TEST REPORT

FCC PART 15 SUBPART C 15.247

Test report

On Behalf of

United Creation Technology Corp., Ltd

For

SMART EYEWEAR

Model No.: TCW01-A1, TCW01-A2, TCW01-C, TCW01-D, TCW01-B1, TCW01-B2

FCC ID: 2AU3D-TCW01A1

Prepared for :	**United Creation Technology Corp., Ltd** **Room 201, Block A, Science and Technology Buliding Phase-2,Nanhai Road 1057,Shekou, Nanshan District, Shenzhen, China**
Prepared By :	**Shenzhen HUAK Testing Technology Co., Ltd.** **1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China**
Date of Test:	**Sep. 22, 2020 ~Sep. 29, 2020**
Date of Report:	**Sep. 29, 2020**
Report Number:	**HK2009242789-2E**

TEST RESULT CERTIFICATION

Applicant's name ..... :	United Creation Technology Corp., Ltd
Address..... :	Room 201, Block A, Science and Technology Buliding Phase-2,Nanhai Road 1057,Shekou, Nanshan District, Shenzhen, China
Manufacture's Name ..... :	United Creation Technology Corp., Ltd
Address..... :	Room 201, Block A, Science and Technology Buliding Phase-2,Nanhai Road 1057,Shekou, Nanshan District, Shenzhen, China

Product description

Trade Mark:	YUHO , VOUGH, 8ightstella
Product name..... :	SMART EYEWEAR
Model and/or type reference .. :	TCW01-A1, TCW01-A2, TCW01-C, TCW01-D, TCW01-B1, TCW01-B2
Standards..... :	**47 CFR FCC Part 15 Subpart C 15.247**

This publication may be reproduced in whole or in part for non-commercial purposes as long as the Shenzhen HUAK Testing Technology Co., Ltd. is acknowledged as copyright owner and source of the material. Shenzhen HUAK Testing Technology Co., Ltd. takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

Date of Test ..... :

Date (s) of performance of tests..... :	Sep. 22, 2020 ~Sep. 29, 2020
Date of Issue..... :	Sep. 29, 2020
Test Result..... :	**Pass**

Prepared by: Gary Qian

Project Engineer

Reviewed by: Leo Zhang

Project Supervisor

Approved by: Jason Zhou

Technical Director

Contents

Page

CONTENTS **3**

1 TEST SUMMARY **6**

1.1 TEST DESCRIPTION 6
1.2 MEASUREMENT UNCERTAINTY 7

2 TEST FACILITY **8**

3 GENERAL INFORMATION **8**

3.1 GENERAL DESCRIPTION OF EUT 8
3.2 DESCRIPTION OF TEST CONDITIONS 10
3.3 DESCRIPTION OF TEST SETUP 10

4 EQUIPMENTS LIST FOR ALL TEST ITEMS **11**

5 TEST RESULT **13**

5.1 ANTENNA REQUIREMENT 13
5.1.1 Standard requirement 13
5.1.2 EUT Antenna 13
5.2 CONDUCTION EMISSIONS MEASUREMENT 14
5.2.1 Applied procedures / Limit 14
5.2.2 Test procedure 14
5.2.3 Test setup 15
5.2.4 Test results 16
5.3 RADIATED EMISSIONS MEASUREMENT 18
5.3.1 Applied procedures / Limit 18
5.3.2 Test setup 18
5.3.3 Test Result 20
5.4 MAXIMUM OUTPUT POWER MEASUREMENT 27
5.4.1 Limit 27
5.4.2 Test procedure 27
5.4.3 Deviation from standard 27
5.4.4 Test setup 27
5.4.5 Test results 27
5.5 POWER SPECTRAL DENSITY 28
5.5.1 Limit 28
5.5.2 Test procedure 28
5.5.3 Deviation from standard 28
5.5.4 Test setup 28
5.5.5 Test results 29
5.6 6DB BANDWIDTH 31
5.6.1 Limit 31
5.6.2 Test procedure 31
5.6.3 Deviation from standard 31
5.6.4 Test setup 31
5.6.5 Test result 31

5.7 OCCUPIED BANDWIDTH 34
5.7.1 Test procedure 34
5.7.2 Deviation from standard 34
5.7.3 Test setup 34
5.7.4 Test result 34
5.8 BAND EDGE 35
5.8.1 Limit 35
5.8.2 Test procedure 35
5.8.3 Deviation from standard 35
5.8.4 Test setup 35
5.8.5 Test results 36
5.9 CONDUCTED SPURIOUS EMISSIONS 37
5.9.1 Applied procedures / Limit 37
5.9.2 Test procedure 37
5.9.3 Deviation from standard 37
5.9.4 Test setup 37
5.9.5 Test results 38
6 TEST SETUP PHOTO 41
7 PHOTOS OF THE EUT 43

** Modifited History **

Revison	Description	Issued Data	Remark
Revsion 1.0	Initial Test Report Release	Sep. 29, 2020	Jason Zhou

1 Test Summary

1.1 Test Description

Test Item	Test Requirement	Result
Antenna Requirement	§15.203/§15.247 (c)	PASS
Conducted Emission	FCC Part 15.207	PASS
Radiated Emissions	FCC Part 15.205/15.209	PASS
Maximum Peak Output Power	FCC Part 15.247(b)	PASS
Power Spectral Density	FCC Part 15.247 (e)	PASS
6dB Bandwidth & 99% Bandwidth	FCC Part 15.247(a)(2)	PASS
Spurious RF Conducted Emission	FCC Part 15.247(d)	PASS
Band Edge	FCC Part 15.247(d)	PASS

1.2 Measurement Uncertainty

All measurements involve certain levels of uncertainties. The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device. The maximum value of the uncertainty as below:

No.	Item	Uncertainty
1	Conducted Emission Test	±2.71dB
2	All emissions, radiated(<1G)	±3.90dB
3	All emissions, radiated(>1G)	±4.28dB
4	RF power, conducted	±0.37dB
5	Occupied Bandwidth	±3.68%

2 Test Facility

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

Address of the test laboratory

Shenzhen HUAK Testing Technology Co., Ltd.
Add.:1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Heping Community, Fuhai Street, Bao'an District, Shenzhen, China
Designation Number: CN1229
Test Firm Registration Number: 616276

3 General Information

3.1 General Description of EUT

Manufacturer:	United Creation Technology Corp., Ltd
Manufacturer Address:	Room 201, Block A, Science and Technology Buliding Phase-2,Nanhai Road 1057,Shekou, Nanshan District, Shenzhen, China
EUT Name:	SMART EYEWEAR
Model No:	TCW01-A1
Serial No:	TCW01-A2, TCW01-C, TCW01-D, TCW01-B1, TCW01-B2
Model Difference:	All models have the same functionality, software and circuitry, except for the model name, the shape and frame of the lenses, and the trademark.Test sample model :TCW01-A1
Brand Name:	YUHO , VOUGH, 8ightstella
Operation frequency:	2402 MHz to 2480 MHz
Channel separation:	2MHz
NUMBER OF CHANNEL:	40
Modulation Technology:	GFSK
Hardware Version:	V3.3
Software Version:	V2.0
Antenna Type:	Internal Antenna
Antenna Gain:	0dBi
Power Supply:	DC 3.7V from battery or DC 5V from DC Cable
Note:	
1.For a more detailed features description, please refer to the manufacturer’s specifications or the User's Manual.	

Description of Channel:					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	14	2430	28	2458
1	2404	15	2432	29	2460
2	2406	16	2434	30	2462
3	2408	17	2436	31	2464
4	2410	18	2438	32	2466
5	2412	19	2440	33	2468
6	2414	20	2442	34	2470
7	2416	21	2444	35	2472
8	2418	22	2446	36	2474
9	2420	23	2448	37	2476
10	2422	24	2450	38	2478
11	2424	25	2452	39	2480
12	2426	26	2454		
13	2428	27	2456		

3.2 Description of Test conditions

(1) E.U.T. test conditions:
For intentional radiators, measurements of the variation of the input power or the adiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

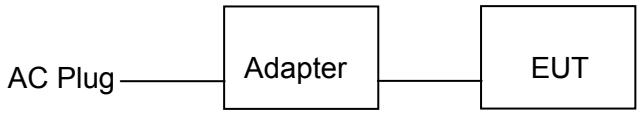
(2) Frequency range of radiated measurements:
The test range will be up to the tenth harmonic of the highest fundamental frequency.

(3) Pre-test the EUT in all transmitting mode at the lowest (2402 MHz), middle (2440 MHz) and highest (2480 MHz) channel with different data packet and conducted to determine the worst-case mode,
only the worst-case results are recorded in this report.

(4) The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

3.3 DESCRIPTION OF TEST SETUP

Operation of EUT during conducted testing and radiation below 1GHz testing:



Operation of EUT during radiation above 1GHz testing:

Adapter information
Model: HW-059200CHQ
Input: 100-240V, 50-60Hz, 0.5A
Output: 5VDC, 2A

The sample was placed (0.8m below 1GHz, 1.5m above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages. The worst case is X position

4 Equipments List for All Test Items

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	R&S	ENV216	HKE-002	Jun. 18, 2020	1 Year
2.	L.I.S.N.	R&S	ENV216	HKE-059	Jun. 18, 2020	1 Year
3.	Receiver	R&S	ESCI 7	HKE-010	Jun. 18, 2020	1 Year
4.	RF automatic control unit	Tonscend	JS0806-2	HKE-060	Jun. 18, 2020	1 Year
5.	Spectrum analyzer	R&S	FSP40	HKE-025	Jun. 18, 2020	1 Year
6.	Spectrum analyzer	Agilent	N9020A	HKE-048	Jun. 18, 2020	1 Year
7.	High gain antenna	Schwarzbeck	LB-180400KF	HKE-054	Jun. 18, 2020	1 Year
8.	Preamplifier	Schwarzbeck	BBV 9743	HKE-006	Jun. 18, 2020	1 Year
9.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	HKE-012	Jun. 18, 2020	1 Year
10.	Loop Antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Jun. 18, 2020	1 Year
11.	Horn Antenna	Schewarzbeck	9120D	HKE-013	Jun. 18, 2020	1 Year
12	Pre-amplifier	EMCI	EMC051845SE	HKE-015	Jun. 18, 2020	1 Year
13	Pre-amplifier	Agilent	83051A	HKE-016	Jun. 18, 2020	1 Year
14	High pass filter unit	Tonscend	JS0806-F	HKE-055	Jun. 18, 2020	1 Year
15	Conducted test software	Tonscend	TS+ Rev 2.5.0.0	HKE-081	N/A	N/A
16	Radiated test software	Tonscend	TS+ Rev 2.5.0.0	HKE-082	N/A	N/A
17.	RF test software	Tonscend	JS1120-B Version 2.6	HKE-083	N/A	N/A
18.	RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 28, 2017	3 Year
19.	RF test software	Tonscend	JS1120-4	HKE-113	N/A	N/A
20.	RF test software	Tonscend	JS1120-3	HKE-114	N/A	N/A
21.	RF test software	Tonscend	JS1120-1	HKE-115	N/A	N/A
22.	Spectrum analyzer	Agilent	N9020A	HKE-048	Jun. 18, 2020	1 Year
23.	Signal generator	Agilent	N5182A	HKE-029	Jun. 18, 2020	1 Year
24.	Signal Generator	Agilent	83630A	HKE-028	Jun. 18, 2020	1 Year
25	Power meter	Agilent	E4419B	HKE-085	Jun. 18, 2020	1 Year
26	Power Sensor	Agilent	E9300A	HKE-086	Jun. 18, 2020	1 Year
27	RF Cable(below1GHz)	Times	9kHz-1GHz	HKE-117	Jun. 18, 2020	1 Year

28.	RF Cable(above 1GHz)	Times	1-40G	HKE-034	Jun. 18, 2020	1 Year
29	RF Cable (9KHz-40GHz)	Tonscend	170660	N/A	Jun. 18, 2020	1 Year
30	Shielded room	Shiel Hong	4*3*3	HKE-039	Dec. 28, 2017	3 Year
31	High gain antenna	Schwarzbeck	LB-180400KF	HKE-054	Jun. 18, 2020	1 Year

5 Test Result

5.1 Antenna Requirement

5.1.1 Standard requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 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. And according to FCC 47 CFR Section 15.247, 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.

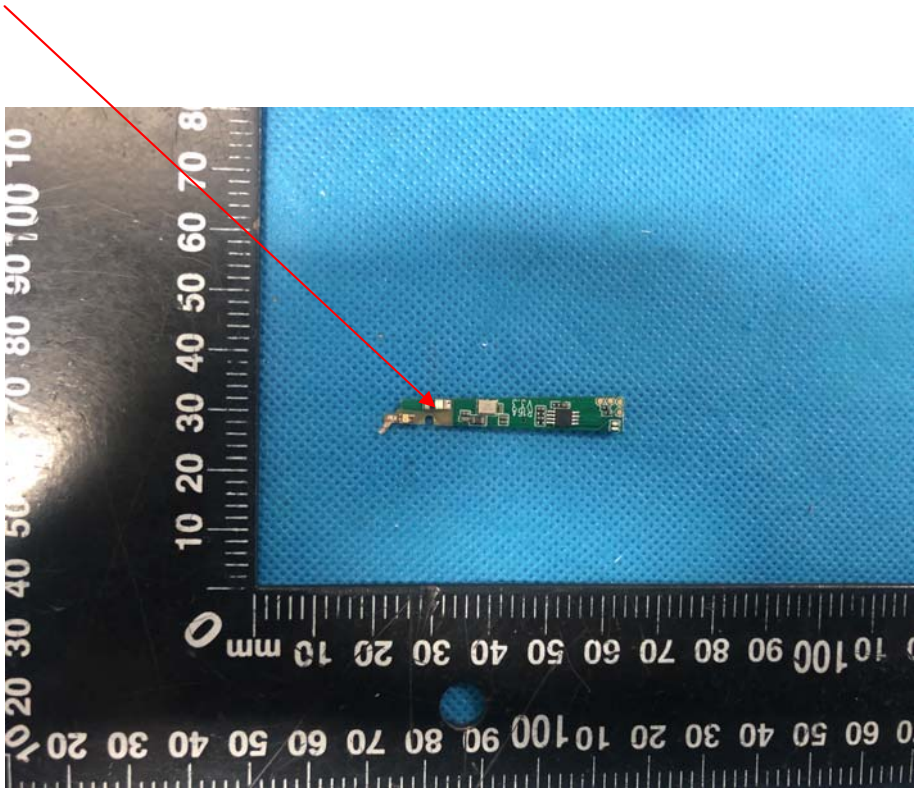
Refer to statement below for compliance.

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction

The antenna used in this product is a Internal antenna, need professional installation, not easy to remove. It conforms to the standard requirements. The directional gains of antenna used for transmitting is 0dBi.

5.1.2 EUT Antenna



5.2 Conduction Emissions Measurement

5.2.1 Applied procedures / Limit

According to FCC CFR Title 47 Part 15 Subpart C Section 15.207, AC Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus as below:

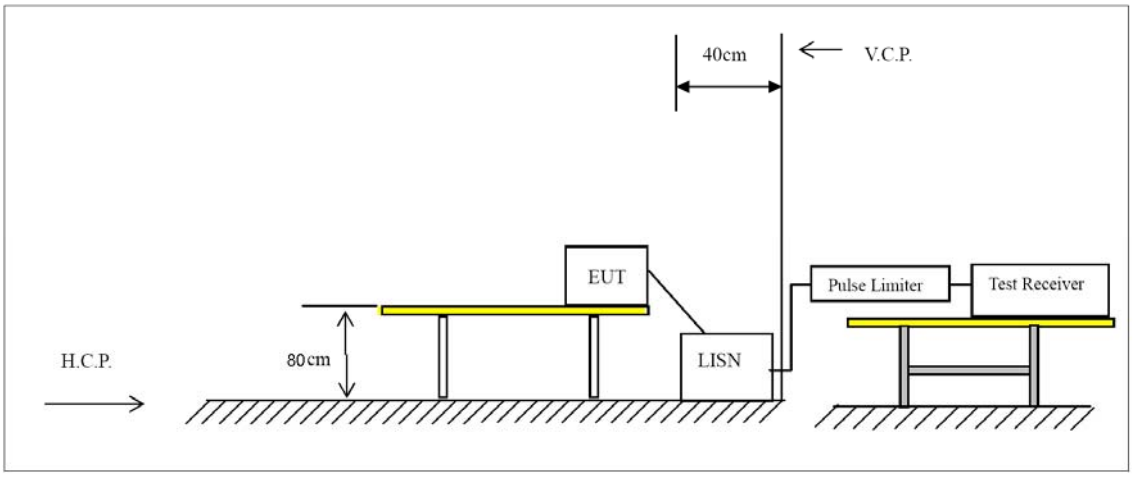
Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

5.2.2 Test procedure

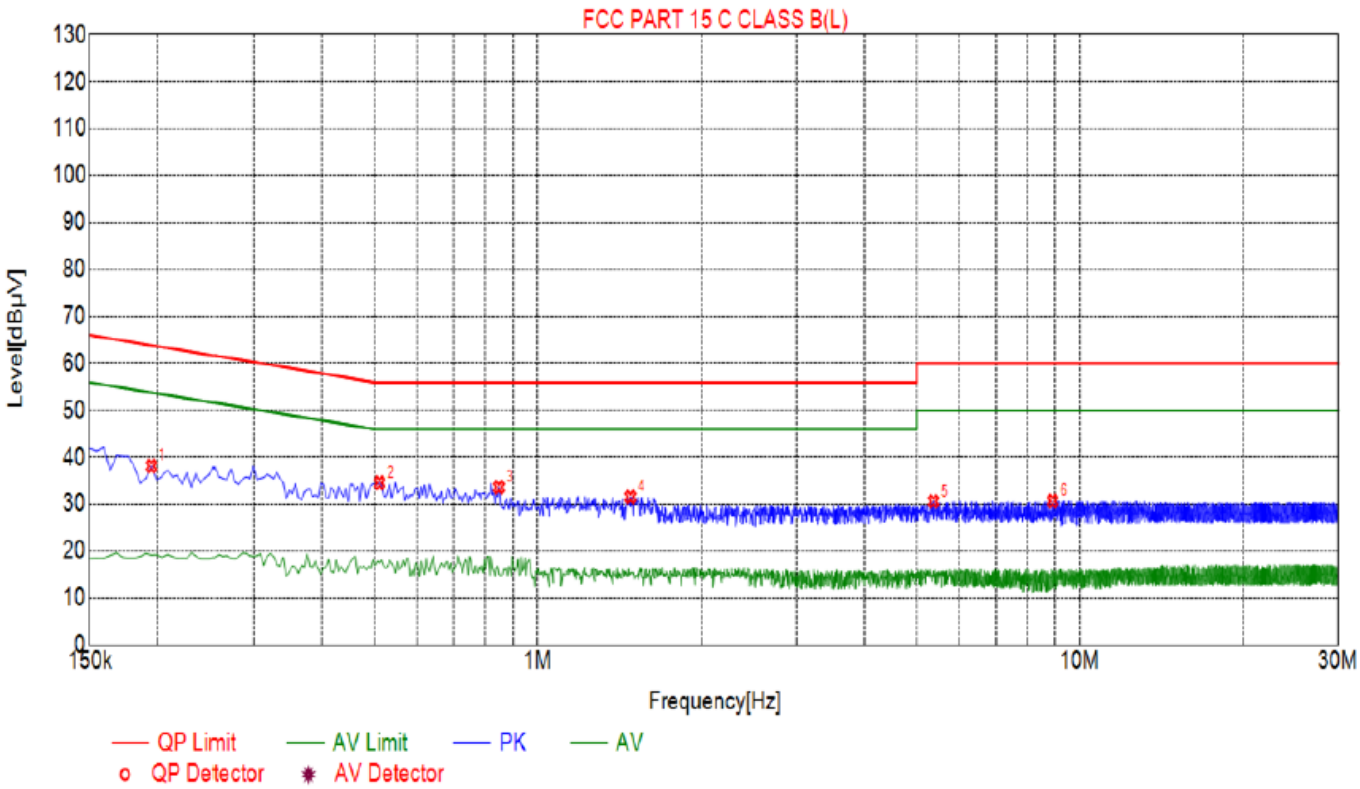
1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10:2013.
2. Support equipment, if needed, was placed as per ANSI C63.10:2013
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10:2013.
4. The adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.

5.2.3 Test setup



5.2.4 Test results

Test Specification: Line



Suspected List								
NO.	Freq. [MHz]	Level [dBμV]	Factor [dB]	Limit [dBμV]	Margin [dB]	Reading [dBμV]	Detector	Type
1	0.1950	38.14	20.03	63.82	25.68	18.11	PK	L
2	0.5100	34.57	20.04	56.00	21.43	14.53	PK	L
3	0.8475	33.63	20.06	56.00	22.37	13.57	PK	L
4	1.4820	31.56	20.10	56.00	24.44	11.46	PK	L
5	5.3700	30.61	20.26	60.00	29.39	10.35	PK	L
6	8.9070	30.68	20.11	60.00	29.32	10.57	PK	L

Remark: Margin = Limit – Level

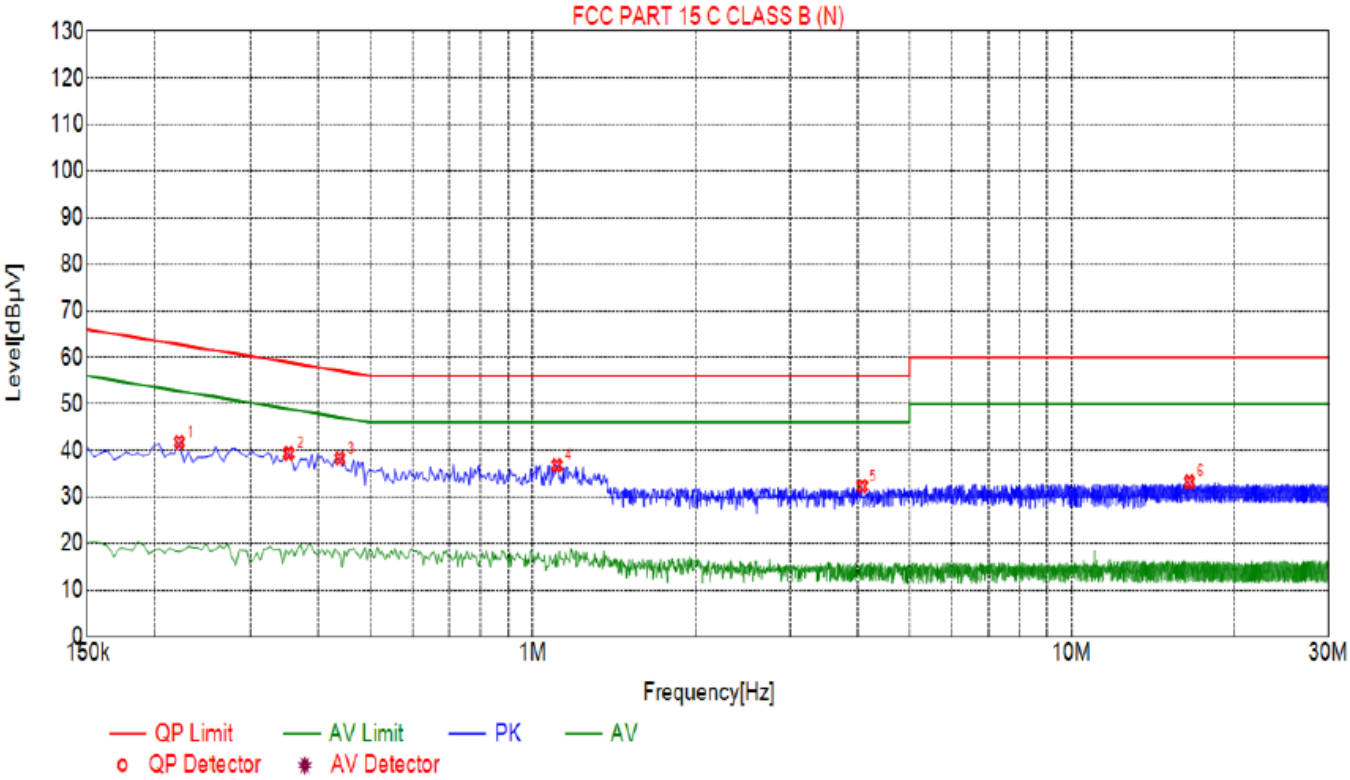
Correction factor = Cable lose + LISN insertion loss

Level=Test receiver reading + correction factor

Notes:

1. *An initial pre-scan was performed on the line and neutral lines with peak detector.*
2. *Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.*
3. *Final Level =Receiver Read level + LISN Factor + Cable Loss*
4. *If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.*

Test Specification: Neutral



Suspected List								
NO.	Freq. [MHz]	Level [dBμV]	Factor [dB]	Limit [dBμV]	Margin [dB]	Reading [dBμV]	Detector	Type
1	0.2220	41.77	20.04	62.74	20.97	21.73	PK	N
2	0.3525	39.36	20.03	58.90	19.54	19.33	PK	N
3	0.4380	38.29	20.05	57.10	18.81	18.24	PK	N
4	1.1085	36.82	20.08	56.00	19.18	16.74	PK	N
5	4.0875	32.33	20.25	56.00	23.67	12.08	PK	N
6	16.5390	33.26	19.99	60.00	26.74	13.27	PK	N

Remark: Margin = Limit – Level
Correction factor = Cable lose + LISN insertion loss
Level=Test receiver reading + correction factor

Notes:

1. *An initial pre-scan was performed on the line and neutral lines with peak detector.*
2. *Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.*
3. *Final Level =Receiver Read level + LISN Factor + Cable Loss.*

If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary

5.3 Radiated Emissions Measurement

5.3.1 Applied procedures / Limit

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission out of authorized band shall not exceed the following table at a 3 meters measurement distance.

In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

Except when the requirements applicable to a given device state otherwise, emissions from licence□exempt transmitters shall comply with the field strength limits shown in table below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

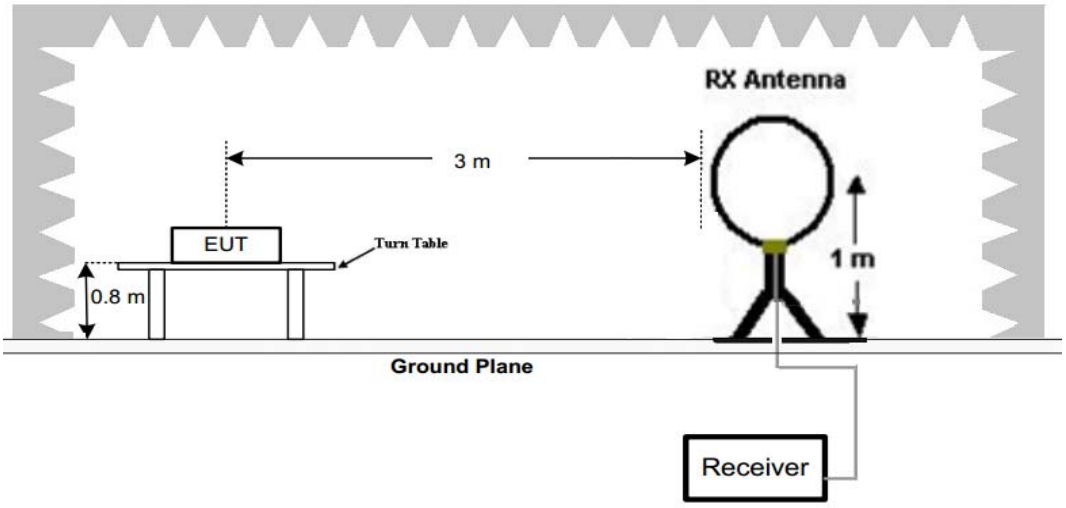
Radiated emission limits

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

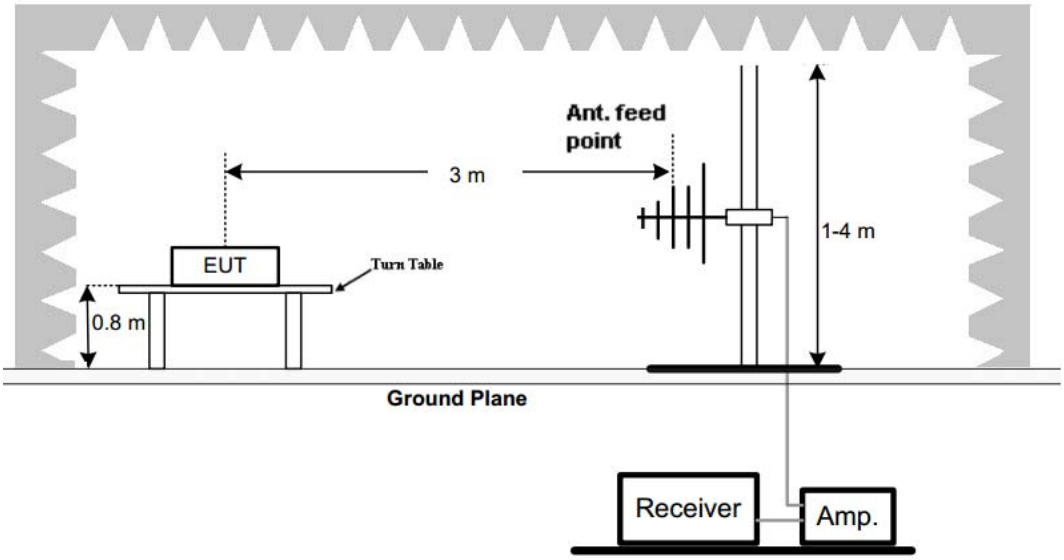
5.3.2 Test setup

Test Configuration:

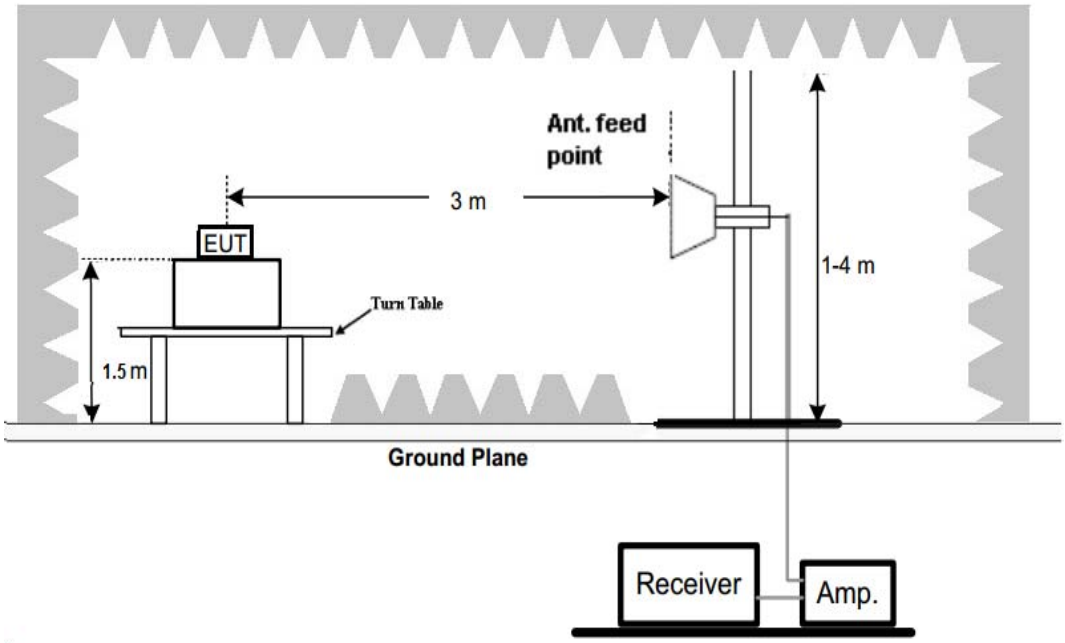
1) 9 kHz to 30 MHz emissions:



2) 30 MHz to 1 GHz emissions:



3) 1 GHz to 25 GHz emissions:



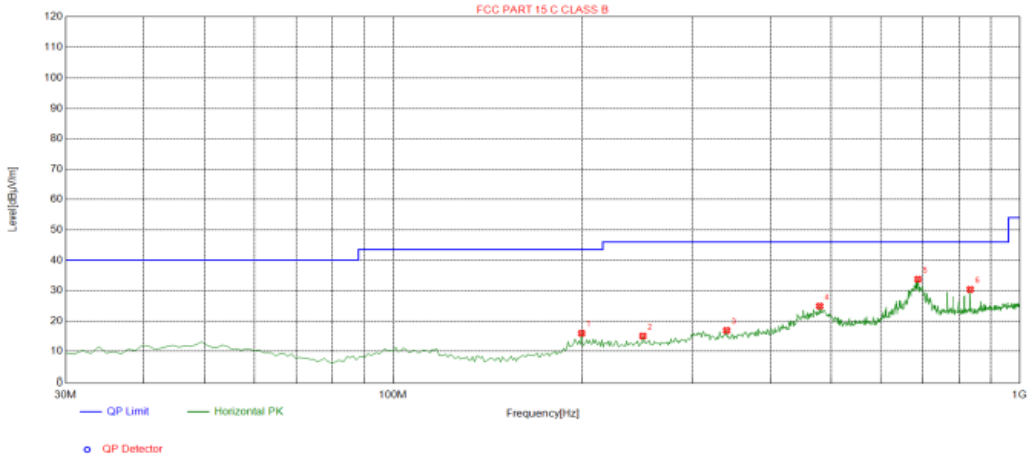
Test Procedure

1. The EUT was placed on turn table which is 0.8m above ground plane for below 1GHz test, and on a low permittivity and low loss tangent turn table which is 1.5m above ground plane for above 1GHz test.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.

5.3.3 Test Result

Below 1GHz Test Results:

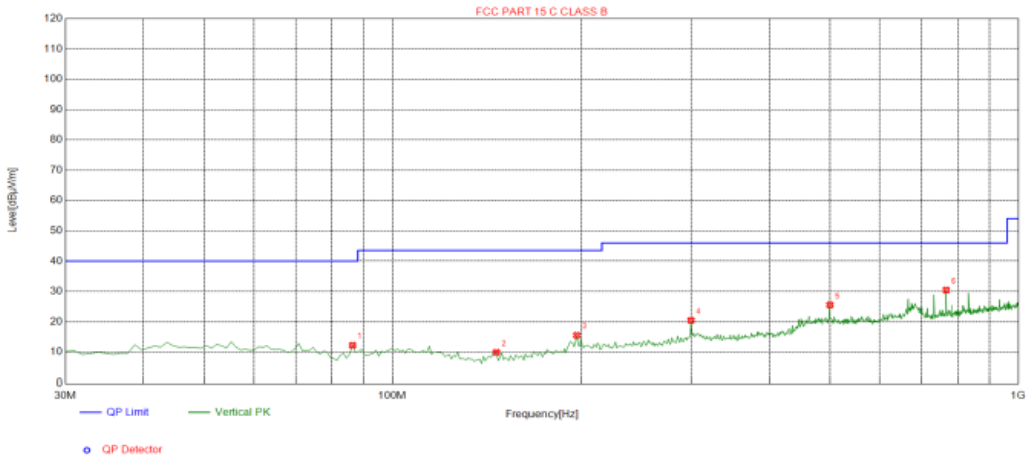
Antenna polarity: H



Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	199.9199	-15.07	31.00	15.93	43.50	27.57	100	120	Horizontal
2	250.4104	-13.40	28.45	15.05	46.00	30.95	100	1	Horizontal
3	340.7107	-11.64	28.52	16.88	46.00	29.12	100	23	Horizontal
4	479.5596	-8.44	33.34	24.90	46.00	21.10	100	226	Horizontal
5	688.3183	-5.16	38.91	33.75	46.00	12.25	100	271	Horizontal
6	833.9640	-2.49	32.86	30.37	46.00	15.63	100	49	Horizontal

Remark: Factor = Cable loss + Antenna factor – Preamplifier; Level = Reading + Factor; Margin = Limit – Level;

Antenna polarity: V



Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	86.3163	-17.95	30.20	12.25	40.00	27.75	100	63	Vertical
2	146.5165	-19.02	28.94	9.92	43.50	33.58	100	79	Vertical
3	197.0070	-15.34	30.89	15.55	43.50	27.95	100	140	Vertical
4	299.9299	-12.74	33.19	20.45	46.00	25.55	100	201	Vertical
5	499.9500	-8.30	33.85	25.55	46.00	20.45	100	349	Vertical
6	766.9670	-3.32	33.79	30.47	46.00	15.53	100	179	Vertical

Remark: Factor = Cable loss + Antenna factor – Preamplifier; Level = Reading + Factor; Margin = Limit – Level;

Remark：

(1) Measuring frequencies from 9 KHz to the 1 GHz, Radiated emission test from 9KHz to 30MHz was verified, and no any emission was found except system noise floor.

(2) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.

(3) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.

For 1GHz to 25GHz

CH Low (2402MHz)
Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4804	57.12	-3.65	53.47	74.00	-20.53	peak
4804	45.77	-3.65	42.12	54.00	-11.88	AVG
7206	53.26	-0.95	52.31	74.00	-21.69	peak
7206	42.59	-0.95	41.64	54.00	-12.36	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4804	56.01	-3.65	52.36	74.00	-21.64	peak
4804	44.66	-3.65	41.01	54.00	-12.99	AVG
7206	54.26	-0.95	53.31	74.00	-20.69	peak
7206	40.28	-0.95	39.33	54.00	-14.67	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

CH Middle (2440MHz)

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4880.00	56.63	-3.54	53.09	74.00	-20.91	peak
4880.00	43.73	-3.54	40.19	54.00	-13.81	AVG
7320.00	56.85	-0.81	56.04	74.00	-17.96	peak
7320.00	43.66	-0.81	42.85	54.00	-11.15	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4880.00	56.66	-3.54	53.12	74.00	-20.88	peak
4880.00	46.52	-3.54	42.98	54.00	-11.02	AVG
7320.00	53.27	-0.81	52.46	74.00	-21.54	peak
7320.00	39.84	-0.81	39.03	54.00	-14.97	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

CH High (2480MHz)

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4960	55.22	-3.43	51.79	74.00	-22.21	peak
4960	44.15	-3.44	40.71	54.00	-13.29	AVG
7440	55.29	-0.77	54.52	74.00	-19.48	peak
7440	40.33	-0.77	39.56	54.00	-14.44	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4960	54.14	-3.43	50.71	74.00	-23.29	peak
4960	45.74	-3.44	42.30	54.00	-11.70	AVG
7440	56.29	-0.77	55.52	74.00	-18.48	peak
7440	37.74	-0.77	36.97	54.00	-17.03	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Remark：

(1) Measuring frequencies from 1 GHz to the 25 GHz。

(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.

(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.

(4) The emissions are attenuated more than 20dB below the permissible limits are not recorded in the report.

(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak
detection at frequency above 1GHz.

(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.

(7)All modes of operation were investigated and the worst-case emissions are reported.

Radiated Band Edge Test:

Operation Mode: TX CH Low (2402MHz)

Horizontal (Worst case):

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310.00	60.48	-5.81	54.67	74	-19.33	peak
2310.00	51.29	-5.81	45.48	54	-8.52	AVG
2390.00	56.03	-5.84	50.19	74	-23.81	peak
2390.00	/	-5.84	/	54	/	AVG
2400.00	57.77	-5.84	51.93	74	-22.07	peak
2400.00	/	-5.84	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310.00	58.26	-5.81	52.45	74	-21.55	peak
2310.00	/	-5.81	/	54	/	AVG
2390.00	54.13	-5.84	48.29	74	-25.71	peak
2390.00	/	-5.84	/	54	/	AVG
2400.00	57.66	-5.84	51.82	74	-22.18	peak
2400.00	/	-5.84	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Operation Mode: TX CH High (2480MHz)
Horizontal (Worst case)

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	55.22	-5.81	49.41	74	-24.59	peak
2483.50	/	-5.81	/	54	/	AVG
2500.00	53.66	-6.06	47.6	74	-26.4	peak
2500.00	/	-6.06	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	54.65	-5.81	48.84	74	-25.16	peak
2483.50	/	-5.81	/	54	/	AVG
2500.00	54.18	-6.06	48.12	74	-25.88	peak
2500.00	/	-6.06	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						
Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.						

5.4 Maximum Output Power Measurement

5.4.1 Limit

The Maximum Peak Output Power Measurement is 30dBm.

5.4.2 Test procedure

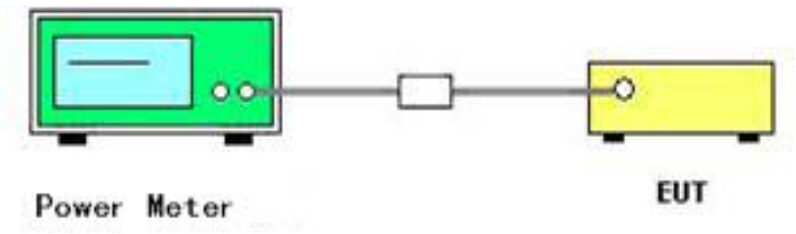
The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

The maximum Average conducted output power may be measured using a wideband RF power meter with a thermocouple derector or equivalent. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

5.4.3 Deviation from standard

No deviation.

5.4.4 Test setup



5.4.5 Test results

Channel	Channel frequency (MHz)	Output power (dBm)	Limit (dBm)	Result
Low	2402	-4.754	30	Pass
Middle	2440	-4.012		Pass
High	2480	-3.259		Pass

5.5 Power Spectral Density

5.5.1 Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

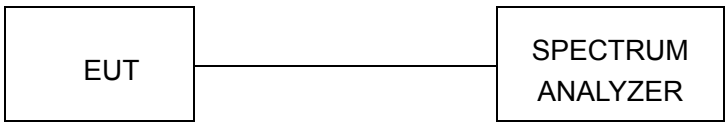
5.5.2 Test procedure

Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
Set the RBW =3 kHz.
Set the VBW =10 KHz.
Set the span to 1.5 times the DTS channel bandwidth.
Detector = peak.
Sweep time = auto couple.
Trace mode = max hold.
Allow trace to fully stabilize.
Use the peak marker function to determine the maximum power level.
If measured value exceeds limit, reduce RBW(no less than 3 kHz)and repeat.
The resulting peak PSD level must be 8 dBm.

5.5.3 Deviation from standard

No deviation.

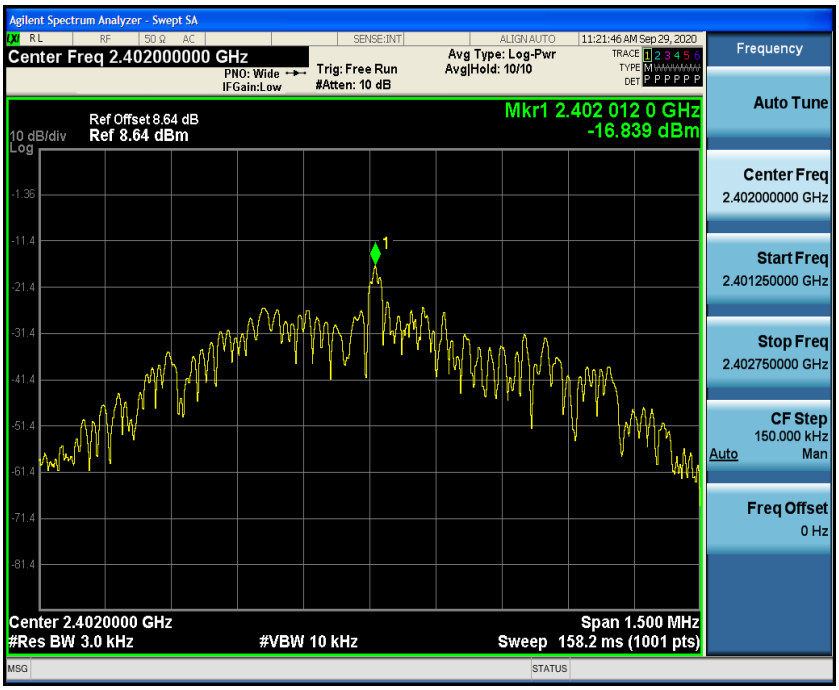
5.5.4 Test setup



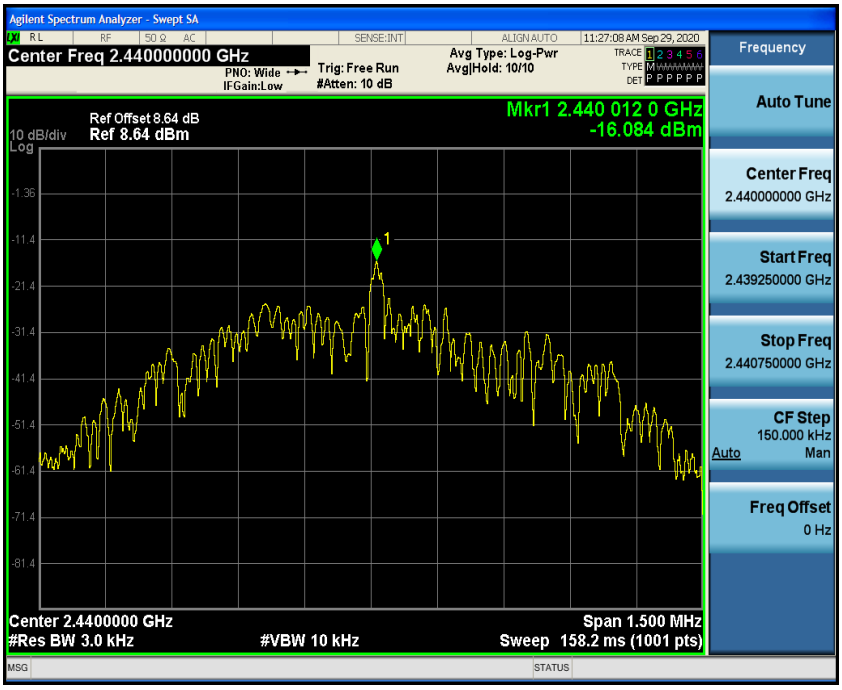
5.5.5 Test results

Channel	Channel frequency (MHz)	Power Spectral Density (dBm/3KHz)	Limit (dBm/3KHz)	Result
Low	2402	-16.84	8.00	Pass
Middle	2440	-16.08		Pass
High	2480	-15.25		Pass

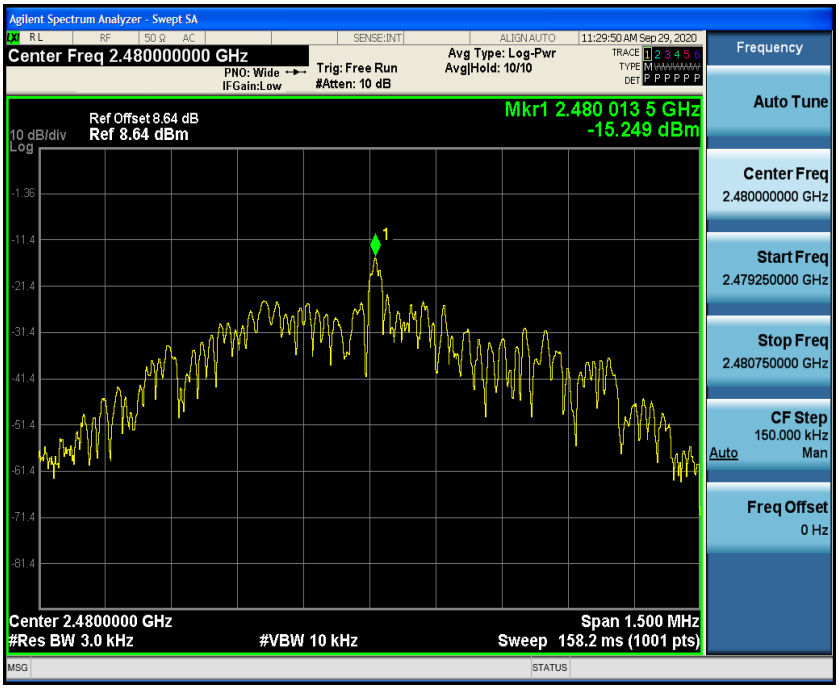
CH 00



CH 19



CH 39


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
11:29:50 AM Sep 29, 2020
Ref Offset 8.64 dB
10 dB/div
Ref 8.64 dBm
Log
Mkr1 2.480 013 5 GHz
-15.249 dBm
Center 2.4800000 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 1.500 MHz
Sweep 158.2 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.479250000 GHz
Stop Freq
2.480750000 GHz
CF Step
150.000 kHz
Auto
Man
Freq Offset
0 Hz

5.6 6dB Bandwidth

5.6.1 Limit

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

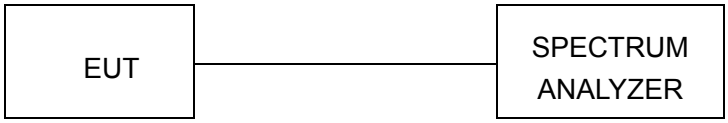
5.6.2 Test procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=100 KHz and VBW=300KHz.
The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.
1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

5.6.3 Deviation from standard

No deviation.

5.6.4 Test setup



5.6.5 Test result

Channel	Channel frequency (MHz)	6dB Bandwidth (MHz)	Limit (KHz)	Result
Low	2402	0.5052	≥500	Pass
Middle	2440	0.5134		Pass
High	2480	0.5046		Pass

CH 00

Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.402000000 GHz
Center Freq: 2.402000000 GHz
Trig: Free Run
Avg|Hold:>1/1
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
11:25:29 AM Sep 29, 2020
Frequency
Ref Offset 8.64 dB
10 dB/div
Ref 20.00 dBm
Mkr1 2.4020143 GHz
-4.9400 dBm
Center 2.402 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 6 MHz
Sweep 1.067 ms
Occupied Bandwidth
1.1832 MHz
Total Power 0.70 dBm
Transmit Freq Error -13.837 kHz
OBW Power 99.00 %
x dB Bandwidth 505.2 kHz
x dB -6.00 dB
Center Freq
2.402000000 GHz
CF Step
600.000 kHz
Auto Man
Freq Offset
0 Hz

CH 19

Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.440000000 GHz
Center Freq: 2.440000000 GHz
Trig: Free Run
Avg|Hold:>1/1
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
11:26:24 AM Sep 29, 2020
Frequency
Ref Offset 8.64 dB
10 dB/div
Ref 20.00 dBm
Mkr1 2.4400165 GHz
-4.2323 dBm
Center 2.44 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 6 MHz
Sweep 1.067 ms
Occupied Bandwidth
1.2345 MHz
Total Power 1.47 dBm
Transmit Freq Error -37.181 kHz
OBW Power 99.00 %
x dB Bandwidth 513.4 kHz
x dB -6.00 dB
Center Freq
2.440000000 GHz
CF Step
600.000 kHz
Auto Man
Freq Offset
0 Hz

CH 39

Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>1/1
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
Frequency
Ref Offset 8.64 dB
10 dB/div
Ref 20.00 dBm
Log
Mkr1 2.480012 GHz
-3.4312 dBm
Center Freq
2.480000000 GHz
Center 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 6 MHz
Sweep 1.067 ms
CF Step
600.000 kHz
Auto
Man
Occupied Bandwidth
1.2702 MHz
Total Power 2.18 dBm
Transmit Freq Error -44.566 kHz
OBW Power 99.00 %
x dB Bandwidth 504.6 kHz
x dB -6.00 dB
Freq Offset
0 Hz
MSG
STATUS

5.7 Occupied Bandwidth

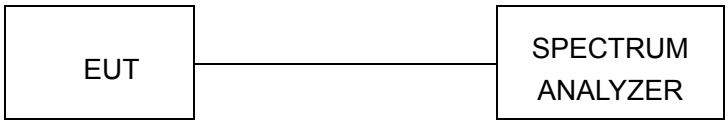
5.7.1 Test procedure

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring 99% power bandwidth:
RBW=1% to 5% of the OBW
VBW=approximately 3 X RBW
Detector=Peak
Trace Mode: Max Hold
Use the 99% power bandwidth function of the instrument to measure the Occupied Bandwidth and recorded.

5.7.2 Deviation from standard

No deviation.

5.7.3 Test setup



5.7.4 Test result

N/A

5.8 Band edge

5.8.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under FCC rules in section 5.8.1, the attenuation required shall be 30 dB instead of 20 dB.

5.8.2 Test procedure

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
b. Span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation, RBW ≥ 1% of the span, VBW ≥ RBW, Sweep = auto,
Detector function = peak, Trace = max hold

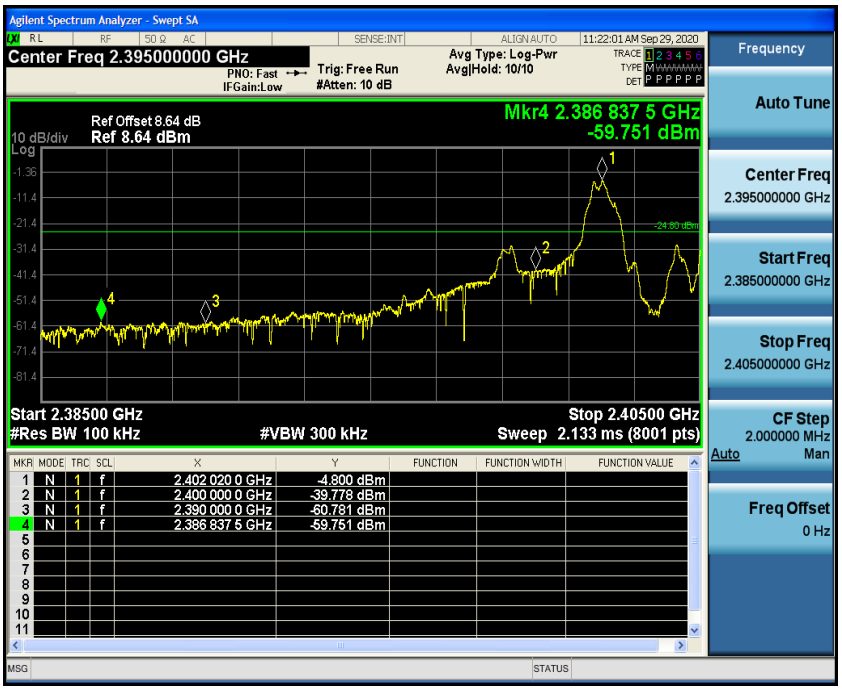
5.8.3 Deviation from standard

No deviation.

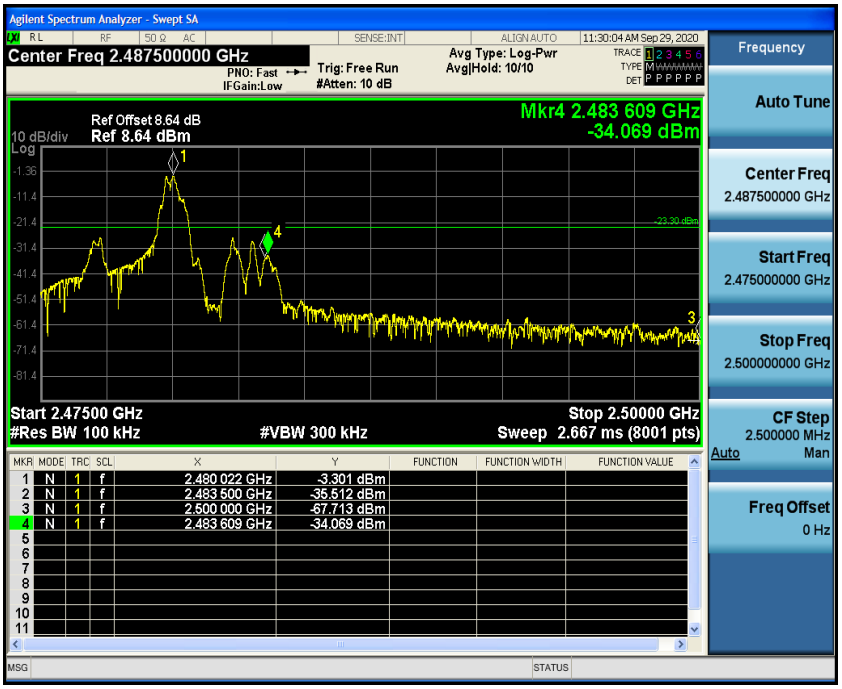
5.8.4 Test setup

5.8.5 Test results

PASS



2402



2480

5.9 Conducted Spurious Emissions

5.9.1 Applied procedures / Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section (b)(3) of RSS 5.4(4), the attenuation required shall be 30 dB instead of 20 dB.
For below 30MHz,For 9KHz-150kHz,150K-10MHz,We use the RBW 1KHz,10KHz, So the limit need to calculated by “10lg(BW1/BW2)“. for example For9KHz-150kHz,RBW 1KHz, The Limit= the highest emission level-20-10log(100/1)= the highest emission level-40.

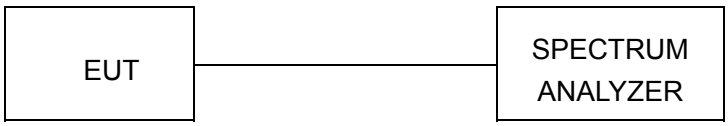
5.9.2 Test procedure

a.The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
b.Span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation, RBW ≥ 1% of the span, VBW ≥ RBW, Sweep = auto,
Detector function = peak, Trace = max hold

5.9.3 Deviation from standard

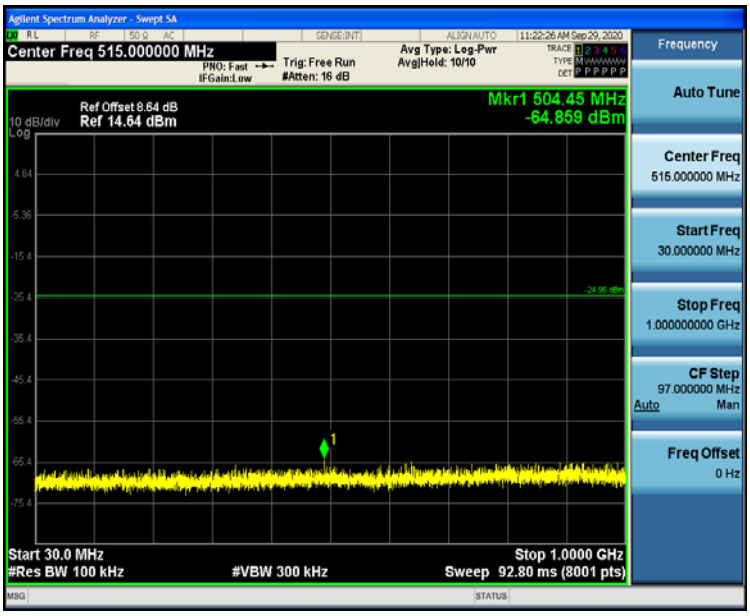
No deviation.

5.9.4 Test setup



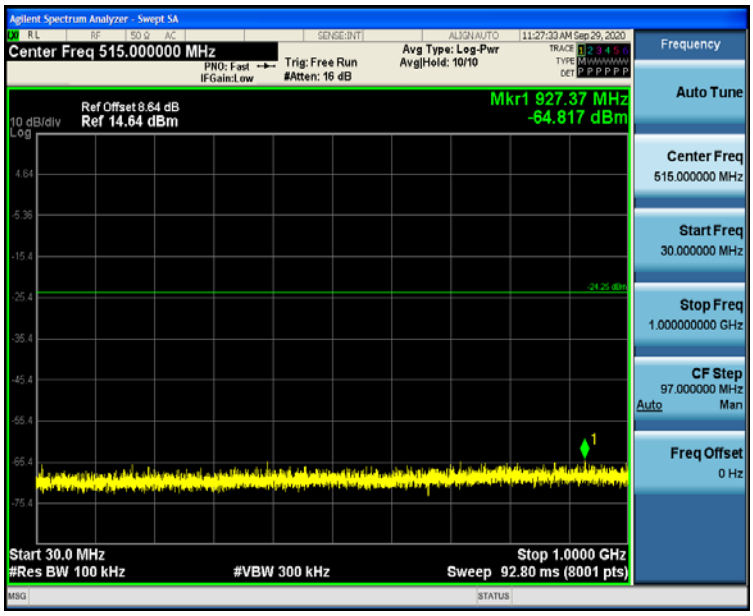
5.9.5 Test results

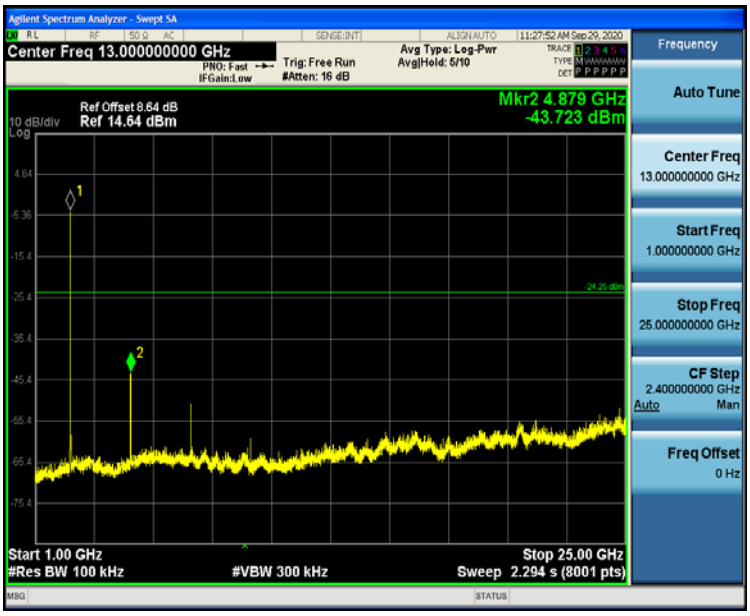
CH 00



CH 19

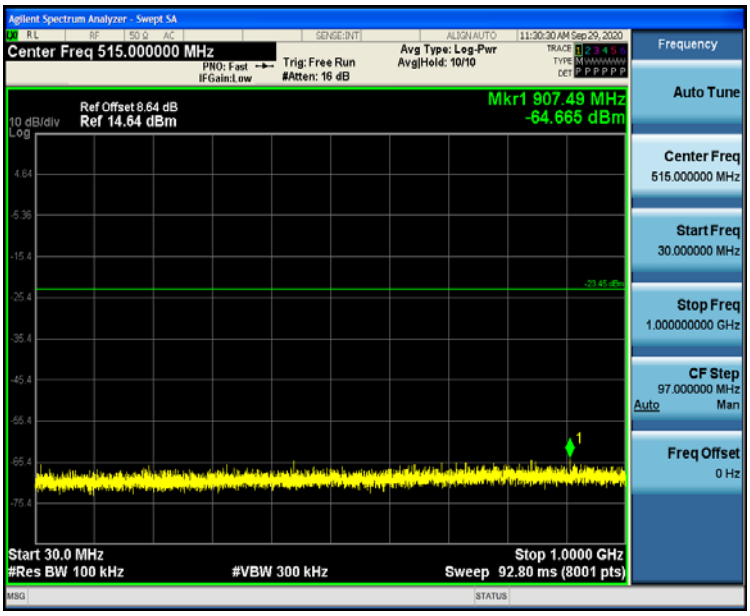
Agilent Spectrum Analyzer - Swept SA
Center Freq 2.440000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
11:27:20 AM Sep 29, 2020
Ref Offset 8.64 dB
10 dB/div Ref 18.64 dBm
Log
Mkr1 2.440 010 5 GHz
-4.251 dBm
Center 2.440000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 4.000 MHz
Sweep 1.067 ms (8001 pts)
Frequency
Auto Tune
Center Freq
2.440000000 GHz
Start Freq
2.438000000 GHz
Stop Freq
2.442000000 GHz
CF Step
400.000 kHz
Auto Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 515.000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 16 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
11:27:33 AM Sep 29, 2020
Ref Offset 8.64 dB
10 dB/div Ref 14.64 dBm
Log
Mkr1 927.37 MHz
-64.817 dBm
Start 30.0 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1.0000 GHz
Sweep 92.80 ms (8001 pts)
Frequency
Auto Tune
Center Freq
515.000000 MHz
Start Freq
30.000000 MHz
Stop Freq
1.000000000 GHz
CF Step
97.000000 MHz
Auto Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 13.000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 16 dB
Avg Type: Log-Pwr
Avg|Hold: 5/10
11:27:52 AM Sep 29, 2020
Ref Offset 8.64 dB
10 dB/div Ref 14.64 dBm
Log
Mkr2 4.879 GHz
-43.723 dBm
Start 1.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.294 s (8001 pts)
Frequency
Auto Tune
Center Freq
13.000000000 GHz
Start Freq
1.000000000 GHz
Stop Freq
25.000000000 GHz
CF Step
2.400000000 GHz
Auto Man
Freq Offset
0 Hz

CH 39

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
11:30:17 AM Sep 29, 2020
Ref Offset 8.64 dB
10 dB/div Ref 18.64 dBm
Mkr1 2.480 012 5 GHz
-3.451 dBm
Center 2.480000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 4.000 MHz
Sweep 1.067 ms (8001 pts)
Frequency
Auto Tune
Center Freq 2.480000000 GHz
Start Freq 2.478000000 GHz
Stop Freq 2.482000000 GHz
CF Step 400.000 kHz
Auto Man
Freq Offset 0 Hz

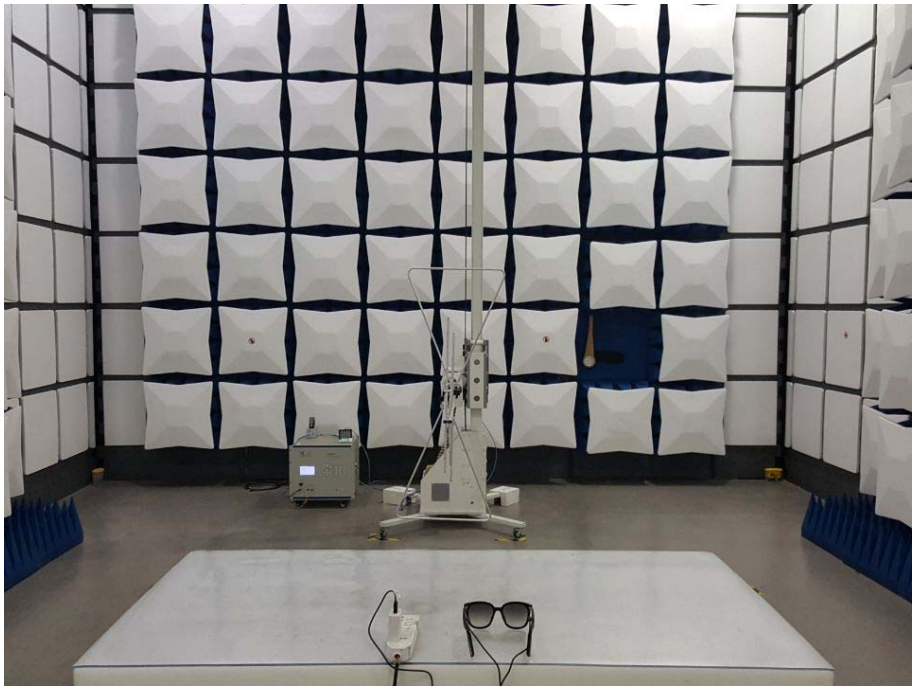

Agilent Spectrum Analyzer - Swept SA
Center Freq 515.000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 16 dB
Avg Type: Log-Pwr
Avg|Hold: 10/10
11:30:30 AM Sep 29, 2020
Ref Offset 8.64 dB
10 dB/div Ref 14.64 dBm
Mkr1 907.49 MHz
-64.665 dBm
Start 30.0 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1.0000 GHz
Sweep 92.80 ms (8001 pts)
Frequency
Auto Tune
Center Freq 515.000000 MHz
Start Freq 30.000000 MHz
Stop Freq 1.000000000 GHz
CF Step 97.000000 MHz
Auto Man
Freq Offset 0 Hz

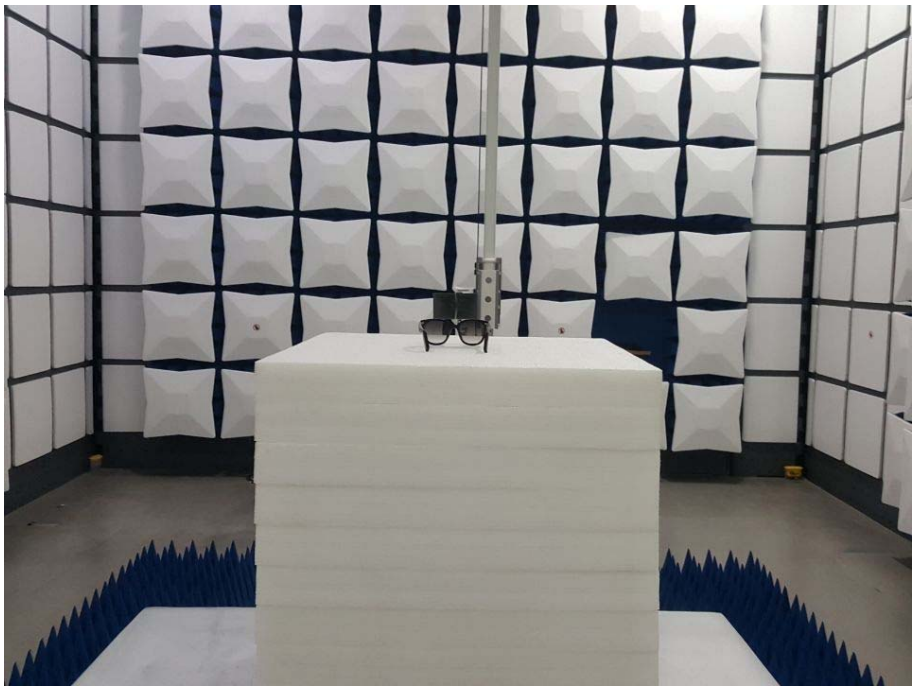
Agilent Spectrum Analyzer - Swept SA
Center Freq 13.000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 16 dB
Avg Type: Log-Pwr
Avg|Hold: 5/10
11:30:49 AM Sep 29, 2020
Ref Offset 8.64 dB
10 dB/div Ref 14.64 dBm
Mkr2 4.960 GHz
-45.828 dBm
Start 1.00 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.294 s (8001 pts)
Frequency
Auto Tune
Center Freq 13.000000000 GHz
Start Freq 1.000000000 GHz
Stop Freq 25.000000000 GHz
CF Step 2.400000000 GHz
Auto Man
Freq Offset 0 Hz

6 Test setup photo

Conducted Emission

Radiated Emissions





7 PHOTOS OF THE EUT

Reference to the reporter : ANNEX A of external photos and ANNEX B of internal photos

---------End of test report---------