. An MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30 MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30 MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 0.8 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB beam-width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

4. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2015/11/07
Two-Line V-Network	R&S	ENV216	MRTSUE06002	1 year	2015/11/07
Two-Line V-Network	R&S	ENV216	MRTSUE06003	1 year	2015/11/07
Temperature/Humidity Meter	Ouleinuo	N/A	MRTSUE06114	1 year	2015/11/20

Radiated Emission

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	E4447A	MRTSUE06028	1 year	2015/10/09
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2015/11/07
Preamplifier	Agilent	83017A	MRTSUE06020	1 year	2015/12/13
Loop Antenna	Schwarzbeck	FMZB1519	MRTSUE06025	1 year	2015/11/08
TRILOG Antenna	Schwarzbeck	VULB9162	MRTSUE06022	1 year	2015/11/08
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06023	1 year	2015/11/08
Broadband Horn Antenna	Schwarzbeck	BBHA9170	MRTSUE06024	1 year	2016/01/05
Temperature/Humidity Meter	Ouleinuo	N/A	MRTSUE06115	1 year	2015/11/20

Software	Version	Function
e3	V8.3.5	EMI Test Software

5. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.

AC Conducted Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): 150kHz~30MHz: 3.5dB
Radiated Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% ($U=2Uc(y)$): Horizontal: 30MHz~1GHz: 4.07dB 1GHz~18GHz: 4.16 dB Vertical: 30MHz~1GHz: 4.18 dB 1GHz~18GHz: 4.76 dB

6. TEST RESULT

6.1. Summary

Company Name: Hewlett Packard Company
FCC ID: O9C-BJNGABB0038
IC: 2299L-BJNGABB0038
FCC Classification: FCC Class B Digital Device (JBP)
Test Mode: Communication

FCC Part Section(s)	Test Description	Test Result
15.107	Conducted Emissions	Pass
15.109	Radiated Emissions	Pass

6.2. Conducted Emission Measurement

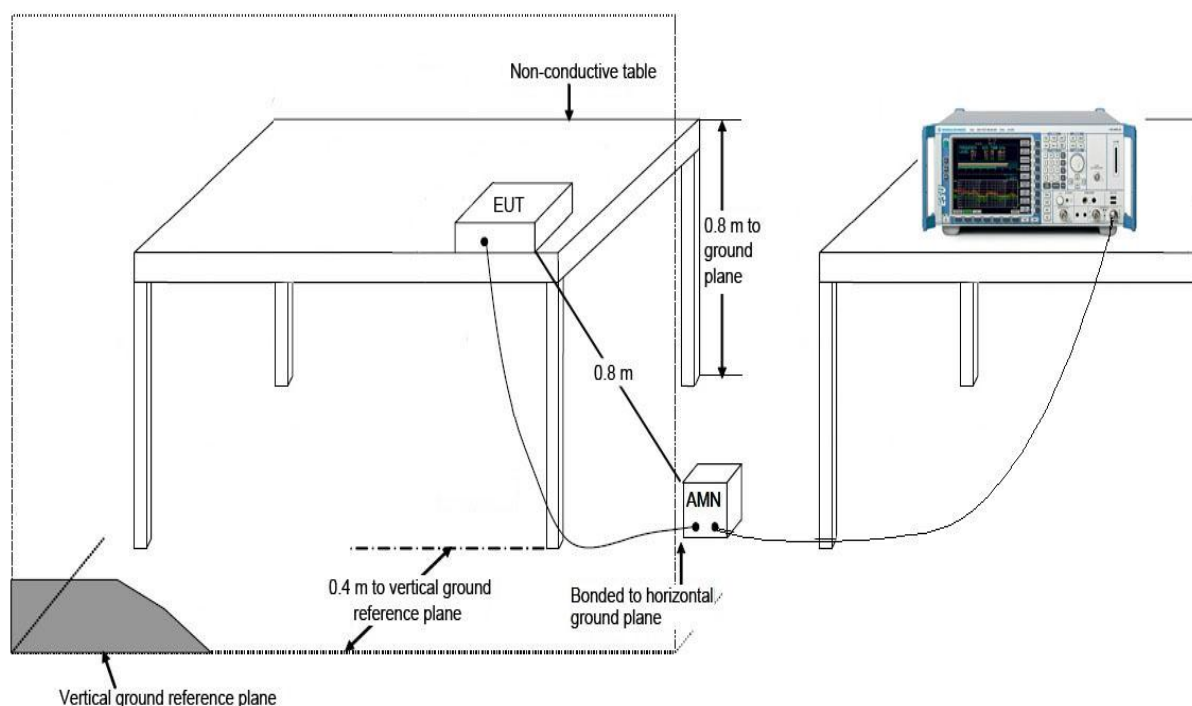
6.2.1. Test Limit

FCC Part 15.107 Limits		
Frequency (MHz)	QP (dB μ V)	AV (dB μ V)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

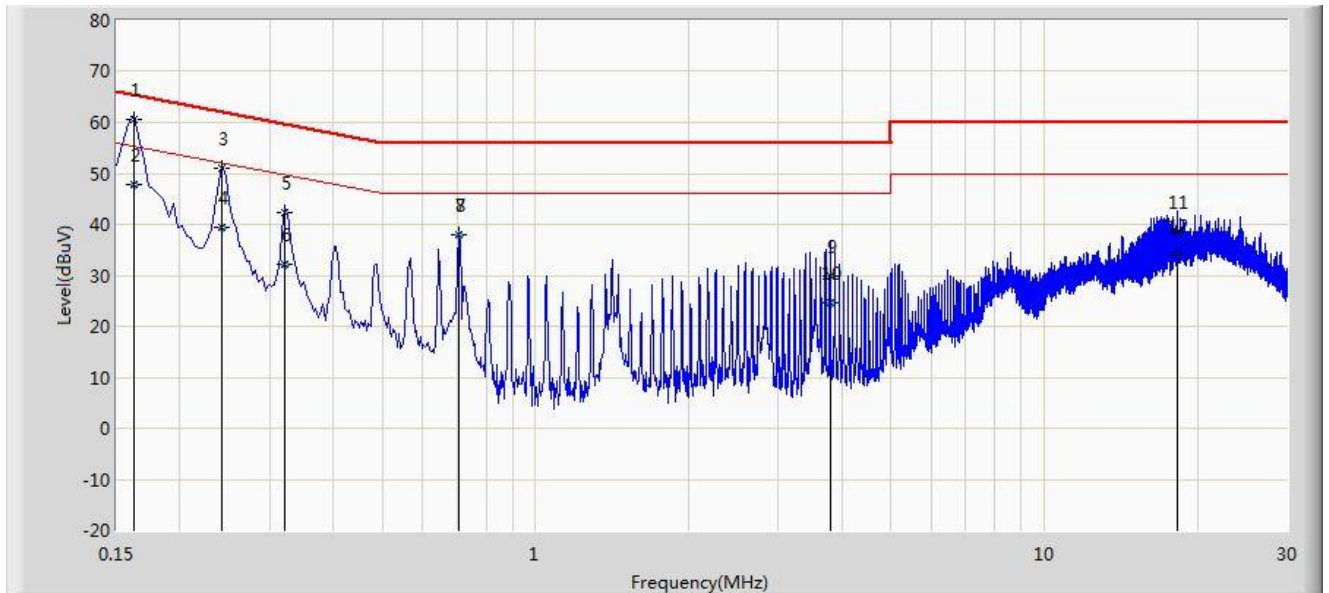
Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

6.2.2. Test Setup



6.2.3. Test Result of Conducted Emissions

Site: SR2	Time: 2015/04/09 - 10:21
Limit: FCC_Part15.107_CE_AC Power Class B	Engineer: Line Chen
Probe: ENV216_101683_Filter On	Polarity: Line
EUT: HPE MSR954-W 1GbE+SFP LTE (AM) Rtr	Power: AC 120V/60Hz
Note: Communication	

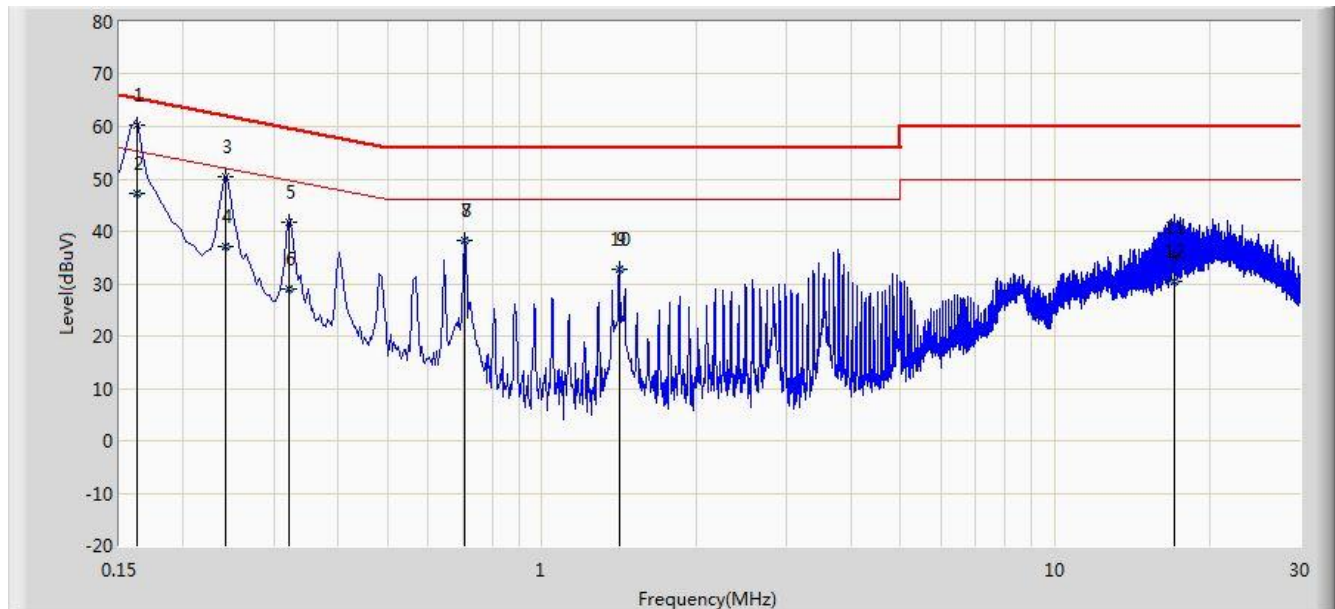


No	Flag	Mark	Frequency (MHz)	Measure Level (dBμV)	Reading Level (dBμV)	Over Limit (dB)	Limit (dBμV)	Factor (dB)	Type
1		*	0.162	60.548	50.451	-4.813	65.361	10.097	QP
2			0.162	47.969	37.872	-7.392	55.361	10.097	AV
3			0.242	50.891	40.934	-11.136	62.027	9.958	QP
4			0.242	39.322	29.365	-12.705	52.027	9.958	AV
5			0.322	42.332	32.310	-17.323	59.655	10.022	QP
6			0.322	32.293	22.271	-17.362	49.655	10.022	AV
7			0.706	38.031	27.971	-17.969	56.000	10.060	QP
8			0.706	37.979	27.919	-8.021	46.000	10.060	AV
9			3.794	29.791	19.833	-26.209	56.000	9.958	QP
10			3.794	24.594	14.636	-21.406	46.000	9.958	AV
11			18.306	38.684	28.583	-21.316	60.000	10.101	QP
12			18.306	33.919	23.818	-16.081	50.000	10.101	AV

Note: Measure Level (dBμV) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB).

Site: SR2	Time: 2015/04/09 - 10:26
Limit: FCC_Part15.107_CE_AC Power Class B	Engineer: Line Chen
Probe: ENV216_101683_Filter On	Polarity: Neutral
EUT: HPE MSR954-W 1GbE+SFP LTE (AM) Rtr	Power: AC 120V/60Hz
Note: Communication	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1		*	0.162	60.350	50.271	-5.011	65.361	10.078	QP
2			0.162	47.267	37.189	-8.094	55.361	10.078	AV
3			0.242	50.467	40.472	-11.560	62.027	9.995	QP
4			0.242	37.199	27.204	-14.829	52.027	9.995	AV
5			0.322	41.856	31.803	-17.799	59.655	10.054	QP
6			0.322	29.087	19.034	-20.568	49.655	10.054	AV
7			0.706	38.315	28.244	-17.685	56.000	10.071	QP
8			0.706	38.260	28.188	-7.740	46.000	10.071	AV
9			1.414	32.670	22.777	-23.330	56.000	9.893	QP
10			1.414	32.619	22.726	-13.381	46.000	9.893	AV
11			17.082	34.945	24.819	-25.055	60.000	10.126	QP
12			17.082	30.293	20.167	-19.707	50.000	10.126	AV

Note: Measure Level (dBμV) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB).

6.3. Radiated Emission Measurement

6.3.1. Test Limit

FCC Part 15.109 Limits		
Frequency (MHz)	Distance (m)	Level (dB μ V/m)
30 - 88	3	40
88 - 216	3	43.5
216 - 960	3	46
Above 960	3	54

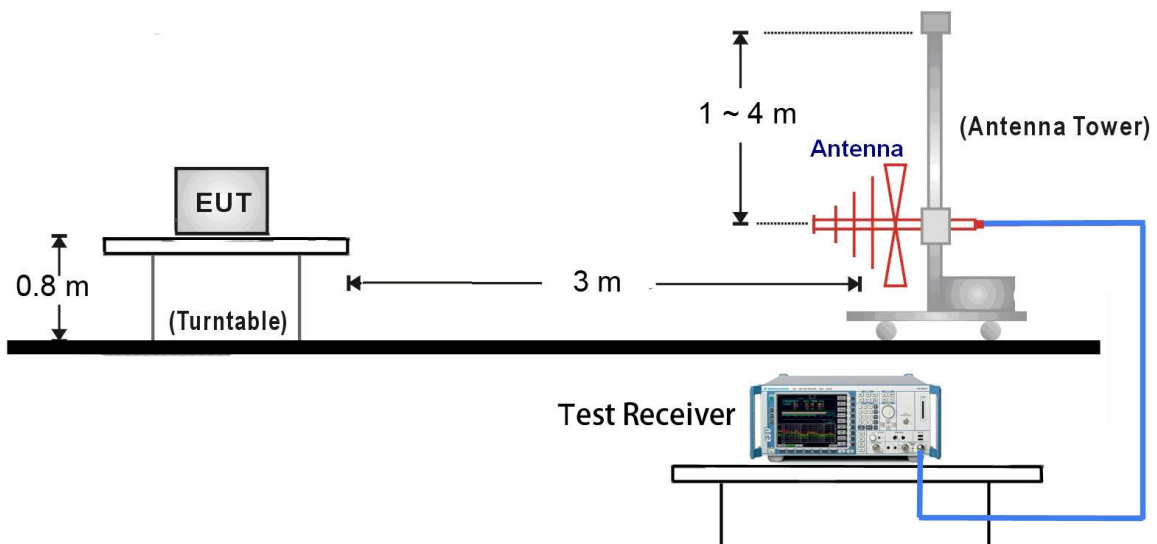
Note 1: The lower limit shall apply at the transition frequency.

Note 2: Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

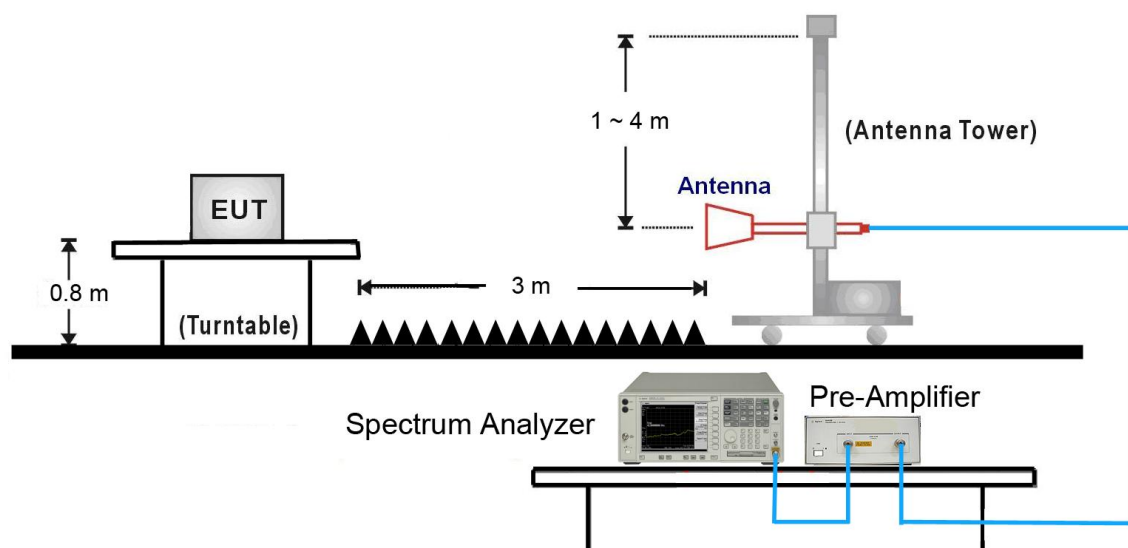
Note 3: E field strength (dB μ V/m) = 20 log E field strength (μ V/m)

6.3.2. Test Setup

30MHz ~ 1GHz Test Setup:

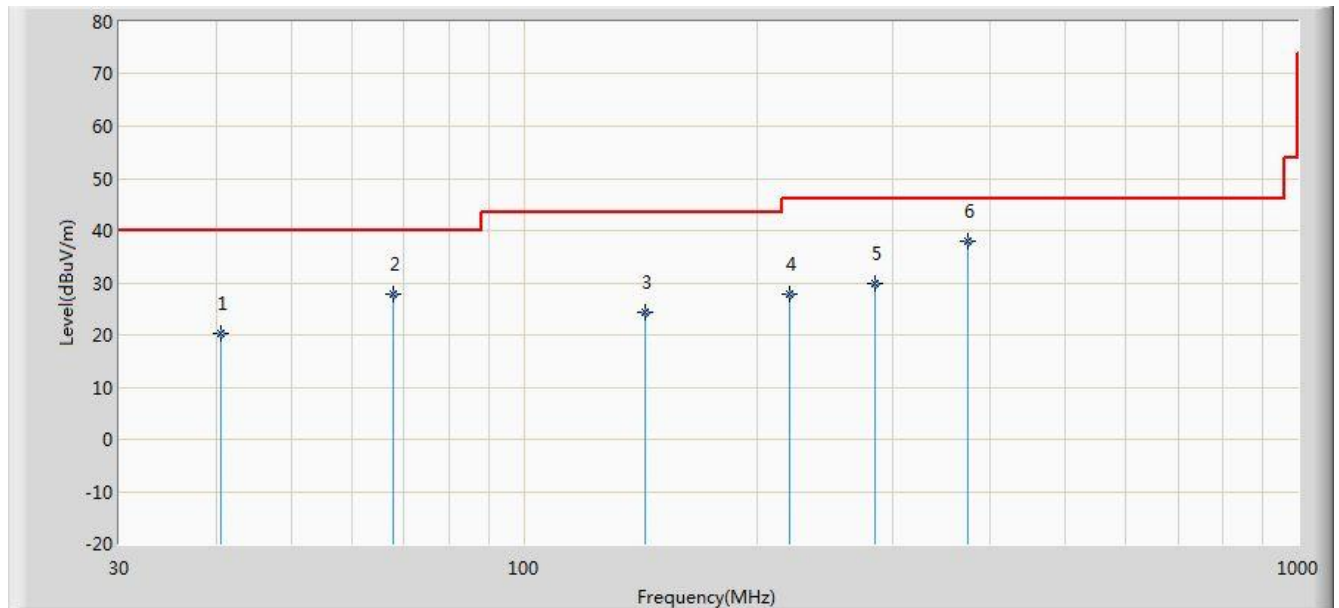


1GHz ~18GHz Test Setup:



6.3.3. Test Result of Radiated Emissions

Site: AC1	Time: 2015/04/29 - 16:19
Limit: FCC_Part15.109_RE(3m)_Class B	Engineer: Line Chen
Probe: VULB9162_0.03-8GHz	Polarity: Horizontal
EUT: HPE MSR954-W 1GbE+SFP LTE (AM) Rtr	Power: AC 120V/60Hz
Note: Communication	

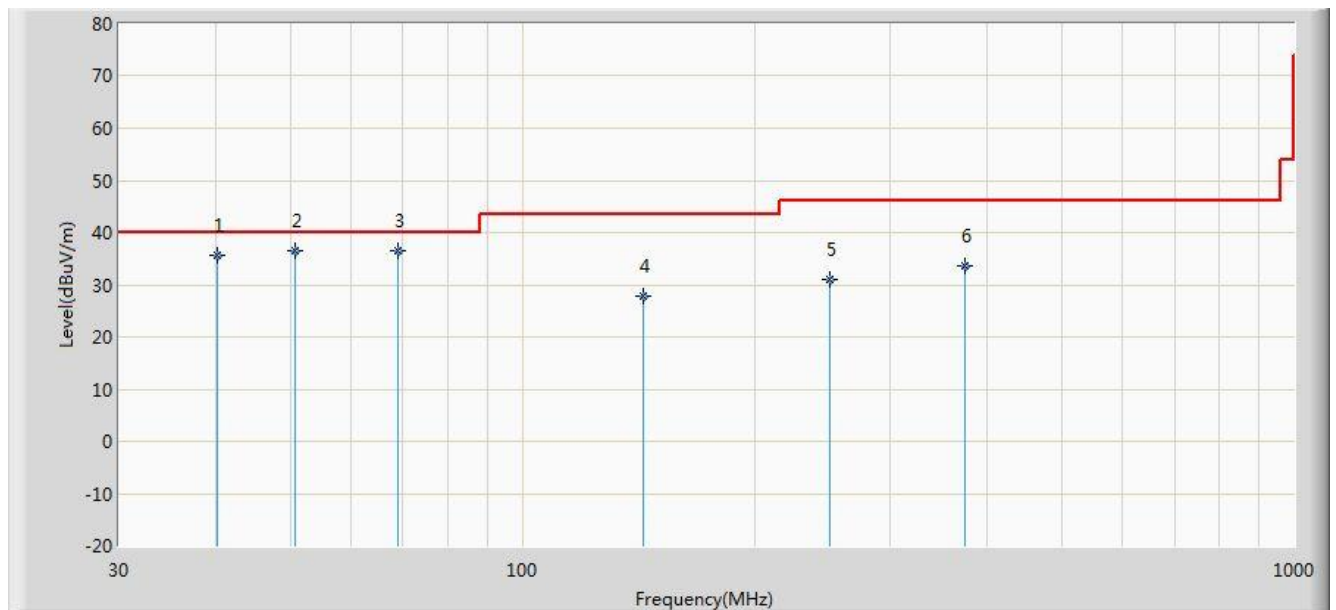


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			40.671	20.225	6.254	-19.775	40.000	13.971	QP
2			67.845	27.886	16.315	-12.114	40.000	11.570	QP
3			143.138	24.444	15.030	-19.056	43.500	9.414	QP
4			220.612	27.935	15.315	-18.065	46.000	12.620	QP
5			283.685	29.813	15.622	-16.187	46.000	14.191	QP
6		*	374.935	37.838	21.687	-8.162	46.000	16.151	QP

Note: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: AC1	Time: 2015/04/29 - 16:21
Limit: FCC_Part15.109_RE(3m)_Class B	Engineer: Line Chen
Probe: VULB9162_0.03-8GHz	Polarity: Vertical
EUT: HPE MSR954-W 1GbE+SFP LTE (AM) Rtr	Power: AC 120V/60Hz
Note: Communication	

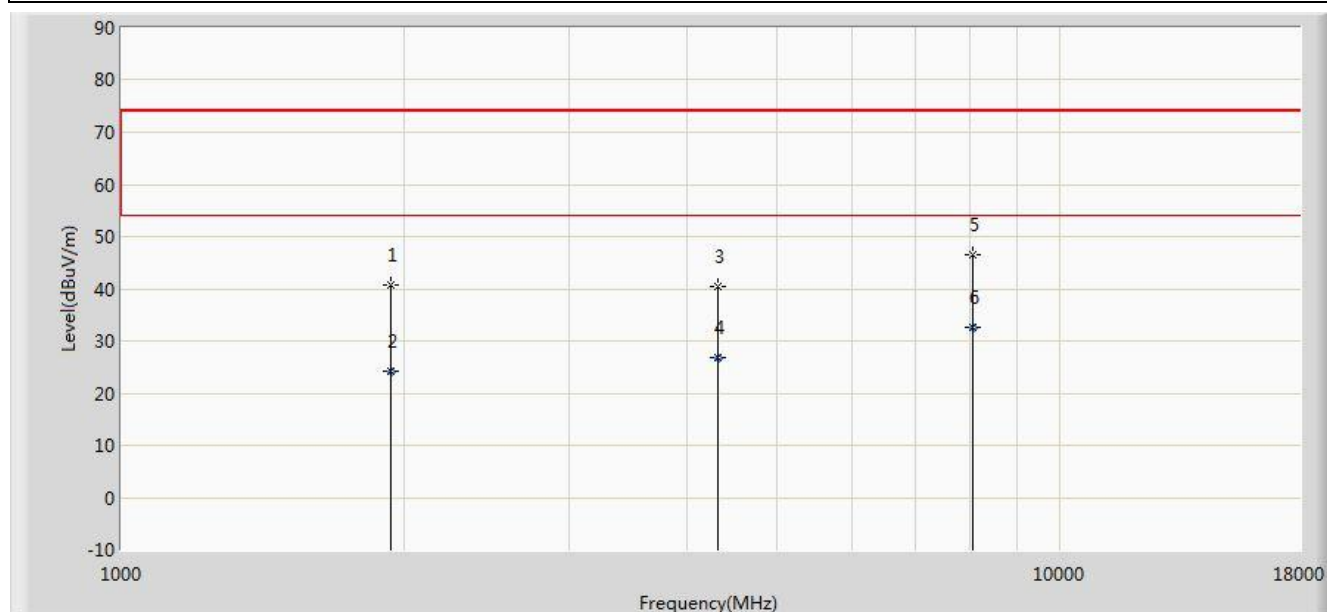


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			40.199	35.542	21.660	-4.458	40.000	13.882	QP
2		*	50.816	36.593	21.700	-3.407	40.000	14.893	QP
3			68.981	36.443	25.250	-3.557	40.000	11.193	QP
4			143.513	27.730	18.315	-15.770	43.500	9.415	QP
5			250.206	30.877	17.245	-15.123	46.000	13.632	QP
6			374.964	33.604	17.452	-12.396	46.000	16.152	QP

Note: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m).

Site: AC1	Time: 2015/04/29 - 16:28
Limit: FCC_Part15.109_RE(3m)_Class B	Engineer: Line Chen
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: HPE MSR954-W 1GbE+SFP LTE (AM) Rtr	Power: AC 120V/60Hz
Note: Communication	

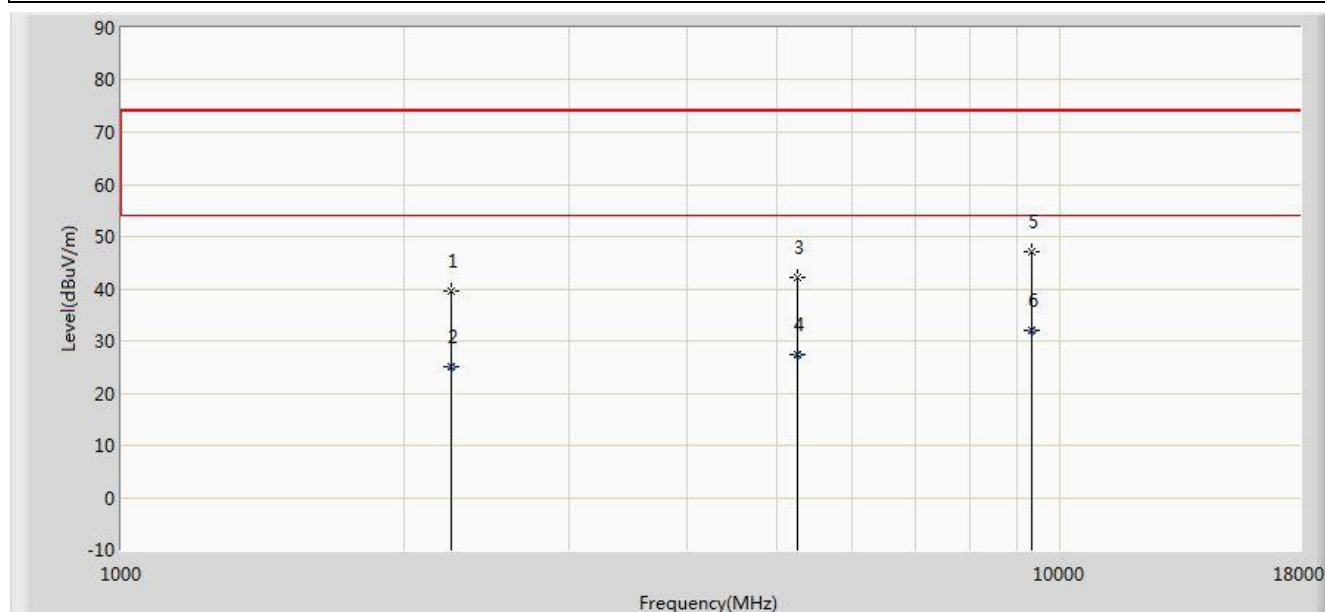


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			1935.000	40.617	46.726	-33.383	74.000	-6.109	PK
2			1935.126	24.207	30.315	-29.793	54.000	-6.109	AV
3			4315.000	40.457	39.243	-33.543	74.000	1.214	PK
4			4315.021	26.755	25.541	-27.245	54.000	1.214	AV
5			8080.500	46.417	37.772	-27.583	74.000	8.645	PK
6		*	8080.621	32.619	23.975	-21.381	54.000	8.645	AV

Note: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) – Pre_Amplifier Gain (dB).

Site: AC1	Time: 2015/04/29 - 16:28
Limit: FCC_Part15.109_RE(3m)_Class B	Engineer: Line Chen
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: HPE MSR954-W 1GbE+SFP LTE (AM) Rtr	Power: AC 120V/60Hz
Note: Communication	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			2249.500	39.666	43.116	-34.334	74.000	-3.449	PK
2			2249.638	25.193	28.642	-28.807	54.000	-3.449	AV
3			5258.500	42.145	38.958	-31.855	74.000	3.187	PK
4			5258.875	27.401	24.214	-26.599	54.000	3.187	AV
5			9338.500	47.034	36.592	-26.966	74.000	10.442	PK
6		*	9338.751	32.128	21.685	-21.872	54.000	10.443	AV

Note: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) – Pre_Amplifier Gain (dB).

7. CONCLUSION

The data collected relate only the item(s) tested and show that the **HPE MSR954-W 1GbE+SFP LTE (AM) Rtr FCC ID: O9C-BJNGABB0038** has been tested to comply with the requirements specified in §15.107 and §15.109 of the FCC Rules.

The End