Radio Test Report-2.4G BLE

Report Reference No. AAEMT/EMC/201119-01-03

Applicant's name.....: Netradyne Inc.

Address ..... 9191 Towne Centre Drive, Suite 200, San Diego, CA 92122

Manufacture's Name ..... Netradyne Inc.

Address ..... 9191 Towne Centre Drive, Suite 200, San Diego, CA 92122

Test item description:

Product name .....: Driveri

Trademark .....: Netradyne

Model and/or type reference .....: D-210

Series Models.....: D-210A, D-211

Standards .....: ETSI EN 300 328 V2.2.2 (2019-07)

Testing Laboratory information:

Testing Laboratory Name .....: AA Electro Magnetic Test Laboratory Private Limited

Address .....: Plot No 174, Udyog Vihar-Phase4, Sector18, Gurgaon, Haryana, India

This device has been tested and found to comply with the stated standard(s), which is (are) required by the council directive of 2014/53/RED and indicated in the test report and are applicable only to the tested sample identified in the report.

Note: This report shall not be reproduced except in full, without the written approval of AA Electro Magnetic Test Laboratory Private Limited, this document may be altered or revised by AA Electro Magnetic Test Laboratory Private Limited, personal only, and shall be noted in the revision of the document. This test report must not be used by the client to claim product end or segment.

Testing.....:

Date of receipt of test item.....: Nov. 19, 2020

Date (s) of performance of tests.....: Nov. 19~ Dec. 08, 2020

Date of Issue .....: Dec. 29, 2020

Test Result .....: **Pass**

Declaration of Conformity: Declaration of conformity of the results is based as per the standard limits

Compiled by (+ signature)Abhinav Kumar: Abhinav Kumar

Authorized & Reviewed by (+ signature) Dr. Lenin Raja:

Issuedby (+ signature) Bittu Kumar: Bittu Kumar

AA Electro Magnetic Test Laboratory Pvt. Ltd.

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

1 Contents

Page

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

2 Test Summary

2.1 Compliance with ETSI EN 300 328 V2.2.2 (2019-07)

No.	Description of Test Item	Basic Standard	Results
Transmitter Parameters			
1	RF Output Power	EN 300 328 clause 4.3.2.2	Pass
2	Power Spectral Density	EN 300 328 clause 4.3.2.3	Pass
3	Duty cycle, Tx-Sequence, Tx-gap	EN 300 328 clause 4.3.2.4	N/A
4	Medium Utilization (MU) factor	EN 300 328 clause 4.3.2.5	N/A
5	Adaptivity	EN 300 328 clause 4.3.2.6	Pass
6	Occupied Channel Bandwidth	EN 300 328 clause 4.3.2.7	Pass
7	Transmitter unwanted emission in the OOB domain	EN 300 328 clause 4.3.2.8	Pass
8	Transmitter unwanted emissions in the spurious domain	EN 300 328 clause 4.3.2.9	Pass
9	Geo-location capability	EN 300 328 Clause 4.3.2.12	N/A
Receiver Parameters			
10	Receiver spurious emissions	EN 300 328 clause 4.3.2.10	Pass
11	Receiver Blocking	EN 300 328 clause 4.3.2.11	Pass

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

3 Test Facility

The test facility is recognized, certified or accredited by the following organizations:

ILAC / NABL Accreditation No.: TC-8597

Three 3m Semi-Anechoic Chamber, 1 full-Anechoic chamber and 2 Shielding Rooms of AA Electro Magnetic Test Laboratory Private Limited have been registered by National Accreditation Board for Testing and Calibration Laboratories (NABL).

ILAC –A2LA Accreditation No.: 5593.01

Three 3m Semi-Anechoic Chamber, 1 full-Anechoic chamber and 2 Shielding Rooms of AA Electro Magnetic Test Laboratory Private Limited have been registered American Association of Laboratory Accreditation (A2LA.)

FCC- Recognition No.: 137777

Three 3m Semi-Anechoic Chamber, 1 full-Anechoic chamber and 2 Shielding Rooms of AA Electro Magnetic Test Laboratory Private Limited have been registered by Federal Communications Commission (FCC).

ISED Recognition No.: 26046

Three 3m Semi-Anechoic Chamber, 1 full-Anechoic chamber and 2 Shielding Rooms of AA Electro Magnetic Test Laboratory Private Limited have been registered by Institute for Social and Economic Development.(ISED)

VCCI- Registration No: 4053

Three 3m Semi-Anechoic Chamber, 1 full-Anechoic chamber and 2 Shielding Rooms of AA Electro Magnetic Test Laboratory Private Limited have been registered by Voluntary Control Council for Interference.(VCCI)

TEC Designation No.: IND063

Three 3m Semi-Anechoic Chamber, 1 full-Anechoic chamber and 2 Shielding Rooms of AA Electro Magnetic Test Laboratory Private Limited have been registered by Telecommunication Engineering (TEC) Center.

BIS Recognition No: 816586

BIS recognized as per CRS scheme for IT electronics, LED control gears, Lamp, Inverter / UPS are recognized as per LRS 2020.

3.1 Deviation from Standard

None

3.2 Abnormalities from Standard Conditions

None

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

4 General Information

4.1 General Description of EUT

Manufacturer:	Netradyne Inc.
Manufacturer Address:	9191 Towne Centre Drive, Suite 200, San Diego, CA 92122
EUT Name:	Driveri
Model No:	D-210
Series Models:	D-210A, D-211
Brand Name:	Netradyne
Operation Frequency:	2402 MHz to 2480 MHz
Channel Number:	40
Modulation Type:	GFSK
Adaptive/non-adaptive:	Adaptive equipment
Antenna Gain:	3 dBi
H/W No.:	501-1-00908_B1
F/W No.:	2.4.9.rc.2
Product Ratings:	Input : 12VDC, 3A
Battery	N /A
Note:	
1.	For a more detailed features description, please refer to the manufacturer's Specifications or the User's Manual.

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

Description of Channel:			
Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	20	2442
01	2404	21	2444
02	2406	22	2446
03	2408	23	2448
04	2410	24	2450
05	2412	25	2452
06	2414	26	2454
07	2416	27	2456
08	2418	28	2458
09	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

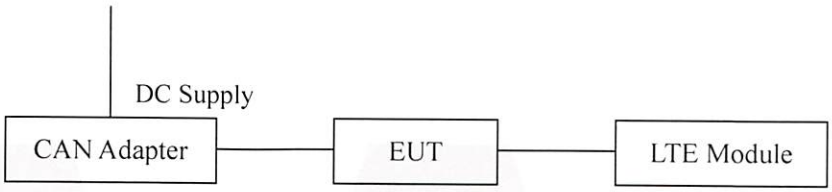
AA Electro Magnetic Test Laboratory Pvt. Ltd.

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

4.2 Description of Test setup

EUT was tested in normal configuration (Please See following Block diagrams)

1. Block diagram of EUT configuration (TX Mode)



Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

4.3 EUT Peripheral List

No.	Equipment	Manufacturer	Model No.	Serial No.	Power cord	Signal cable
1	DC Power Supply	JUNKE	JK15040K	20181126-43	2m Unshielded Cable	N/A

4.4 TEST Peripheral List

No.	Equipment	Manufacturer	EMC Compliance	Model No.	Serial No.	Power cord	Signal cable
1	Driveri/DCM LTE Module	Netradyne Inc.	N/A	DriverI/DCM	N/A	N/A	N/A
2	CAN Adaptor Board	Netradyne Inc.	N/A	A1 version : D-210-AD1 A2 version : D-210-AD2 A3 version : D-210-AD3	N/A	N/A	N/A

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

4.5 Equipments List for All Test Items

No	Test Equipment	Manufacturer	Model No	Serial No	Cal. Date	Cal.Due Date
1	EMI TEST Receiver	Rohde and Schwarz	ESIB26	838786/010	2020/01/28	2021/01/27
2	Loop antenna	DAZE Beijing	ZN30900C	18052	2020/01/29	2021/01/28
3	Hi power horn antenna	DAZE Beijing	ZN30700	18012	2020/01/30	2021/01/29
4	Horn antenna	DAZE Beijing	ZN30702	18006	2020/01/30	2021/01/29
5	Horn antenna	DAZE Beijing	ZN30703	18005	2020/01/30	2021/01/29
6	Pre amplifier	KELIANDA	LNA-0009295	-	2020/01/28	2021/01/29
7	Pre amplifier	KELIANDA	CF-00218	-	2020/01/28	2021/01/27
8	Biconical Antenna	DAZE Beijing	ZN30505C	17038	2020/01/28	2021/01/29
9	EMI-RECEIVER	Schwarzbeck	FCKL	1528194	2020/01/28	2021/01/27
10	Spectrum Analyzer	ADVANTEST	R3361	-	2020/05/15	2021/05/14
11	LISN	Kyoritsu	KNW-407	8-1789-5	2020/01/28	2021/01/27
12	Network-LISN	SCHWAR ZBECK	NNBM8125	81251314	2020/01/28	2021/01/27
13	Network-LISN	SCHWAR ZBECK	NNBM8125	81251315	2020/01/28	2021/01/27
14	PULSELIMITER	Rohde and Schwarz	ESH3-Z2	100681	2020/05/13	2021/05/12
15	50ΩCoaxialSwitch	DAIWA	1565157	-	2020/05/13	2021/05/12
16	50ΩCoaxialSwitch	-	-	-	2020/05/13	2021/05/12
17	Wireless signal power	DARE!!	RPR3006W	RFSW190220	2020/01/29	2021/01/27
18	Signal Generator	KEYSIGHT	N5181A	512071	2020/01/29	2021/01/28

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

19	RF Vector Signal Generator	Keysight	N5182B	512094	2020/01/29	2021/01/28
20	Spectrum analyzer	R&S	FSV-40N	101385	2020/01/29	2021/01/28
21	Radio Communication Tester	R&S	CMW 500	124589	2020/05/15	2021/05/14
22	Signal Generator	R&S	SMP02	837017/004 836593/005	2020/05/15	2021/05/14
23	DC Power Supply	Guanker	JK15040K	TNC/ET/C/001/15	2020/02/02	2021/02/01
24	Pro.Temp&Humi. chamber	MENTEK	MHP-150-1C	MAA08112501	2020/02/02	2021/02/01
25	Attenuators	AGILENT	8494B	-	-	-
26	Attenuators	AGILENT	8495B	-	-	-

AA Electro Magnetic Test Laboratory Pvt. Ltd.

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

4.6 Test conditions

4.6.1 Normal conditions

Ambient:	Temperature:	+15°C to +35°C
	Relative humidity:	20% to 75%
	Press:	1010 mbar
Power supply:	DC	12V

4.6.2 Extreme conditions

Ambient:	Temperature:	-20 °C to +40 °C (Which declared by manufacture)
Power supply:	DC	10.8Vto13.2V

4.7 Measurement Uncertainty

No.	Item	Uncertainty
1	Conducted Emission Test	2.78dB
2	Radiated Emission Test	2.82dB
3	RF power, conducted	2.62dB
4	RF power density, conducted	2.72dB
5	Spurious emissions, conducted	2.83dB
6	All emissions, radiated(<1G)	2.80dB
7	All emissions, radiated(>1G)	2.81dB

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

5 Transmitter Requirements

5.1 RF Output Power

5.1.1 Limit(ETSI EN 300 328, V2.2.2/2019-07 Clause 4.3.1.2.3)

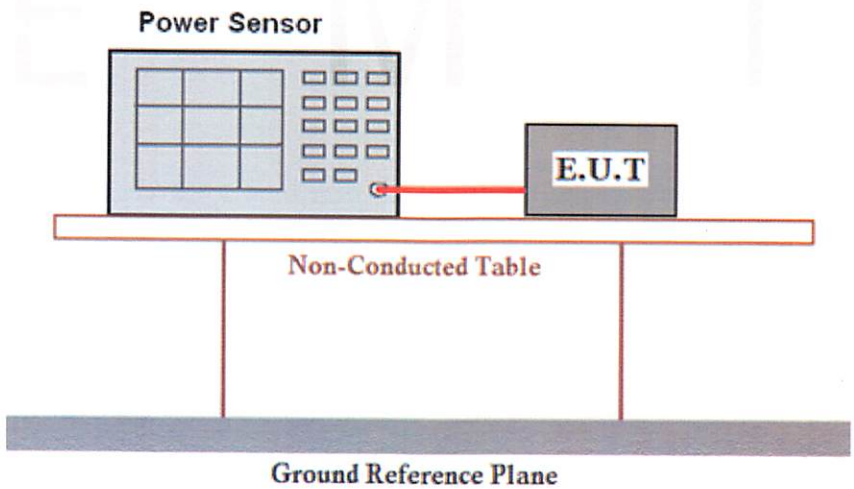
RF OUTPUT POWER	
Condition	Limit
☐ Non-adaptive wide band modulations systems	Equal to or less than the value declared by the supplier. This declared value shall be equal to or less than 20 dBm.
☒ Adaptive wide band modulations systems	≤20dBm

5.1.2 Test procedure

1. Refer to chapter 5.4.2.2 of ETSI EN 300 328 V2.2.2 (2019-07)
2.

Measurement	
☒Conducted measurement	☐Radiated measurement

5.1.3 Test Setup



Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

5.1.4 Test result

TEST CONDITIONS				Total e.i.r.p(dBm)		
				CH00	CH19	CH39
T nom(°C)	25.00	V nom (V)	12.0	1.95	0.62	-1.74
T min (°C)	-20.00	V max(V)	13.2	1.84	0.56	-1.82
		V min(V)	10.8	1.59	0.60	-1.79
T max (°C)	40.00	V max(V)	13.2	1.77	0.49	-1.93
		V min(V)	10.8	1.91	0.51	-1.75
Max e.i.r.p Power				**1.95**		
Limits				20 dBm		
Result				**Complies**		

Note: 1.Power measurement actual measurement for 25 Burst power.

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

5.2 Power Spectral Density

5.2.1 Limit(ETSI EN 300 328, V2.2.2/2019-07 Clause 4.3.2.3.3)

RF OUTPUT POWER	
Condition	Limit
For equipment using wide band modulations other than FHSS	≤10 dBm/MHz

5.2.2 Test procedure

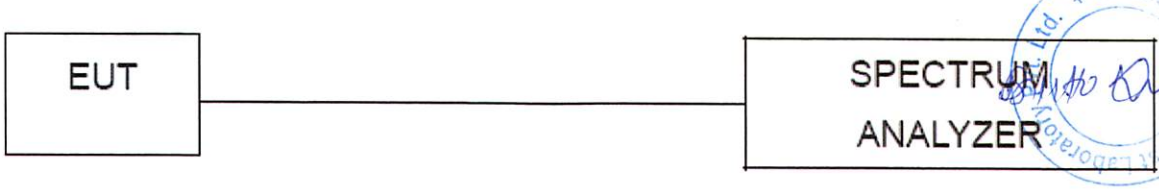
Refer to chapter 5.4.3.2 of ETSI EN 300 328 V2.2.2 (2019-07)

Measurement	
☒Conducted measurement	☐Radiated measurement

The setting of the Spectrum Analyzer

Start Frequency	2400MHz
Stop Frequency	2483.5MHz
Detector	RMS
Sweep Point	> 8 350; for spectrum analyzers not supporting this number of sweep points, the frequency band may be segmented
Sweep time	For non-continuous transmissions: 2 × Channel Occupancy Time × number of sweep points For continuous transmissions: 10 s; the sweep time may be increased further until a value where the sweep time has no further impact anymore on the RMS value of the signal.
RBW / VBW	10KHz / 30KHz

5.2.3 Test Setup

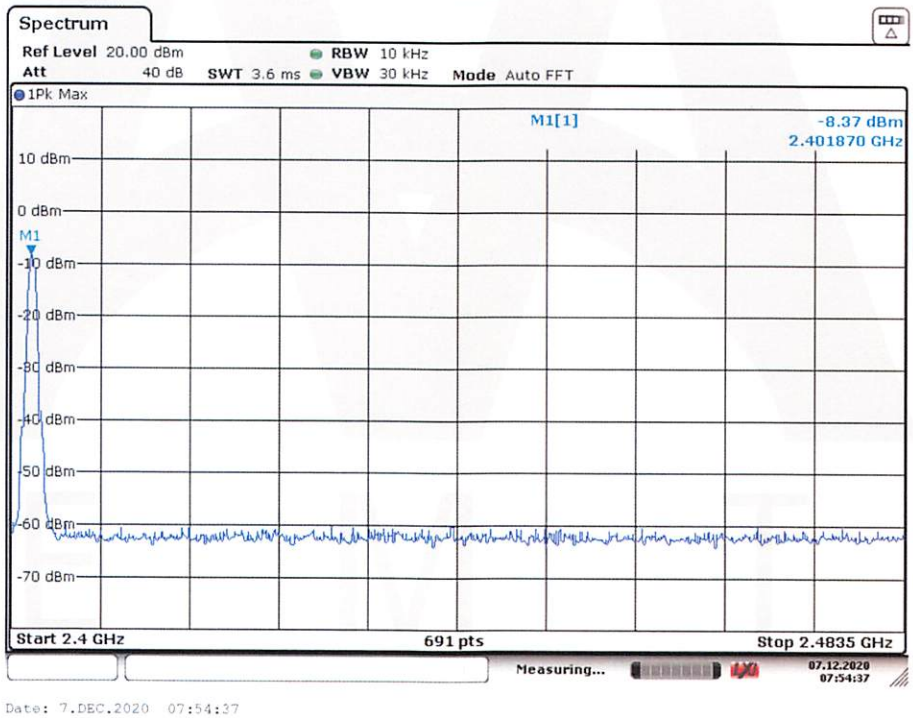


Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

5.2.4 Test result

Channel Frequency (MHz)	Power Density (dBm/MHz)	Limit (dBm/1 MHz) (E.I.R.P)	PASS/FAIL
2402	-8.37	10	PASS
2440	-9.49	10	PASS
2480	-11.94	10	PASS

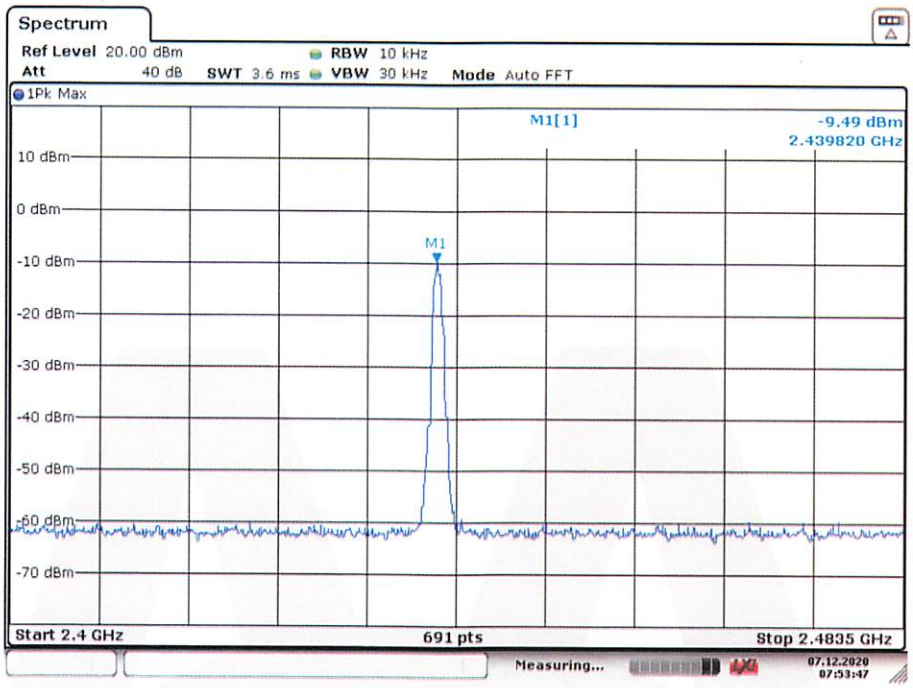
CH-2402MHz



Date: 7.DEC.2020 07:54:37

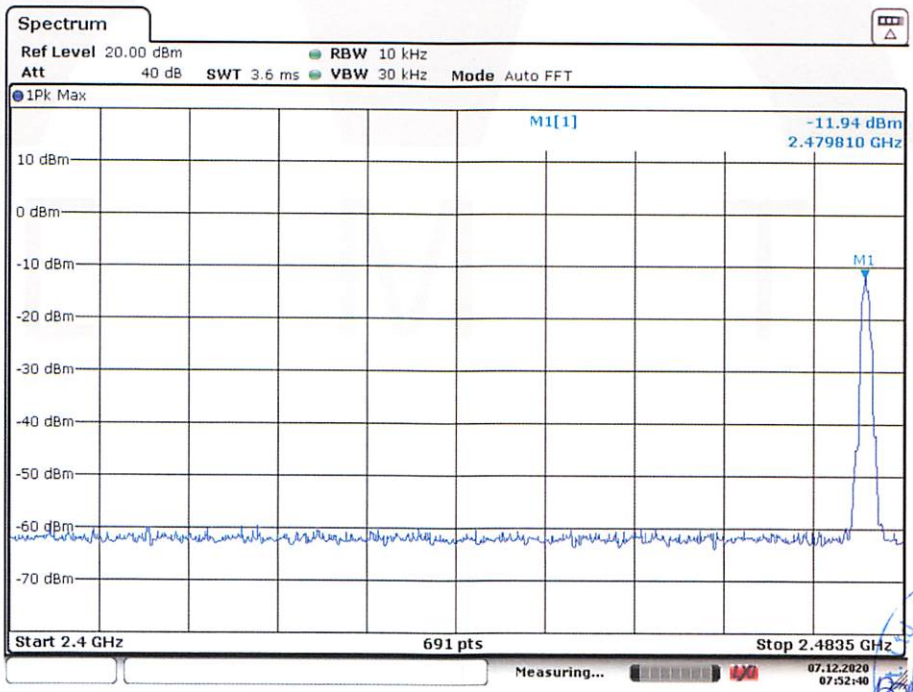
Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

CH-2440MHz



Date: 7.DEC.2020 07:53:48

CH-2480MHz



Date: 7.DEC.2020 07:52:40

AA Electro Magnetic Test Laboratory

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

5.3 Occupied Channel Bandwidth

5.3.1 Limit (ETSI EN 300 328, V2.2.2/2019-07 Clause 4.3.2.7.3)

OCCUPIED CHANNEL BANDWIDTH		
Condition		Limit
All types of equipment		Shall fall completely within the band 2400 to 2483.5 MHz
Additional requirement	For non-adaptive using wide band modulations other than FHSS system and E.I.R.P >10 dBm	Less than 20 MHz
	For non-adaptive frequency hopping system and E.I.R.P >10 dBm	Less than 5 MHz

5.3.2 Test procedure

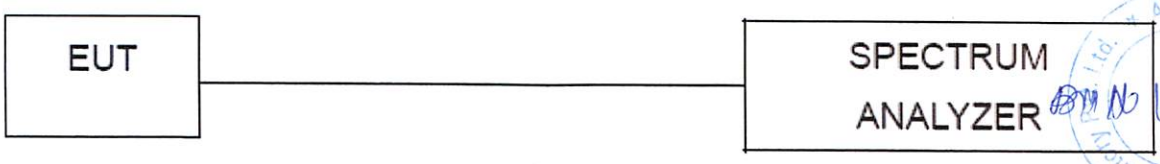
Refer to chapter 5.4.7.2 of ETSI EN 300 328 V2.2.2 (2019-07)

Measurement	
☒Conducted measurement	☐Radiated measurement

The setting of the Spectrum Analyzer

Center Frequency	The centre frequency of the channel under test
Frequency Span	2 × Nominal Channel Bandwidth
Detector	RMS
RBW	~ 1 % of the span without going below 1 %
VBW	3 × RBW
Trace	Max hold
Sweep time	1s

5.3.3 Test Setup



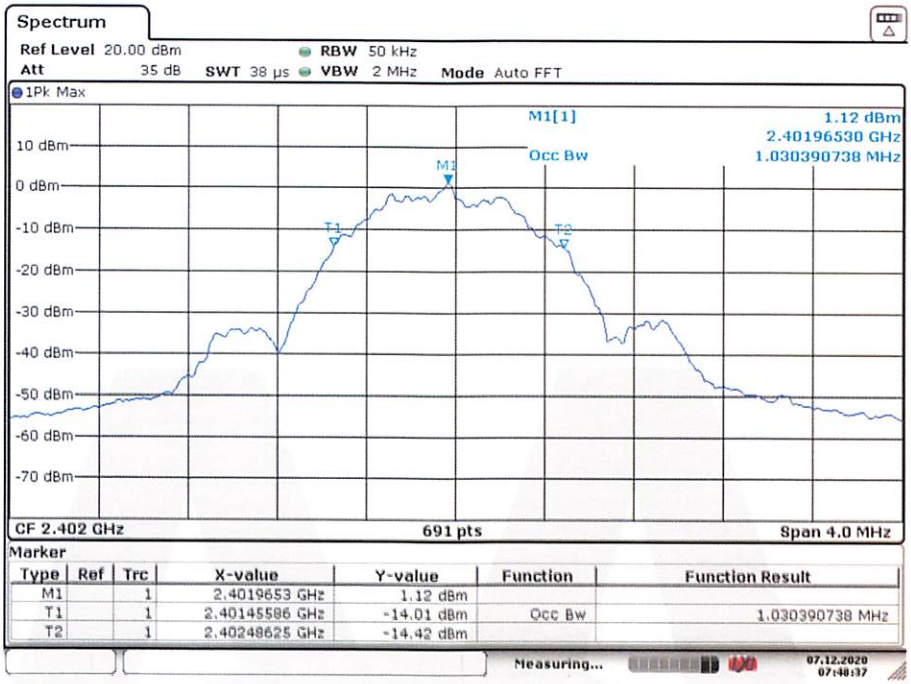
Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

5.3.4 Test result

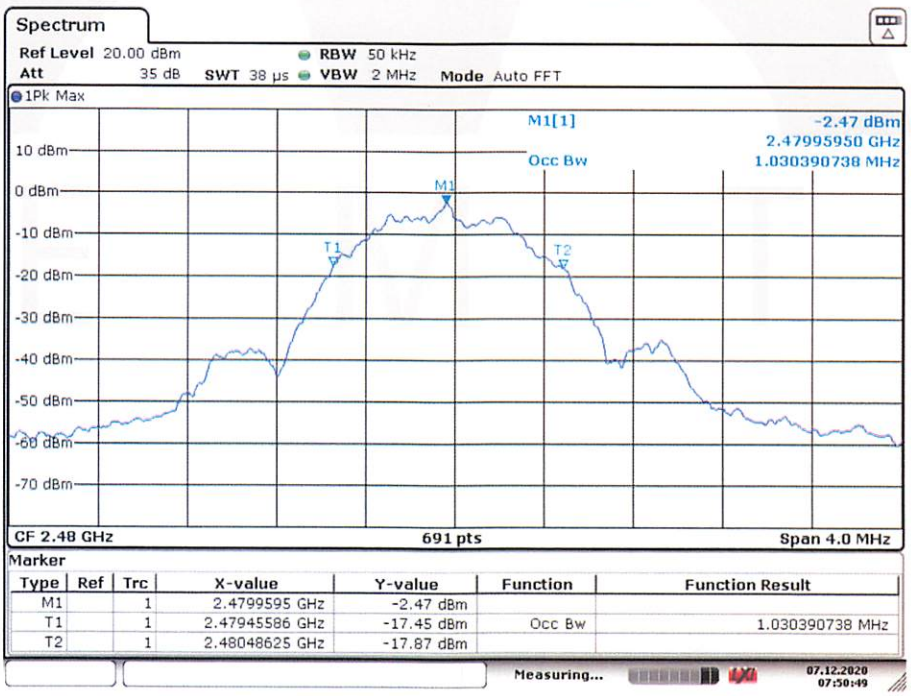
CHANNEL	CHANNEL FREQUENCY (MHz)	99%OCCUPIED BANDWIDTH (MHz)	FL/FH (MHz)	Limit	PASS /FAIL
00	2402	1.03	2404.445	FL>2400MHz, FH<2483.5 MHz	PASS
39	2480	1.03	2481.812		PASS

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

Frequency:	2402	Channel:	Lowest



Mode:	2480	Channel:	Highest

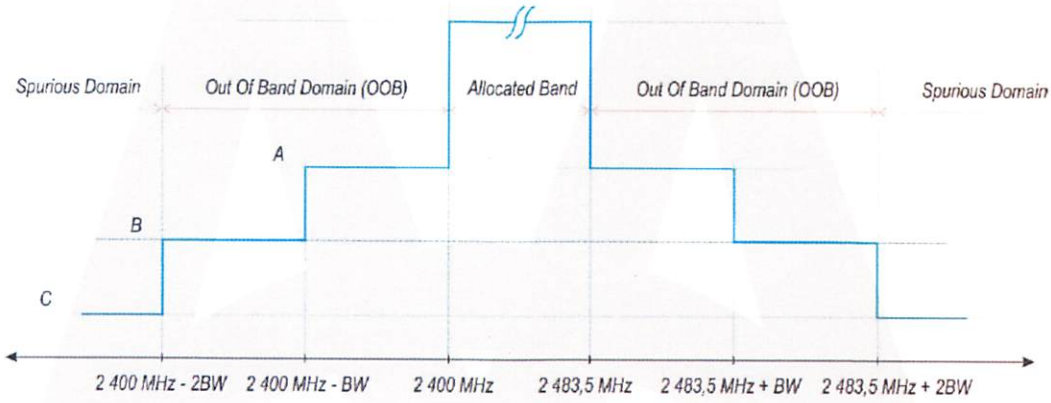


Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

5.4 Transmitter unwanted emissions in the OOB domain

5.4.1 Limit(ETSI EN 300 328, V2.2.2/2019-07 Clause 4.3.2.8.3)

Transmitter unwanted emissions in the OOB domain	
Condition	Limit
Under all test conditions	The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the mask in below figure.



A: -10 dBm/MHz e.i.r.p.
B: -20 dBm/MHz e.i.r.p.
C: Spurious Domain limits

BW = Occupied Channel Bandwidth in MHz or 1 MHz whichever is greater

5.4.2 Test procedure

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.8.2

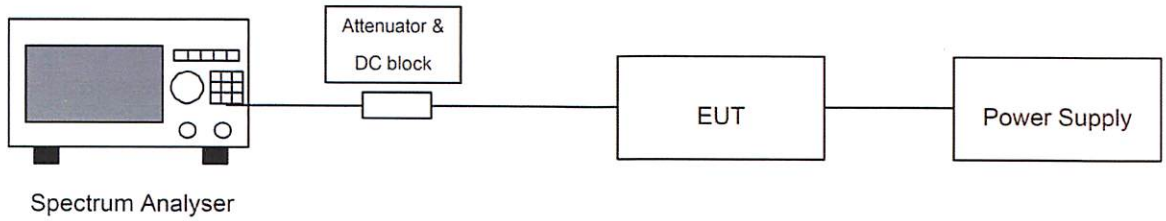
Measurement	
☒Conducted measurement	☐Radiated measurement

The setting of the Spectrum Analyzer

Span	0Hz
Filter Mode	Channel Filter
Trace Mode	Max Hold
Trigger Mode	Video trigger; in case video triggering is not possible, an external trigger source may be used
Detector	RMS
Sweep Point / Sweep Mode	Sweep Time [s] / (1 µs) or 5 000 whichever is greater/ Continuous
RBW / VBW	1MHz / 3MHz

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

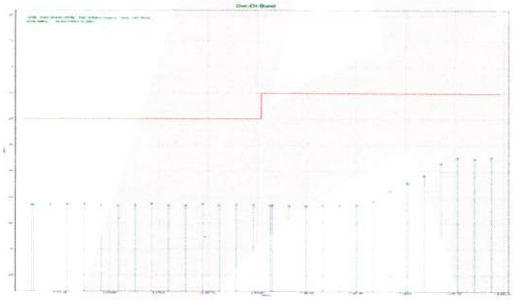
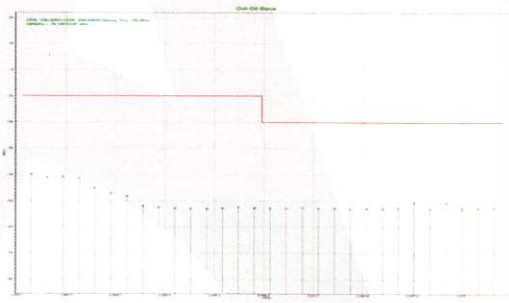
5.4.3 Test Setup



5.4.4 Test result

Measurement Data:

Test plots at normal condition are followed:

Test Condition:				Normal condition			
Frequency:	2402	Channel:	Lowest	Frequency:	2480	Channel:	Highest
							

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

5.5 Adaptivity (Channel access mechanism)

5.5.1 Limit(ETSI EN 300 328, V2.2.2/2019-07 Clause 4.3.2.6)

Requirement	Operational Mode			
	☐Non-LBT based Detect and Avoid	☐LBT based Detect and Avoid		
		☐Frame Based Equipment	☐Load Based Equipment (CCA using 'energy detect')	☐Load Based Equipment (CCA not using any of the mechanisms referenced as note 2)
Minimum Clear Channel Assessment (CCA) Time	NA	not less than 18 us (see note 1)	(see note 2)	not less than 18 us (see note 1)
Maximum Channel Occupancy (COT) Time	<40 ms	1ms to 10 ms	(see note 2)	(13/32)*q ms (see note 3)
Minimum Idle Period	5 % minimum of 100 μs	5% of COT	(see note 2)	NA
Extended CCA check	NA	NA	(see note 2)	R*CCA (see note 4)
Short Control Signalling Transmissions	Maximum duty cycle of 10% within an observation period of 50 ms (see note 5)			

Note 1: The CCA time used by the equipment shall be declared by the supplier.
Note 2: Load Based Equipment may implement an LBT based spectrum sharing mechanism based on the Clear Channel Assessment (CCA) mode using energy detect as described in IEEE 802.11™-2012 [i.3], clause 9, clause 10, clause 16, clause 17, clause 19 and clause 20, or in IEEE 802.15.4™-2011 [i.4], clause 4, clause 5 and clause 8 providing the
equipment complies with the conformance requirements referred to in clause 4.3.2.6.3.4.
Note 3: q is selected by the manufacturer in the range [4…32]
Note 4: The value of R shall be randomly selected in the range [1…q]
Note 5: Adaptive equipment may or may not have Short Control Signaling Transmissions.

The detection threshold shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the detection threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive)antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p., the detection threshold level may be relaxed to:

TL = -70 dBm/MHz + 10 × log10 (100 mW / Pout) (Pout in mW e.i.r.p.)

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

Table 9: Unwanted Signal parameters

Wanted signal mean power from companion device (dBm)	Unwanted signal frequency (MHz)	Unwanted CW signal power (dBm)
-30/ sufficient to maintain the link(see note 2)	2395 or 2488,5 (see note 1)	-35 (see note 2)

NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.4.6.1.

NOTE 2: A typical value which can be used in most cases is -50 dBm/MHz.

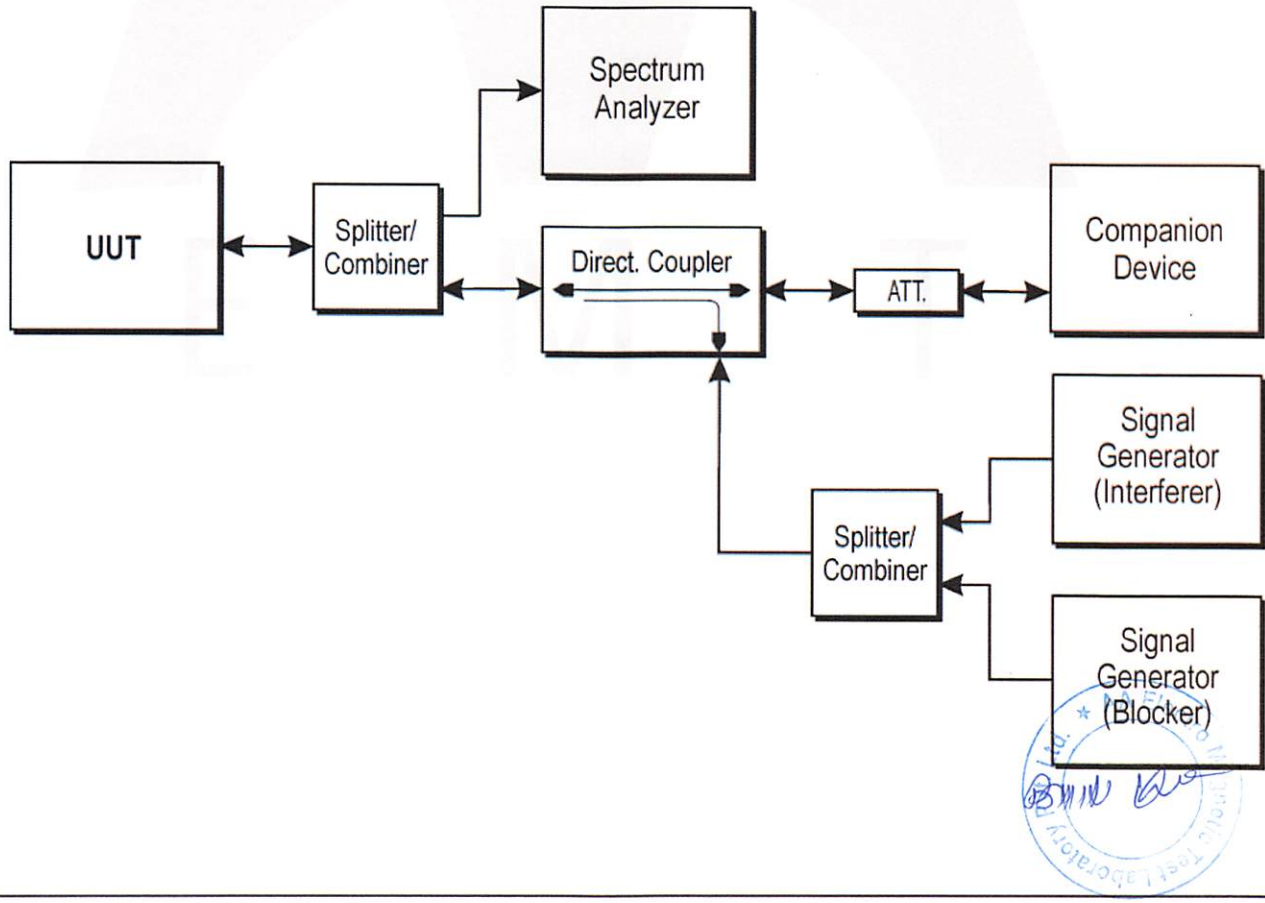
NOTE 3: The level specified is the level in front of the UUT antenna. In case of conducted measurements, this level has to be corrected by the actual antenna assembly gain.

5.5.2 Test procedure

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.6.2

Measurement	
☒Conducted measurement	☐Radiated measurement

5.5.3 TEST SETUP



Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

5.5.4 List of Measurements

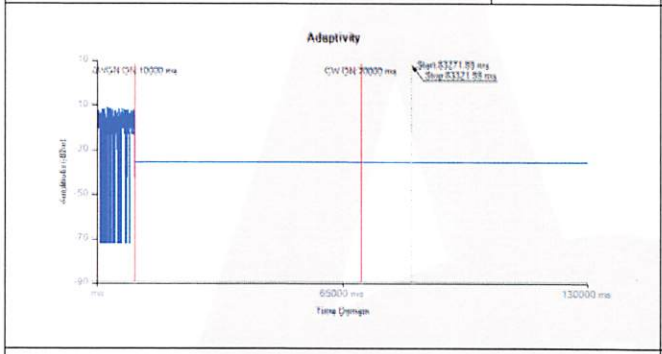
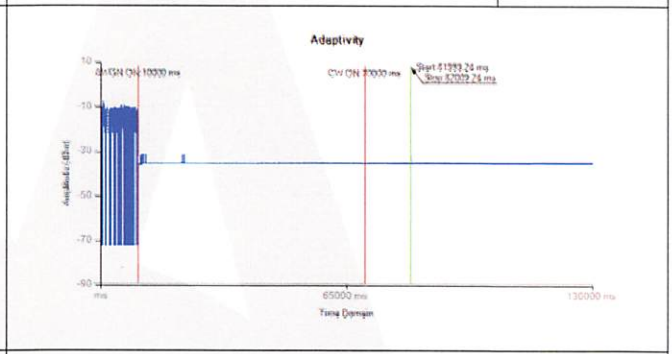
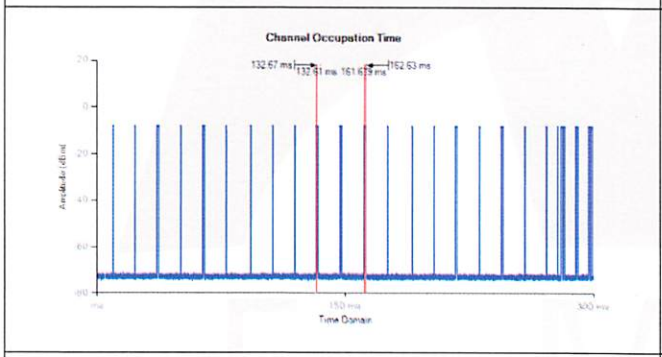
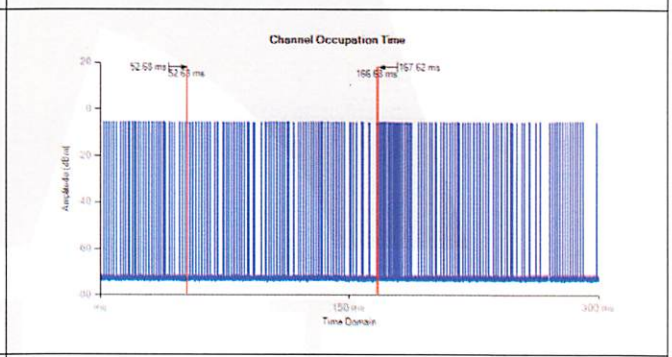
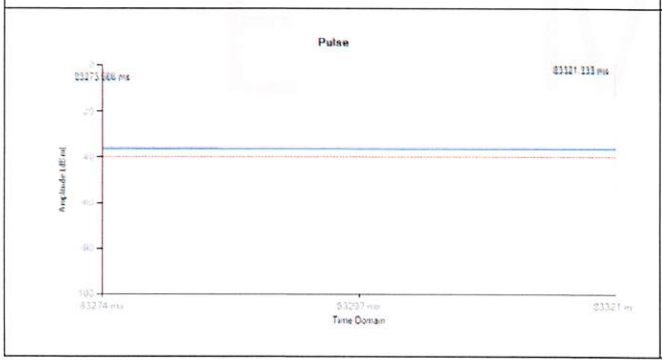
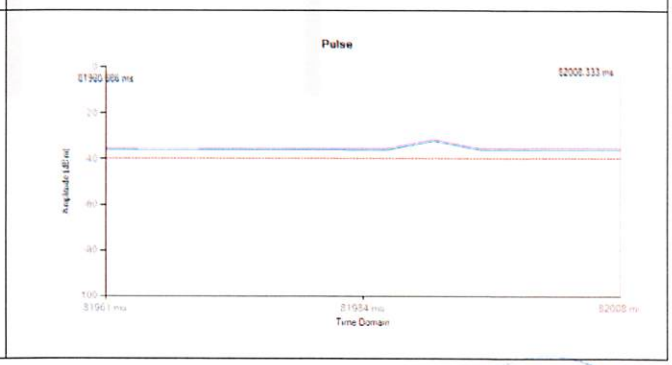
UUT operational Mode		
Frame Based Equipment	Load Based Equipment (CCA using 'energy detect')	Load Based Equipment (CCA not using any of the mechanisms referenced)
	V	

Clause	Test Parameter	Remarks	PASS/FAIL
4.3.2.5.2.2.1	Adaptive (Frame Based Equipment)	Not Applicable	N/A
4.3.2.5.2.2.2	Adaptive (Load Based Equipment)	Applicable	PASS
4.3.2.5.3	Short Control Signaling Transmissions	Applicable	PASS

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

5.5.5 Test result

Test plots are below:

Lowest channel-2402MHz		Highest channel-2480MHz	
AWGN Interference Level (dBm)	-50	AWGN Interference Level (dBm)	-50
AWGN Interference Start Time (ms)	83270.857	AWGN Interference Start Time (ms)	10062.784
Max COT (ms)	1.520	Max COT (ms)	0.548
Idle Time (ms)	0.415	Idle Time (ms)	0.357
Duty Cycle (%)	94.846	Duty Cycle (%)	96.017
			
			
			

Note:

During the test, the signal observed on the channel being investigated is the Short Control Signalling Transmissions.

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

5.6 Transmitter unwanted emissions in the spurious domain

5.6.1 Limit(ETSI EN 300 328, V2.2.2/2019-07 Clause 4.3.2.9.3)

TRANSMITTER UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN		
Frequency Range	Maximum Power Limit (E.R.P.(≤1 GHz) E.I.R.P.(> 1 GHz))	Bandwidth
30 MHz to 47 MHz	-36dBm	100 kHz
47 MHz to 74 MHz	-54dBm	100 kHz
74 MHz to 87.5 MHz	-36dBm	100 kHz
87.5 MHz to 118 MHz	-54dBm	100 kHz
118 MHz to 174 MHz	-36dBm	100 kHz
174 MHz to 230 MHz	-54dBm	100 kHz
230 MHz to 470 MHz	-36dBm	100 kHz
470 MHz to 862 MHz	-54dBm	100 kHz
862 MHz to 1 GHz	-36dBm	100 kHz
1 GHz ~ 12.75 GHz	-30dBm	1 MHz

5.6.2 Test procedure

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.9

Measurement	
☒Conducted measurement	☒Radiated measurement

The setting of the Spectrum Analyzer

RBW	100K(＜1GHz) / 1M(＞1GHz)
VBW	300K(＜1GHz) / 3M(＞1GHz)

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

5.6.3 TEST SETUP

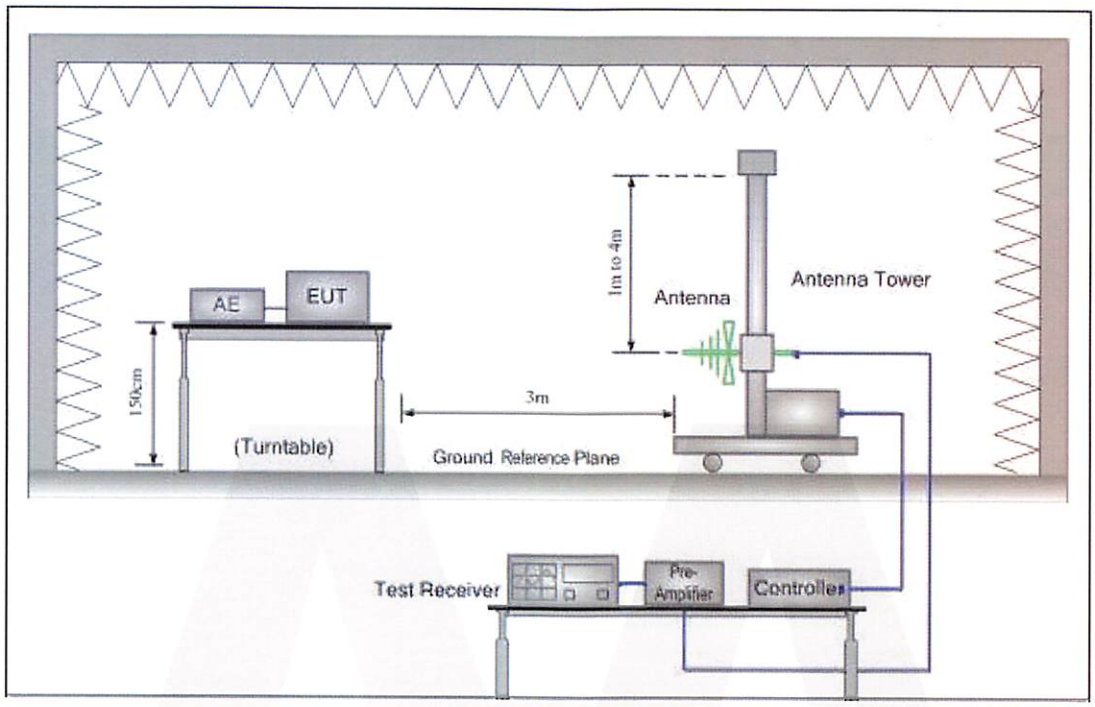


Figure 1. 30MHz to 1GHz

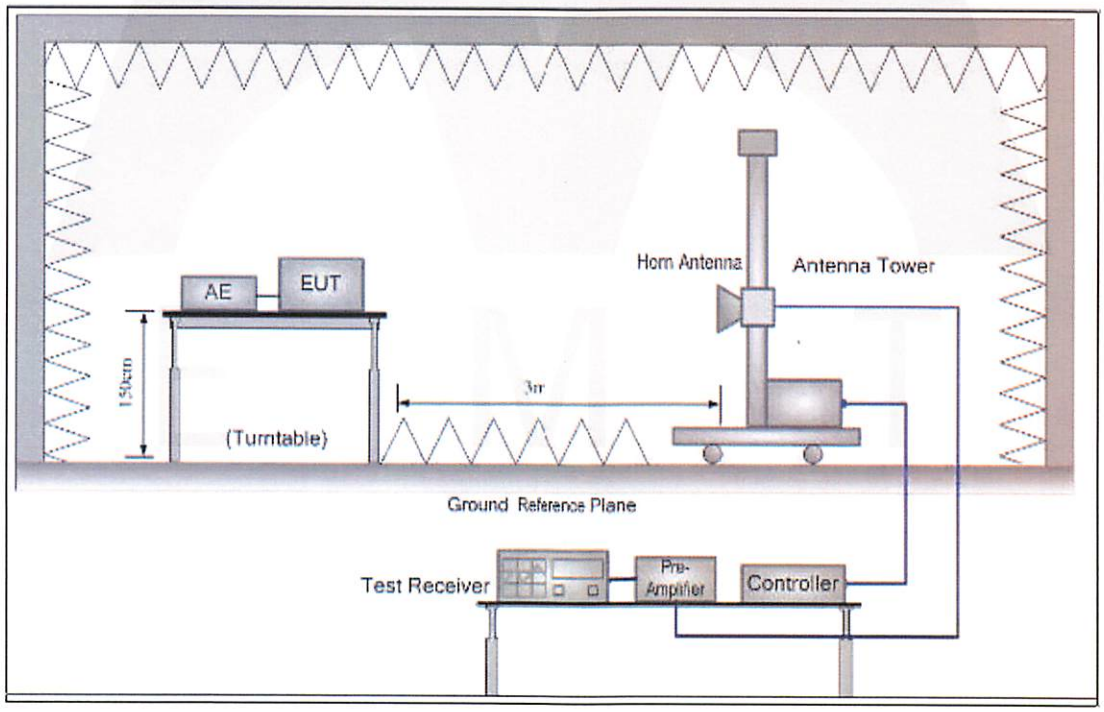


Figure 2. Above 1GHz

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

5.6.4 Radiated Test result

Lowest (2402 MHz)

Below 1 GHz				
Maximum Frequency	Spurious Emission polarization and Level		Limit	Over Limit
MHz	polarization	dBm	dBm	dB
64.41	Vertical	-63.27	-54	-9.27
236.71	Vertical	-69.12	-36	-33.12
400.75	Vertical	-66.74	-36	-30.74
117.43	Horizontal	-58.27	-54	-4.27
353.46	Horizontal	-63.17	-36	-27.17
456.40	Horizontal	-69.15	-36	-33.15
Above 1 GHz				
Maximum Frequency	Spurious Emission polarization and Level		Limit	Over Limit
MHz	polarization	dBm	dBm	dB
4823.97	Vertical	-42.31	-30	-12.31
7235.77	Vertical	-43.10	-30	-13.10
9648.48	Vertical	-46.27	-30	-16.27
4943.00	Horizontal	-39.99	-30	-9.99
7416.69	Horizontal	-43.48	-30	-13.48
9888.74	Horizontal	-48.40	-30	-18.40

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

Highest CH (2480 MHz)

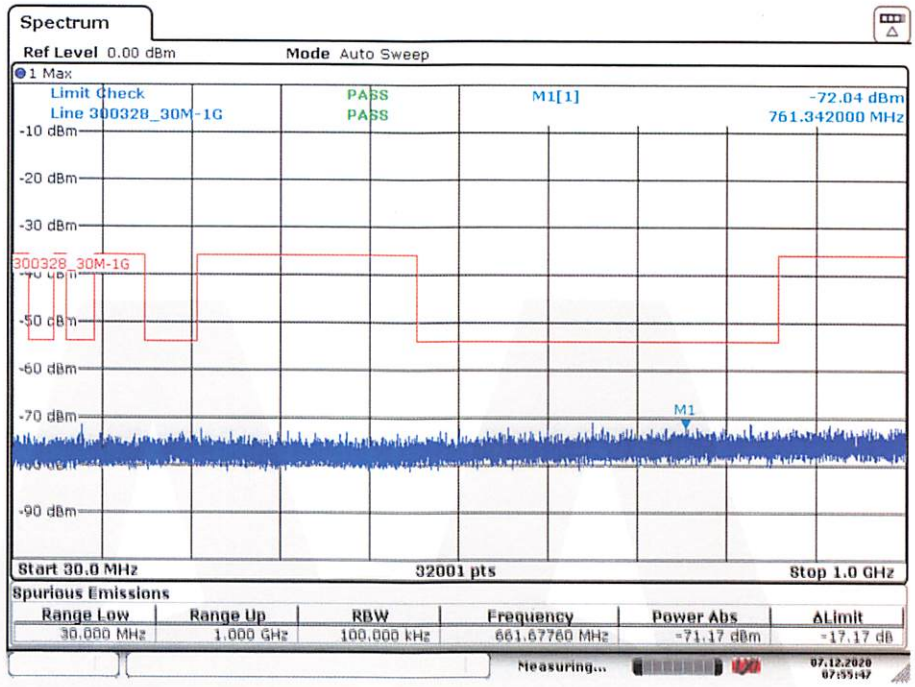
below1GHz				
Maximum Frequency	Spurious Emission polarization and Level		Limit	Over Limit
MHz	polarization	dBm	dBm	dB
110.78	Vertical	-57.57	-54	-3.57
395.47	Vertical	-62.84	-36	-26.84
514.41	Vertical	-64.11	-54	-10.11
92.94	Horizontal	-62.76	-54	-8.76
292.87	Horizontal	-64.91	-36	-28.91
637.99	Horizontal	-63.54	-54	-9.54
Above1GHz				
Maximum Frequency	Spurious Emission polarization and Level		Limit	Over Limit
MHz	polarization	dBm	dBm	dB
4923.58	Vertical	-34.91	-30	-4.91
7386.04	Vertical	-41.42	-30	-11.42
9848.07	Vertical	-46.58	-30	-16.58
4923.71	Horizontal	-38.85	-30	-8.85
7386.79	Horizontal	-43.41	-30	-13.41
9849.16	Horizontal	-42.48	-30	-12.48

Note: All the modes had been tested, but only the worst data recorded in the report.

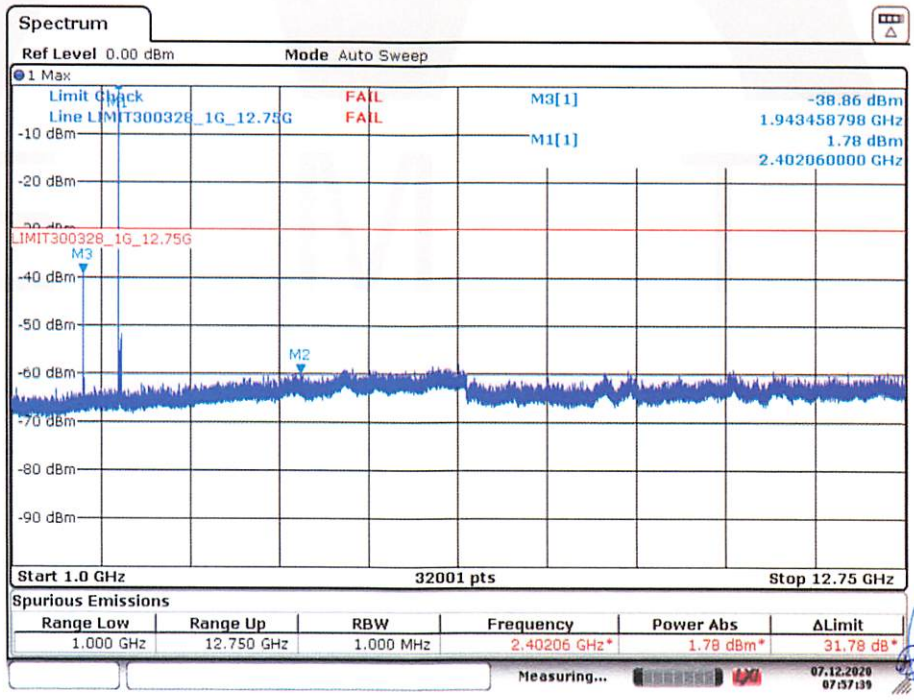
Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

5.6.5 Conducted Test result

Low CH



Date: 7.DEC.2020 07:55:47

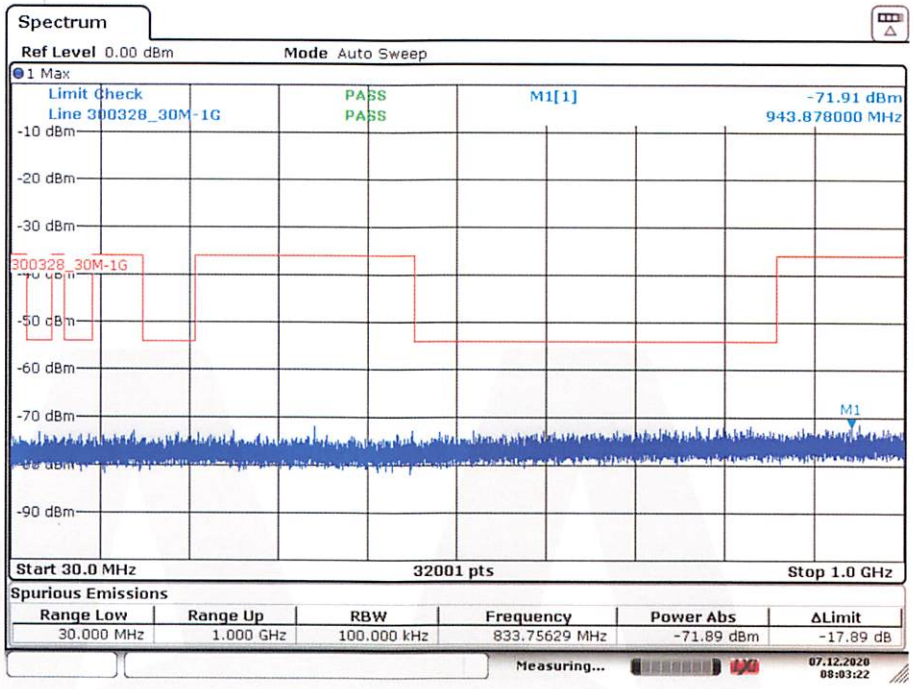


Date: 7.DEC.2020 07:57:39

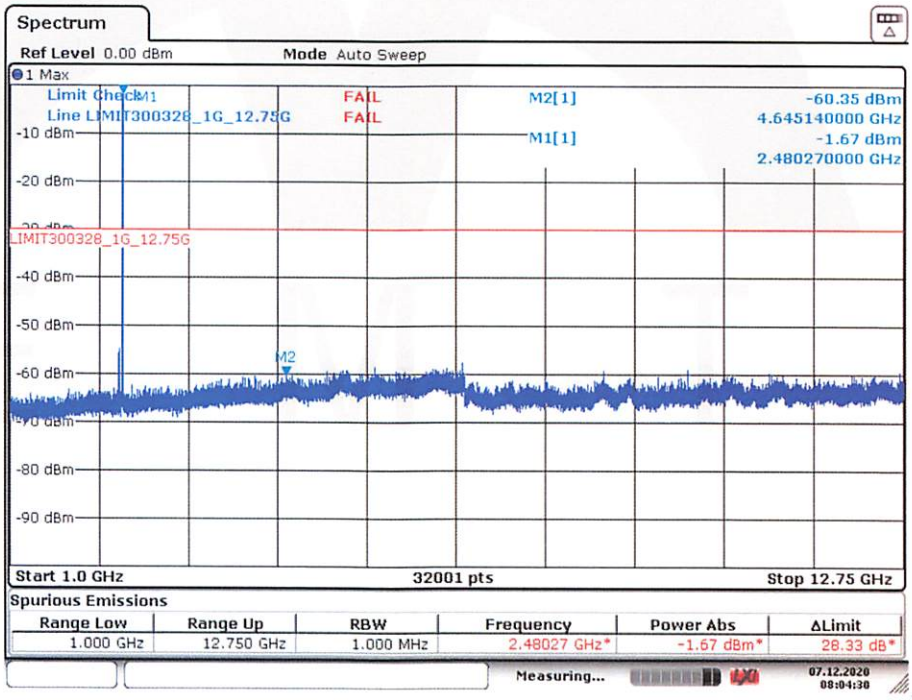
Note: Mark Point 1 is intentional frequency of EUT, hence considered as PASS.

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

High CH



Date: 7.DEC.2020 08:03:22



Date: 7.DEC.2020 08:04:30

Note: Mark Point 1 is intentional frequency of EUT, hence considered as PASS.

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

5.7 Receiver spurious emissions

5.7.1 Limit(ETSI EN 300 328, V2.2.2/2019-07 Clause 4.3.2.10.3)

Spurious emission limits for receivers

Frequency range	Maximum power, e.r.p. (≤ 1 GHz) e.i.r.p. (> 1 GHz)	Bandwidth
30 MHz to 1 GHz	-57 dBm	100KHz
1 GHz to 12,75 GHz	-47 dBm	1MHz

5.7.2 Test procedure

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.10

Measurement	
☒Conducted measurement	☒Radiated measurement

The setting of the Spectrum Analyzer

RBW	100K(＜1GHz) / 1M(＞1GHz)
VBW	300K(＜1GHz) / 3M(＞1GHz)

5.7.3 Test Setup

Radiated measurement:

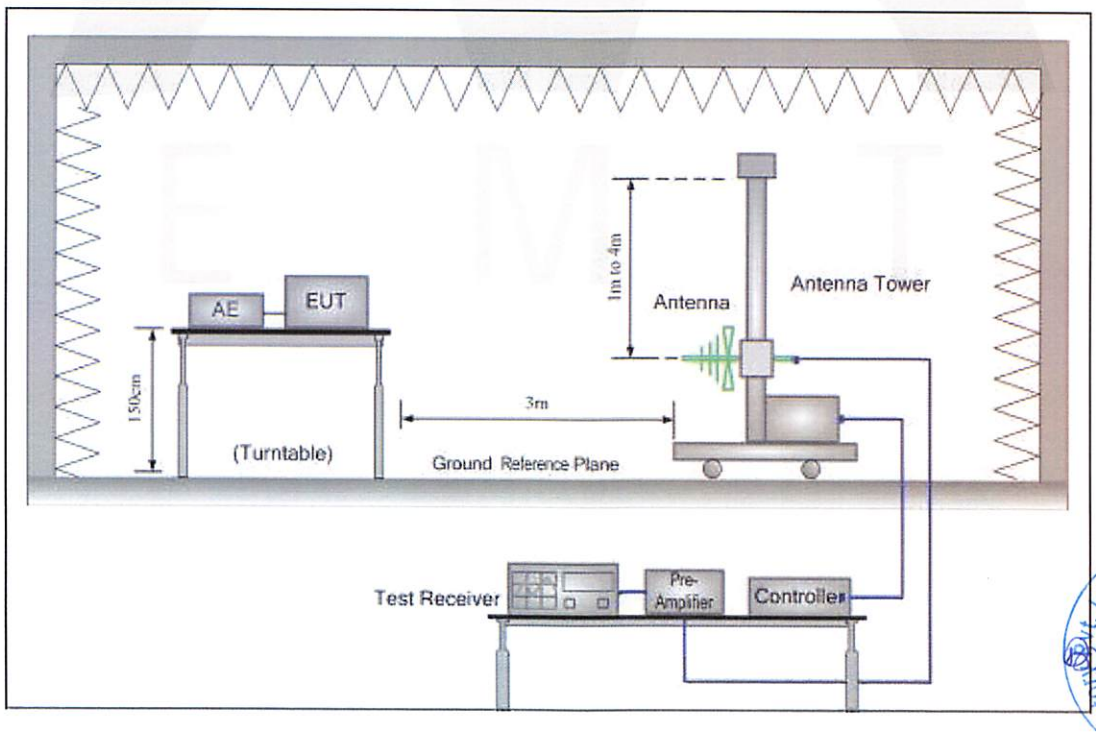


Figure 1. 30MHz to 1GHz

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

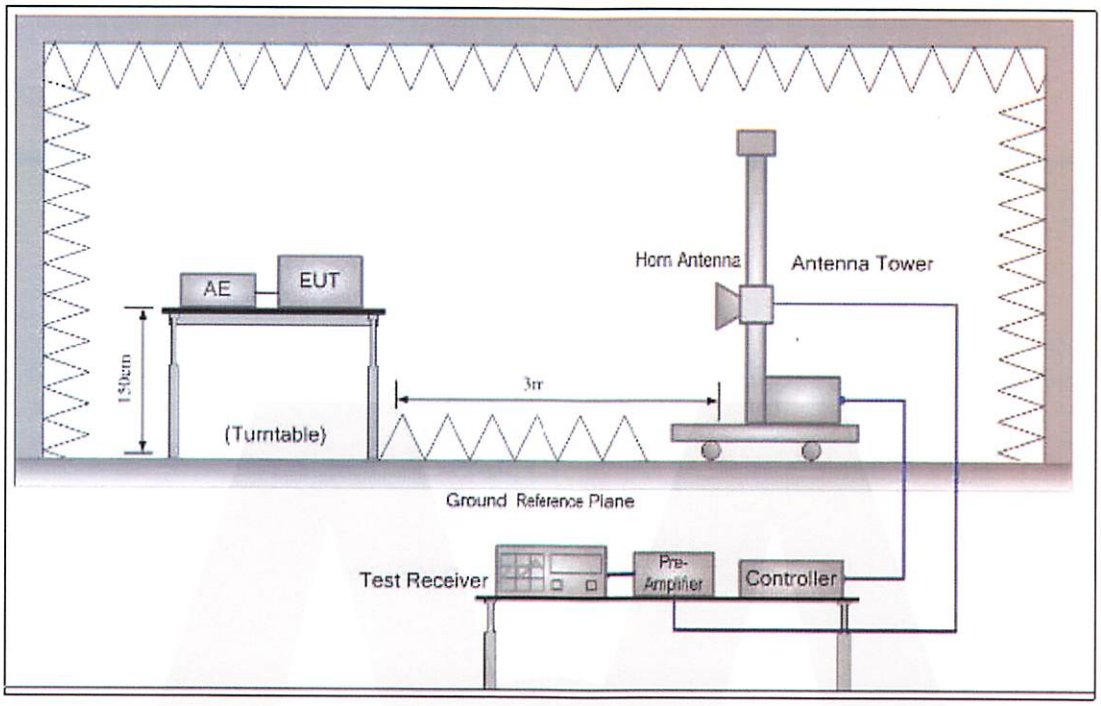
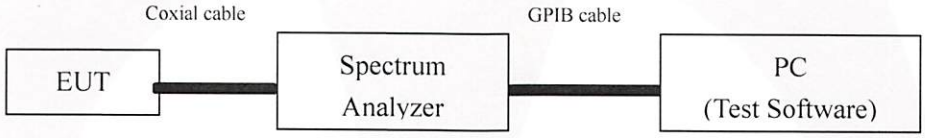


Figure 2. Above 1GHz

Conducted measurement:



1. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).
2. Testing was performed when the equipment was in a receive-only mode.
3. The measurements were performed when normal hopping was disabled. In this case measurements were performed when operating at the lowest and the highest hopping frequency.
4. The test setup has been constructed as the normal use condition. Controlling software has been activated to set the EUT on specific status.

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

5.7.4 Test result(Radiated measurement)

Low CH (2402 MHz)

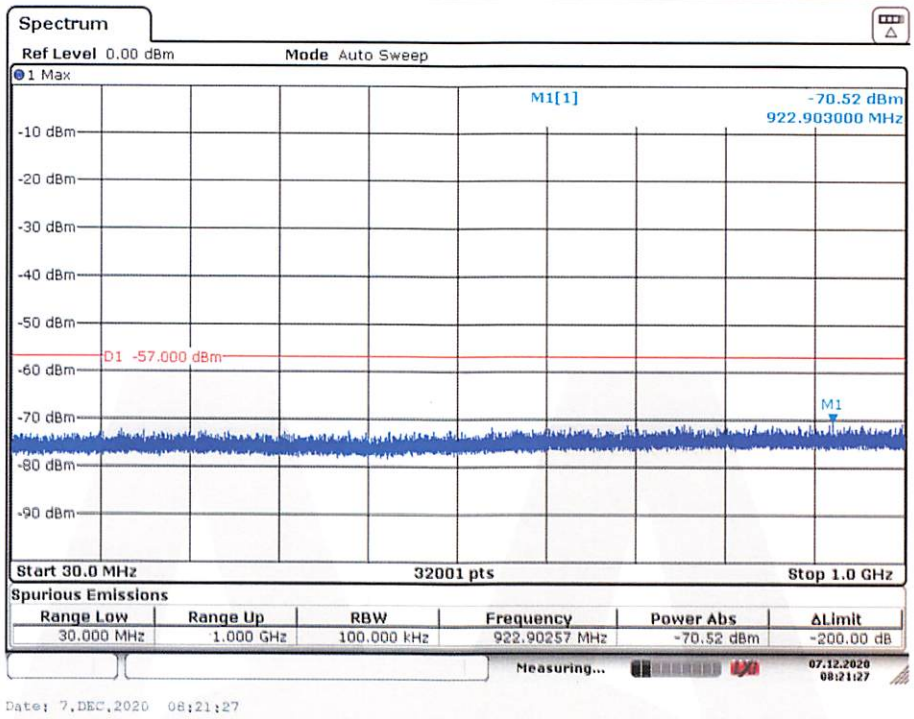
below1GHz				
Maximum Frequency	Spurious Emission polarization and Level		Limit	Over Limit
MHz	polarization	dBm	dBm	dB
64.93	Vertical	-72.13	-57	-15.13
207.49	Vertical	-70.22	-57	-13.22
473.96	Vertical	-65.72	-57	-8.72
117.76	Horizontal	-70.06	-57	-13.06
253.38	Horizontal	-66.73	-57	-9.73
472.07	Horizontal	-65.62	-57	-8.62
Above1GHz				
Maximum Frequency	Spurious Emission polarization and Level		Limit	OverLimit
MHz	polarization	dBm	dBm	dB
2054.09	Vertical	-55.89	-47	-8.89
2853.15	Vertical	-58.49	-47	-11.49
4898.68	Vertical	-57.43	-47	-10.43
2717.69	Horizontal	-51.48	-47	-4.48
3178.55	Horizontal	-53.68	-47	-6.68
4935.67	Horizontal	-56.76	-47	-9.76

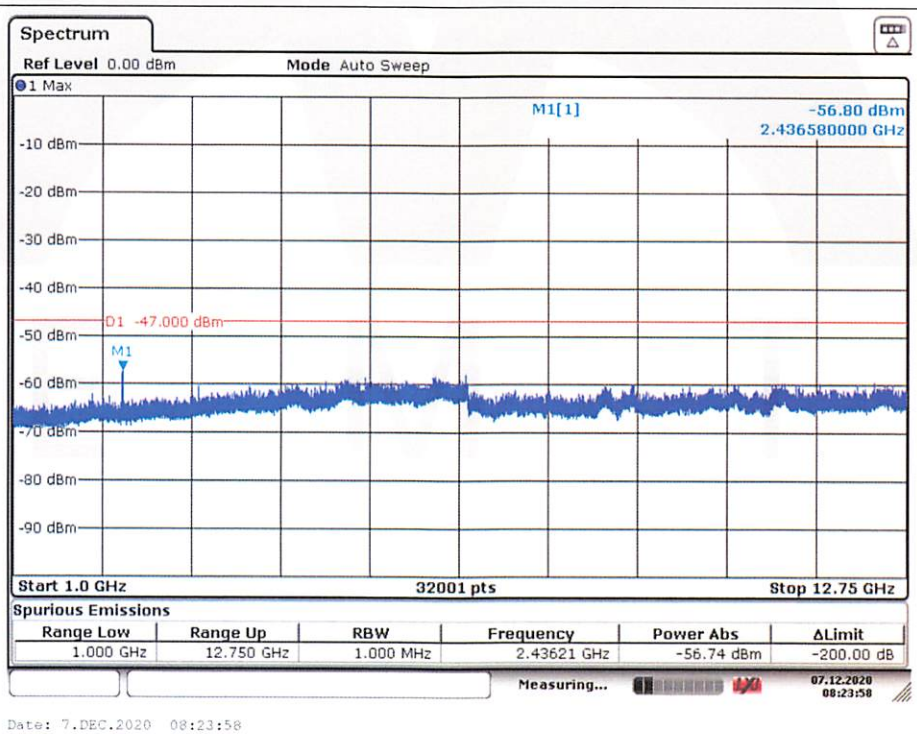
High CH (2480 MHz)

below1GHz				
Maximum Frequency	Spurious Emission polarization and Level		Limit	Over Limit
MHz	polarization	dBm	dBm	dB
57.35	Vertical	-72.82	-57	-15.82
477.28	Vertical	-71.11	-57	-14.11
415.08	Vertical	-62.69	-57	-5.69
99.20	Horizontal	-71.37	-57	-14.37
150.88	Horizontal	-67.94	-57	-10.94
618.11	Horizontal	-68.80	-57	-11.80
Above1GHz				
Maximum Frequency	Spurious Emission polarization and Level		Limit	Over Limit
MHz	polarization	dBm	dBm	dB
1881.99	Vertical	-56.68	-47	-9.68
2557.37	Vertical	-61.11	-47	-14.11
5268.63	Vertical	-49.62	-47	-2.62
2238.91	Horizontal	-53.29	-47	-6.29
3217.56	Horizontal	-54.47	-47	-7.47
4796.45	Horizontal	-60.31	-47	-13.31

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

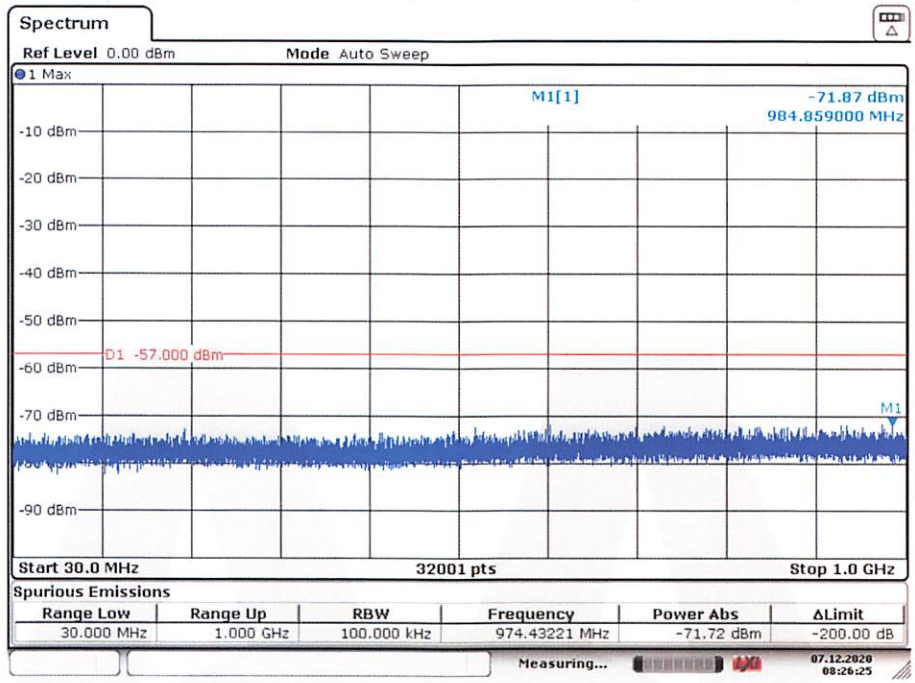
Test result (Conducted measurement) - Low CH (2402MHz)

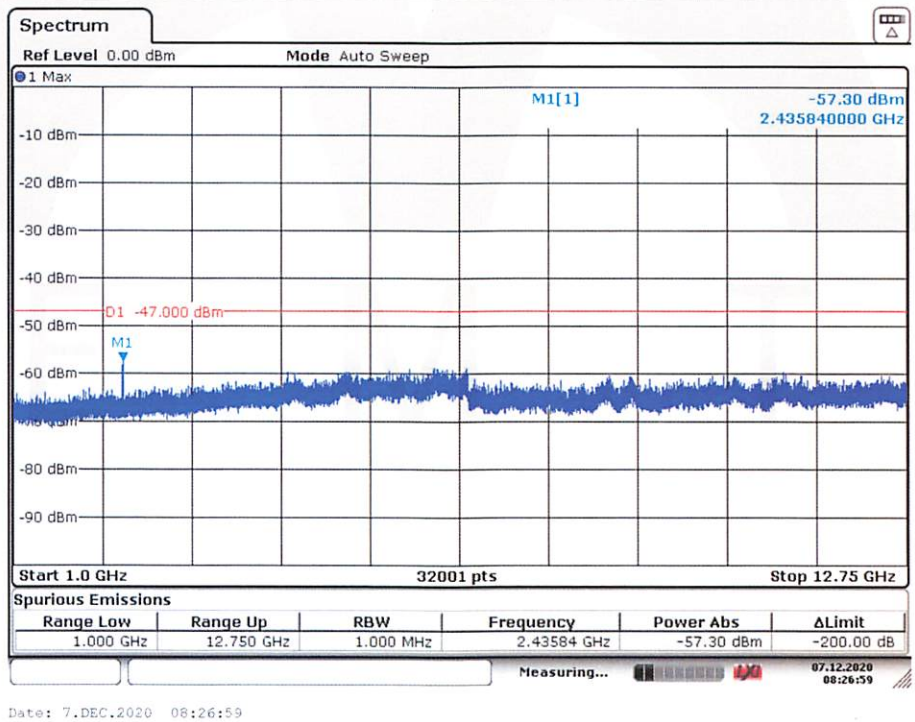




Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

Test result (Conducted measurement) - High CH (2480MHz)





AA Electro Magnetic Test Laboratory Pvt. Ltd.

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

5.8 Receiver Blocking

5.8.1 Performance Criteria

The minimum performance criterion shall be a PER less than or equal to 10 %. The manufacturer may declare alternative performance criteria as long as that is appropriate for the intended use of the equipment (see clause 5.4.1.t)).

5.8.2 Limit(ETSI EN 300 328, V2.2.2/2019-07 (Clause 4.3.2.11.4)

While maintaining the minimum performance criteria as defined in clause 4.3.2.11.3, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category provided in table 14, table 15 or table 16.

☒**Table 14: Receiver blocking parameters for Receiver Category 1 equipment**

Wanted signal mean power from companion device (dBm) (see notes 1 and 4)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 4)	Type of blocking signal
(-133 dBm + 10 × $\log_{10}$(OCBW)) or -68 dBm whichever is less (see note 2)	2 380 2 504	-34	CW
(-139 dBm + 10 × $\log_{10}$(OCBW)) or -74 dBm whichever is less (see note 3)	2 300 2 330 2 360 2 524 2 584 2 674		

NOTE 1: OCBW is in Hz.
NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 26 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 3: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 20 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 4: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

☐**Table 15: Receiver blocking parameters receiver category 2 equipment**

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × $\log_{10}$(OCBW) + 10 dB) or (-74 dBm + 10 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW

NOTE 1: OCBW is in Hz.
NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 26 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.

☐**Table 16: Receiver blocking parameters receiver category 3 equipment**

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × $\log_{10}$(OCBW) + 20 dB) or (-74 dBm + 20 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW

NOTE 1: OCBW is in Hz.
NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative the test may be performed using a wanted signal up to P_{min} + 30 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.

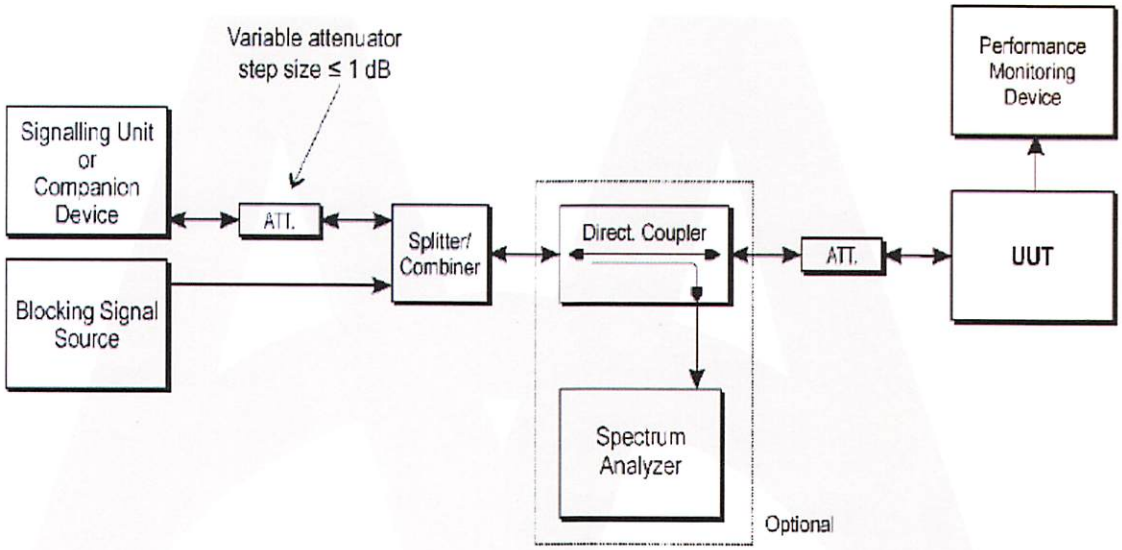
Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

5.8.3 Test procedure

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.11.2

Measurement	
☒Conducted measurement	☐Radiated measurement

5.8.4 Test Setup



Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

5.8.5 Test result

Receiver category 1

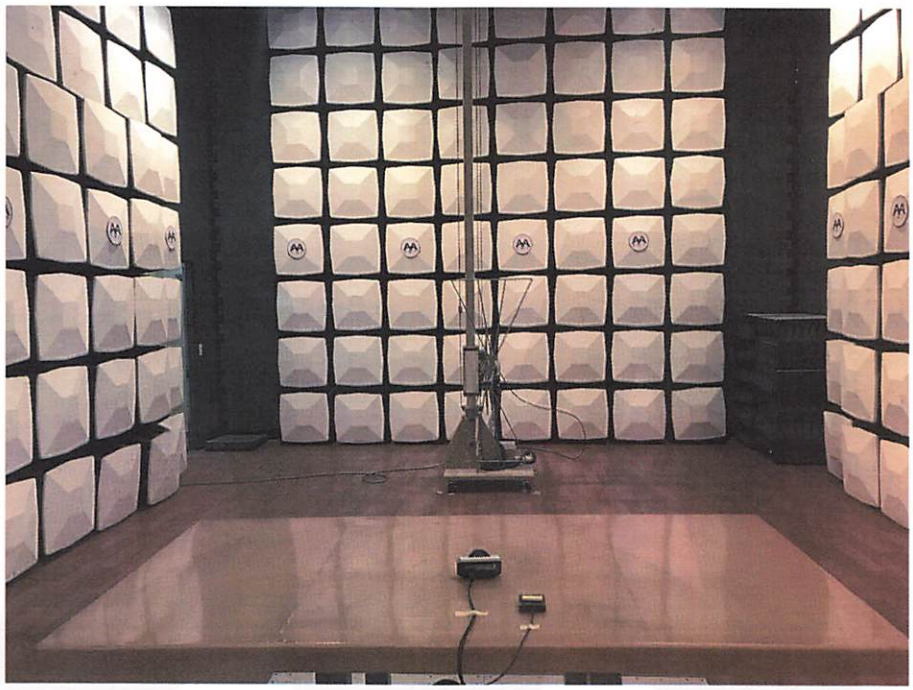
Wanted signal mean power from companion device	Blocking signal Frequency(MHz)	Blocking signal power(dBm)	PER% Note(2)	PER Limit %
802.11b low CH				
-68	2380	-34	0.539	≤10%
	2504		1.077	
-74	2300	-34	0.642	≤10%
	2330		0.167	
	2360		0.668	
	2524		1.129	
	2584		0.707	
	2674		0.645	
802.11b High CH				
-68	2380	-34	1.184	≤10%
	2504		0.806	
-74	2300	-34	0.150	≤10%
	2330		0.207	
	2360		1.070	
	2524		0.908	
	2584		0.699	
	2674		0.113	

Note: The above results were obtained from laboratory tests.

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com

6 Test Setup photograph

Spurious Emission Test Setup



** End of report **

For AA Electro Magnetic Test Laboratory

Authorised Signatory

Plot No.174, Udyog Vihar Phase 4, Sector -18, Gurgaon -122016, Haryana, India
Contact:0124-4235350, 4145343, e-mail: info@aaemtlabs.com, Website: www.aaemtlabs.com