FCC Test Report

Report No.: AGC04600180601FE03

FCC ID	:	2AQMIGW10018
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	Bluetooth Headphone
BRAND NAME	:	Grado
MODEL NAME	:	Grado GW100
CLIENT	:	Grado Laboratories, Inc.
DATE OF ISSUE	:	July 11, 2018
STANDARD(S) **TEST PROCEDURE(S)**	:	FCC Part 15 Subpart C Section 15.249
REPORT VERSION	:	V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd

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Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	July 11, 2018	Valid	Initial release

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1. VERIFICATION OF CONFORMITY

Applicant	Grado Laboratories, Inc.
Address	4614 - 7th Avenue, Brooklyn, NY 11220, U.S.A.
Manufacturer	Antonio International Limited
Address	Unit 216, 2/F, Lakeside 1, 8 Science Park West Avenue, Hong Kong Science Park, Shatin, New Territories, Hong Kong
Product Designation	Bluetooth Headphone
Brand Name	Grado
Test Model	Grado GW100
Date of test	June 25, 2018 to July 06, 2018
Deviation	None
Condition of Test Sample	Normal
Report Template	AGCRT-US-BR/RF

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, the energy emitted by the sample tested as described in this report is in compliance with the requirements of FCC Rules Part 15.249. The test results of this report relate only to the tested sample identified in this report.

Tested By _____

Jonhen Wang(Wang Yonghuan) July 06, 2018

Reviewed By _____

Cool Cheng(Cheng Mengguo) July 11, 2018

Approved By _____

Forrest Lei(Lei Yonggang) July 11, 2018
Authorized Officer

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2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

A major technical description of EUT is described as following

Operation Frequency	2.402 GHz to 2.480GHz
Bluetooth Version	V4.2
Modulation	BR ☒GFSK, EDR ☒π /4-DQPSK, ☒8DPSK BLE ☐GFSK
Number of channels	79
Hardware Version	V1.3
Software Version	V1.8
Antenna Designation	FPCB Antenna
Antenna Gain	0dBi
Power Supply	DC 3.7V by battery
Note: The USB port only used for charging and can't be used to transfer data with PC.	

2.2. TABLE OF CARRIER FREQUENCYS

BR/EDR Channel List

Frequency Band	Channel Number	Frequency
2400~2483.5MHz	0	2402MHz
	1	2403MHz
	:	:
	38	2440 MHz
	39	2441 MHz
	40	2442 MHz
	:	:
	77	2479 MHz
	78	2480 MHz

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3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ±U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

- Uncertainty of Conducted Emission, Uc = ±3.2 dB
- Uncertainty of Radiated Emission below 1GHz, Uc = ±3.9 dB
- Uncertainty of Radiated Emission above 1GHz, Uc = ±4.8 dB

4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel GFSK
2	Middle channel GFSK
3	High channel GFSK
4	Low channel π /4-DQPSK
5	Middle channel π /4-DQPSK
6	High channel π /4-DQPSK
7	Low channel 8DPSK
8	Middle channel 8DPSK
9	High channel 8DPSK
10	BT Link with charging
11	BT Link(Hopping mode)

Note:
1. All the test modes can be supply by battery, only the result of the worst case was recorded in the report, if no other cases.
2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.
3. The EUT used fully-charged battery when tested.

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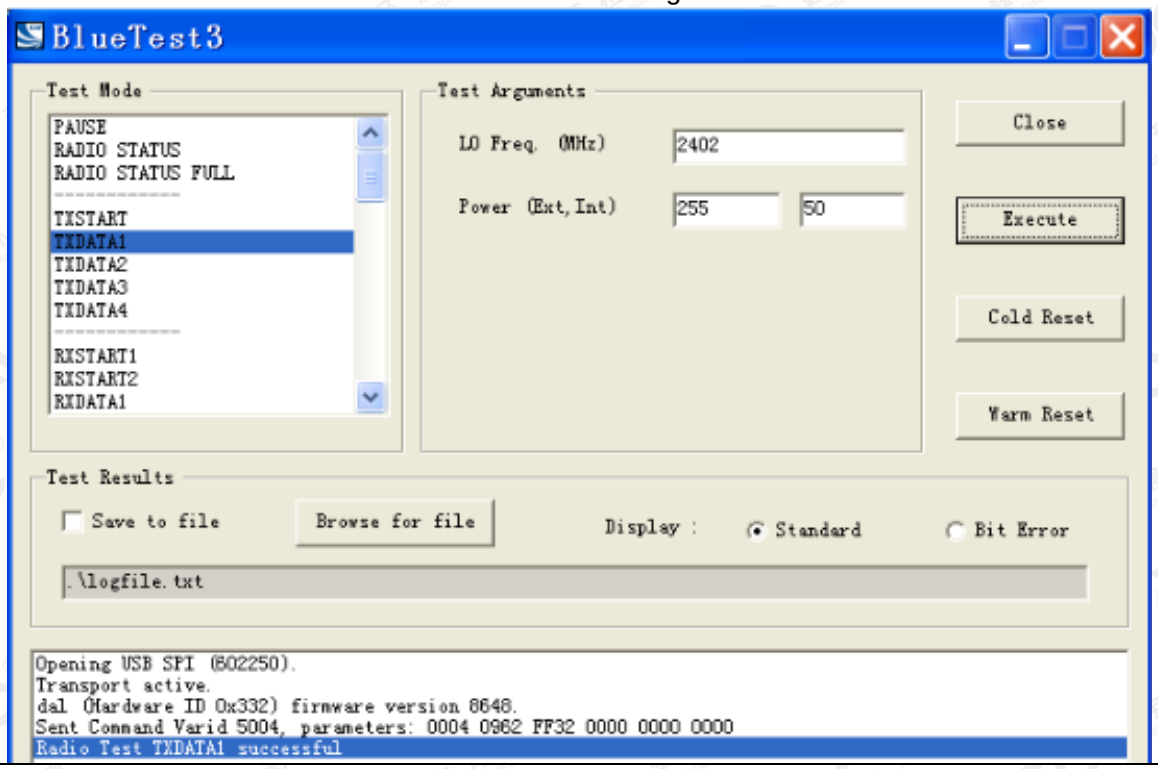
Software Setting



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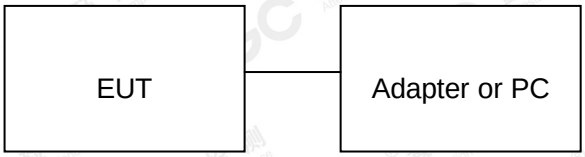
5. SYSTEM TEST CONFIGURATION

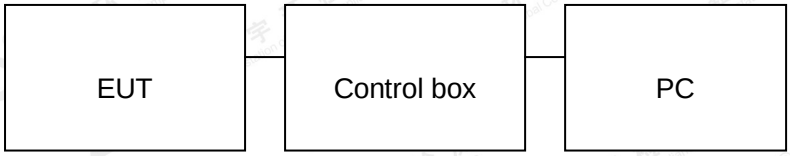
5.1. CONFIGURATION OF EUT SYSTEM

Configure 1: (Normal hopping)



Note: Owing to the EUT has own battery, and testing may be performed while PC or adapter removed.

Configure 2: (Control continuous TX)



5.2. EQUIPMENT USED IN EUT SYSTEM

Item	Equipment	Mfr/Brand	Model/Type No.	Remark
1	Bluetooth Headphone	Grado	Grado GW100	EUT
2	Battery	ZLY	422535	Accessory
3	PC	APPLE	A1465	A.E
4	Control box	CSR	USB_SPI_TOOLS	A.E
5	Adapter	IPRO	NTR-S01	A.E
6	USB Cable	N/A	1m unshielded	A.E
7	USB Cable	N/A	0.6m unshielded	Accessory
8	AUX IN Cable	N/A	1m unshielded	Accessory
9	Mobile phone	HUAWEI	V9	A.E

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5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.249(a) §15.209	Radiated Emission	Compliant
§15.249(d)	Band Edges	Compliant
§15.207	Conduction Emission	Compliant
§15.215	Bandwidth	Compliant

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6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2F., Bldg.2, No.1-4, Chaxi Sanwei Technical Industrial Park, Gushu, Xixiang, Bao'an District B112-B113, Bldg.12, Baoan Bldg Materials Center, No.1 of Xixiang Inner Ring Road, Baoan District, Shenzhen 518012
NVLAP Lab Code	600153-0
Designation Number	CN5028
Test Firm Registration Number	682566
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by National Voluntary Laboratory Accreditation program, NVLAP Code 600153-0

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7. TEST METHOD

All measurements contained in this report were conducted with ANSI C63.10-2013

8. TEST EQUIPMENT LIST

TEST EQUIPMENT OF CONDUCTED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESPI	101206	Jun.20, 2018	Jun.19, 2019
LISN	R&S	ESH2-Z5	100086	Aug.21, 2017	Aug.20, 2018

TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	Jun.20, 2018	Jun.19, 2019
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Dec.08, 2017	Dec.07, 2018
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep.20, 2017	Sep.19, 2018
preamplifier	ChengYi	EMC184045SE	980508	Sep.15, 2017	Sep.14, 2018
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	May 18, 2017	May 17, 2019
Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-205	Jun.20, 2018	Jun.19, 2019
ANTENNA	SCHWARZBECK	VULB9168	D69250	Sep.28, 2017	Sep.27, 2018
Radiation Cable 1	MXT	RS1	R005	N/A	N/A
Radiation Cable 2	MXT	RS1	R006	N/A	N/A
Loop Antenna	A.H.Systems,Inc	SAS-562B	--	Mar. 01, 2018	Feb. 28, 2019
Filter (2.4-2.483GHz)	Micro-tronics	087	--	Jun.20, 2018	Jun.19, 2019

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9. RADIATED EMISSION

9.1. TEST LIMIT

Standard FCC15.249

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
900-928MHz	50	500
2400-2483.5MHz	50	500
5725-5875MHz	50	500
24.0-24.25GHz	250	2500

Standard FCC 15.209

Frequency (MHz)	Distance Meters	Field Strengths Limit	
		μ V/m	dB(μV)/m
0.009 ~ 0.490	300	2400/F(kHz)	---
0.490 ~ 1.705	30	24000/F(kHz)	---
1.705 ~ 30	30	30	---
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	Other:74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

Remark: (1) Emission level dBμ V = 20 log Emission level μ V/m
(2) The smaller limit shall apply at the cross point between two frequency bands.
(3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

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9.2. MEASUREMENT PROCEDURE

1. The measuring distance of 3m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation(Below 1GHz)
2. The measuring distance of 3m shall used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation(Above 1GHz)
3. The height of the test antenna shall vary between 1m to 4m.Both horizontal and vertical polarization Of the antenna are set to make the measurement.
4. The initial step in collecting radiated emission data is a receive peak detector mode. Pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
5. All readings are peak unless otherwise stated QP in column of Note. Peak denoted that the Peak reading compliance with the QP limits and then QP Mode measurement didn't perform(Below 1GHz)
6. All readings are Peak mode value unless otherwise stated AVG in column of Note. If the Peak mode measured value compliance with the Peak limits and lower than AVG Limits, the EUT shall be deemed to meet Peak & AVG limits and then only Peak mode was measured, but AVG mode didn't perform.(Above 1GHz)

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The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP
Start ~Stop Frequency	Fundamental: 2.4~2.483GHz RBW 2MHz/ VBW 6MHz for Peak, RBW 2MHz/ VBW 10Hz for Average Harmonics: 1GHz~25GHz RBW 1MHz/ VBW 3MHz for Peak, RBW 1MHz/ VBW 10Hz for Average
Receiver Parameter	**Setting**
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP

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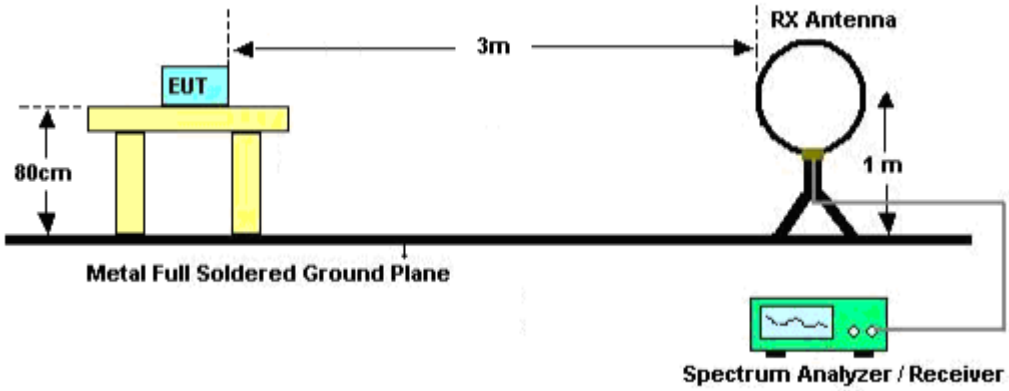
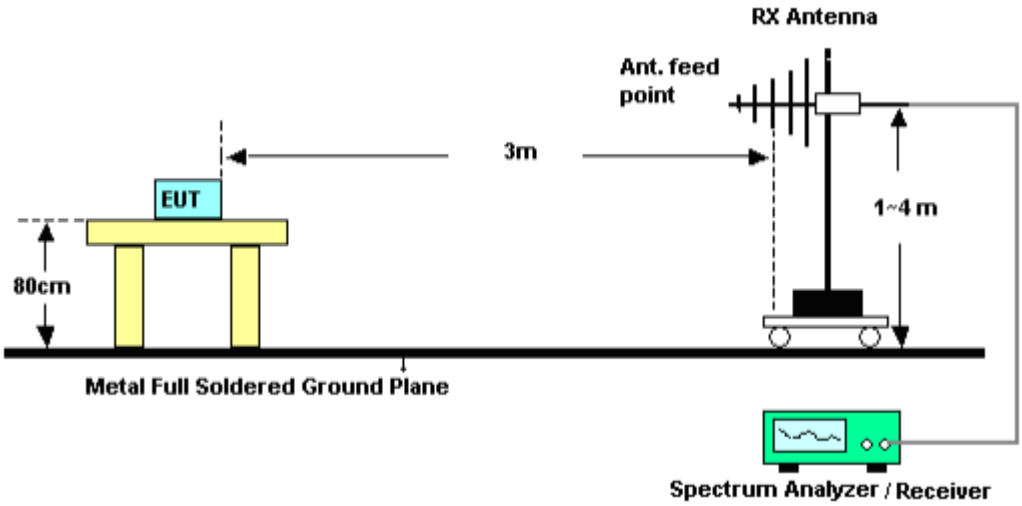
9.3. TEST SETUP

RADIATED EMISSION TEST-SETUP FREQUENCY BELOW 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



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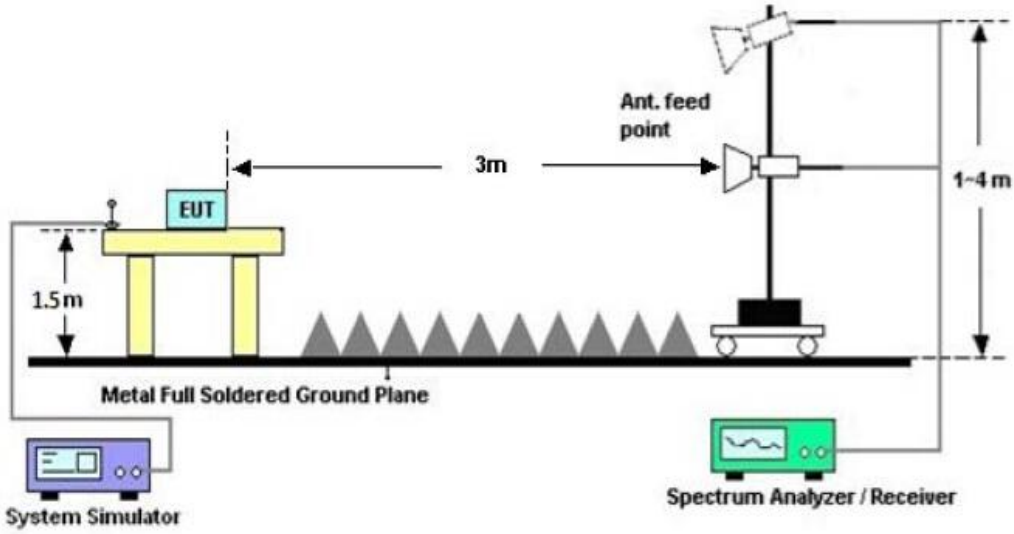
RADIATED EMISSION TEST SETUP ABOVE 1000MHz



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9.4. TEST RESULT

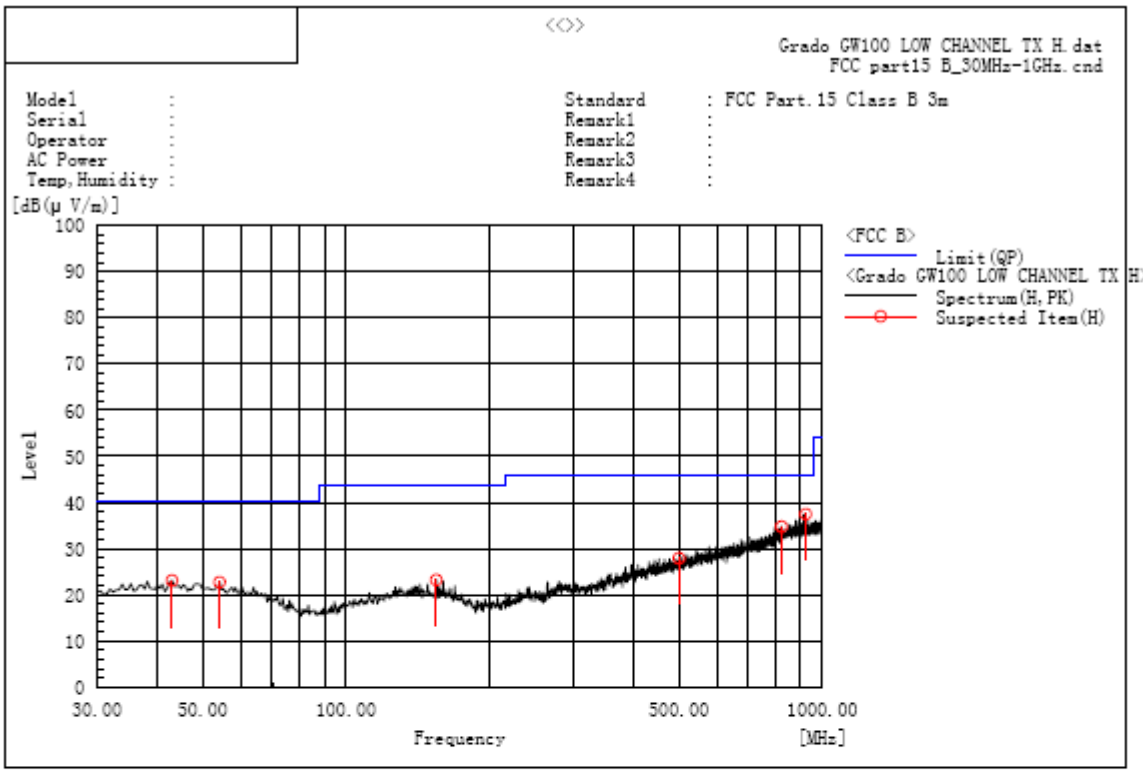
(Worst modulation: GFSK)

RADIATED EMISSION BELOW 30MHz

No emission found between lowest internal used/generated frequencies to 30MHz.

RADIATED EMISSION BELOW 1GHz

RADIATED EMISSION TEST- (30MHz-1GHz)-LOW CHANNEL-HORIZONTAL



A. Suspected List:

Frequency MHz	Polarization	Reading dB(uV)	Factor dB (1/m)	Level dB(uV/m) PK	Limit dB(uV/m) QP	Margin dB	Pass/Fail	Height cm	Angle deg
43.095	H	5.7	17.4	23.1	40.0	16.9	Pass	100.0	1.4
54.250	H	5.9	16.8	22.7	40.0	17.3	Pass	150.0	70.7
154.645	H	6.6	16.6	23.2	43.5	20.3	Pass	200.0	326.2
499.965	H	5.0	22.9	27.9	46.0	18.1	Pass	100.0	289.3
821.520	H	5.6	29.1	34.7	46.0	11.3	Pass	150.0	70.7
923.370	H	7.1	30.4	37.5	46.0	8.5	Pass	100.0	289.3

RESULT: PASS

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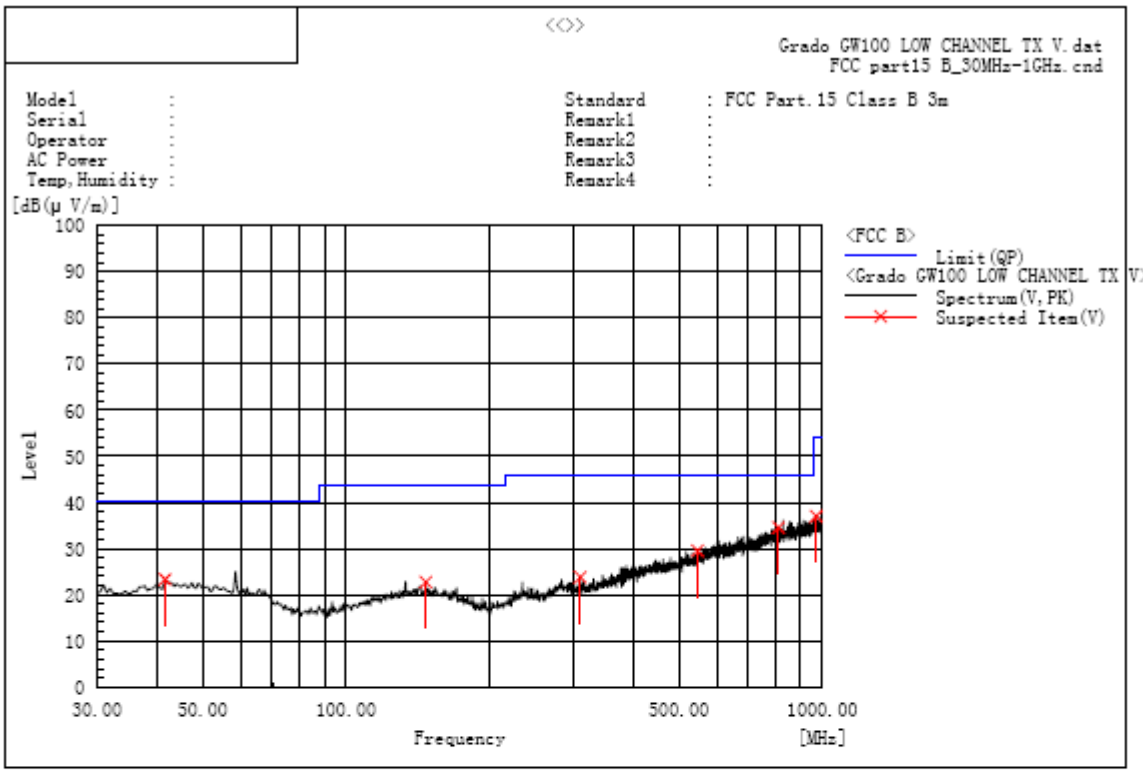
RADIATED EMISSION TEST- (30MHz-1GHz)-LOW CHANNEL -VERTICAL



A. Suspected List:

Frequency MHz	Polarization	Reading dB(uV)	Factor dB (1/m)	Level dB(uV/m) PK	Limit dB(uV/m) QP	Margin dB	Pass/Fail	Height cm	Angle deg
41.640	V	6.0	17.4	23.4	40.0	16.6	Pass	100.0	184.6
146.885	V	6.2	16.6	22.8	43.5	20.7	Pass	200.0	94.5
310.330	V	6.2	17.6	23.8	46.0	22.2	Pass	150.0	252.0
547.010	V	5.8	23.8	29.6	46.0	16.4	Pass	150.0	287.7
808.910	V	5.7	28.9	34.6	46.0	11.4	Pass	200.0	245.0
970.900	V	6.2	30.8	37.0	54.0	17.0	Pass	150.0	144.2

RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. The “Factor” value can be calculated automatically by software of measurement system.

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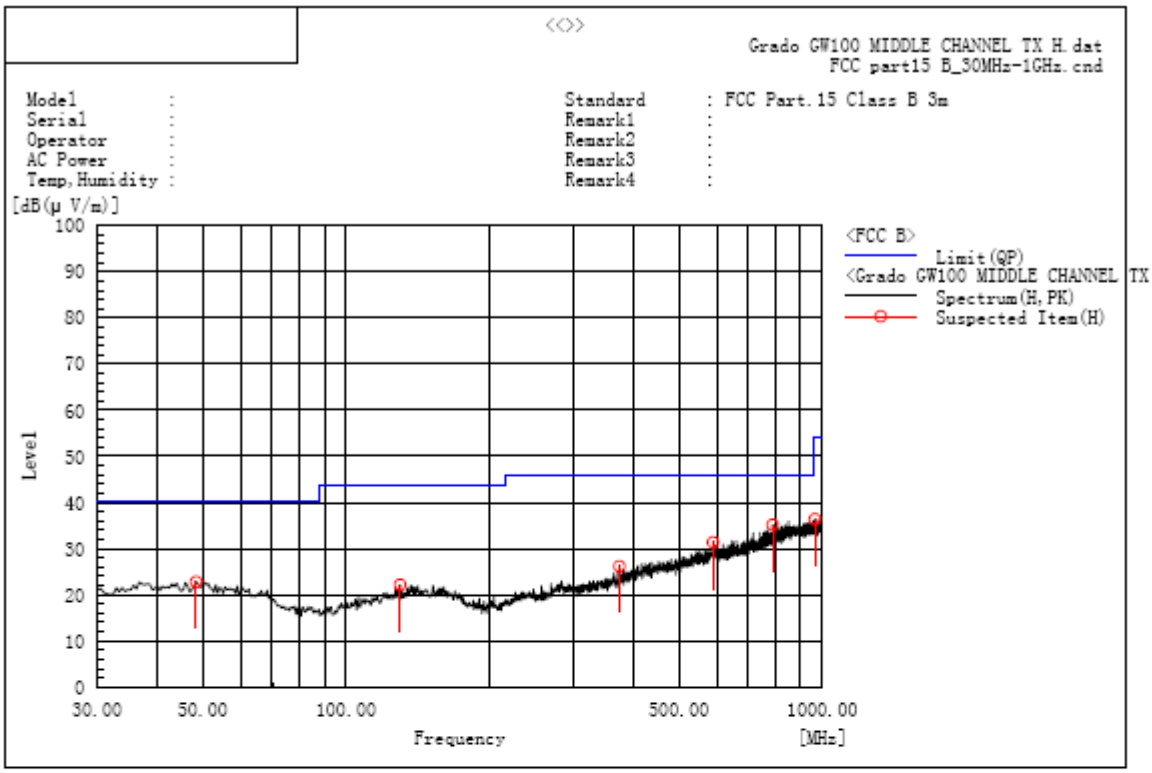
RADIATED EMISSION TEST- (30MHz-1GHz)-MIDDLE CHANNEL-HORIZONTAL



A. Suspected List:

Frequency MHz	Polarization	Reading dB(uV)	Factor dB (1/m)	Level dB(uV/m) PK	Limit dB(uV/m) QP	Margin dB	Pass/Fail	Height cm	Angle deg
48.430	H	5.7	17.1	22.8	40.0	17.2	Pass	200.0	267.4
129.910	H	6.0	16.2	22.2	43.5	21.3	Pass	150.0	142.8
374.835	H	6.3	19.9	26.2	46.0	19.8	Pass	100.0	216.8
589.690	H	6.7	24.7	31.4	46.0	14.6	Pass	200.0	266.2
787.085	H	6.8	28.4	35.2	46.0	10.8	Pass	150.0	287.7
964.595	H	5.6	30.8	36.4	54.0	17.6	Pass	200.0	266.2

RESULT: PASS

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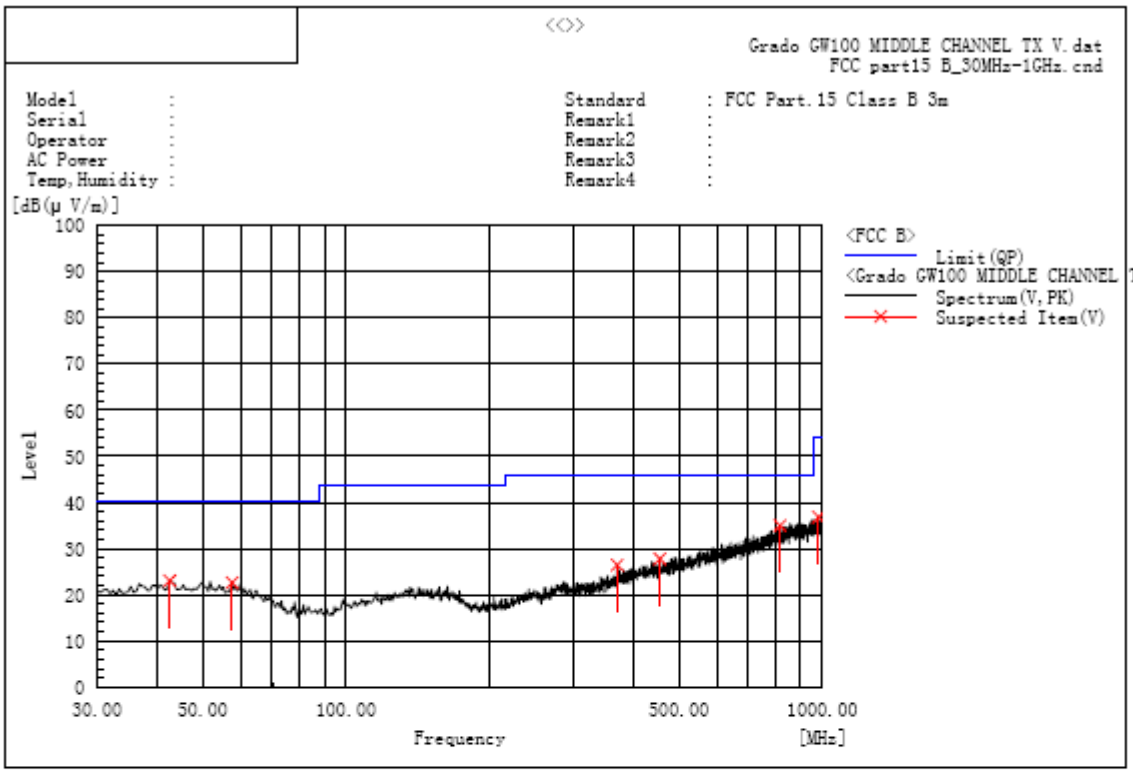
RADIATED EMISSION TEST- (30MHz-1GHz)-MIDDLE CHANNEL -VERTICAL



A. Suspected List:

Frequency MHz	Polarization	Reading dB(uV)	Factor dB (1/m)	Level dB(uV/m) PK	Limit dB(uV/m) QP	Margin dB	Pass/Fail	Height cm	Angle deg
42.610	V	5.7	17.4	23.1	40.0	16.9	Pass	200.0	324.1
57.645	V	6.1	16.5	22.6	40.0	17.4	Pass	100.0	91.3
370.955	V	6.7	19.7	26.4	46.0	19.6	Pass	150.0	72.4
455.830	V	5.6	22.2	27.8	46.0	18.2	Pass	150.0	292.2
814.730	V	6.0	29.0	35.0	46.0	11.0	Pass	150.0	72.4
981.570	V	6.0	30.9	36.9	54.0	17.1	Pass	200.0	71.4

RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. The "Factor" value can be calculated automatically by software of measurement system.

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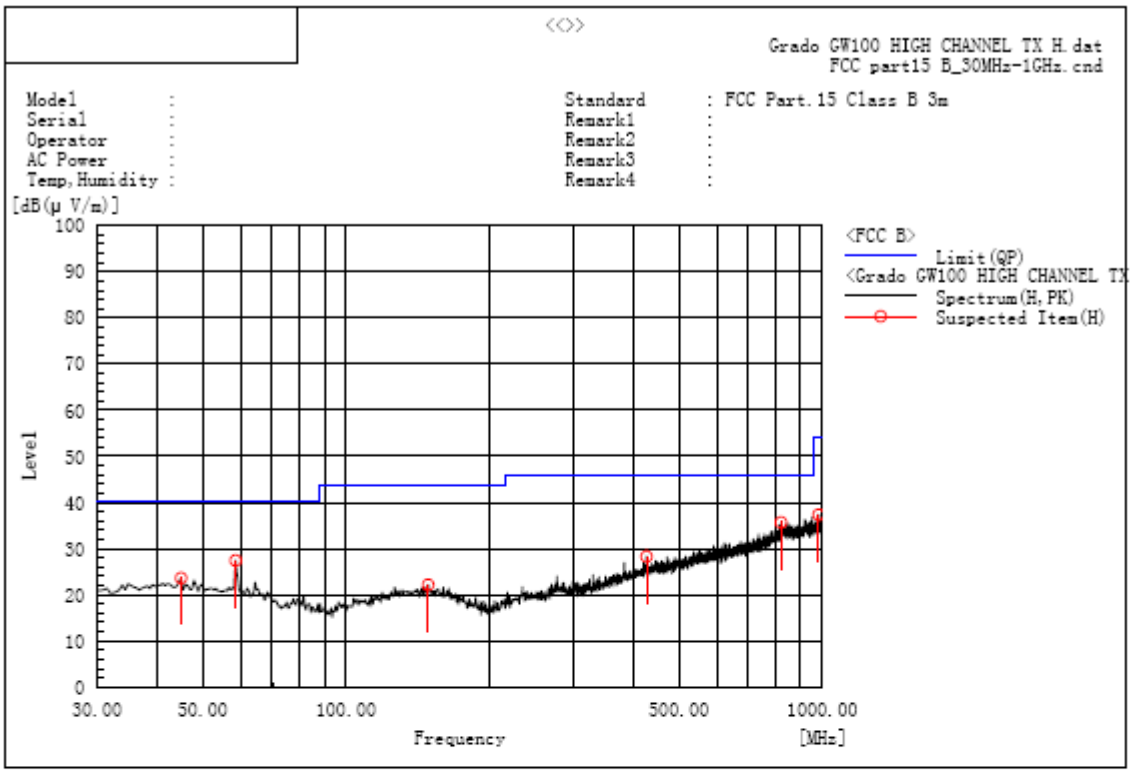
RADIATED EMISSION TEST- (30MHz-1GHz)-HIGH CHANNEL-HORIZONTAL



A. Suspected List:

Frequency MHz	Polarization	Reading dB(uV)	Factor dB (1/m)	Level dB(uV/m) PK	Limit dB(uV/m) QP	Margin dB	Pass/Fail	Height cm	Angle deg
45.035	H	6.3	17.3	23.6	40.0	16.4	Pass	200.0	163.8
58.615	H	11.0	16.4	27.4	40.0	12.6	Pass	150.0	71.4
148.825	H	5.5	16.6	22.1	43.5	21.4	Pass	150.0	151.2
427.700	H	6.7	21.6	28.3	46.0	17.7	Pass	100.0	253.4
819.580	H	6.6	29.1	35.7	46.0	10.3	Pass	200.0	93.1
982.540	H	6.3	31.0	37.3	54.0	16.7	Pass	150.0	114.1

RESULT: PASS

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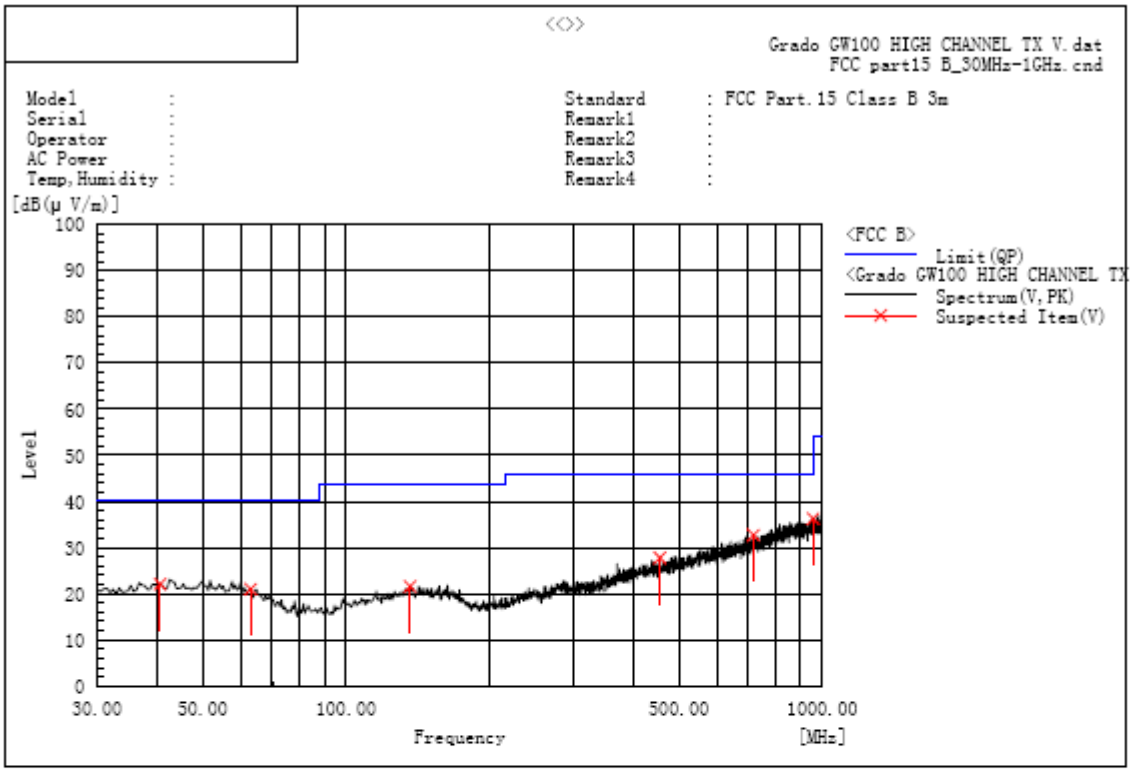
RADIATED EMISSION TEST- (30MHz-1GHz)-HIGH CHANNEL -VERTICAL



A. Suspected List:

Frequency MHz	Polarization	Reading dB(uV)	Factor dB (1/m)	Level dB(uV/m) PK	Limit dB(uV/m) QP	Margin dB	Pass/Fail	Height cm	Angle deg
40.670	V	4.7	17.4	22.1	40.0	17.9	Pass	150.0	72.4
62.980	V	5.1	15.9	21.0	40.0	19.0	Pass	150.0	72.4
136.215	V	5.0	16.6	21.6	43.5	21.9	Pass	150.0	255.1
455.830	V	5.6	22.2	27.8	46.0	18.2	Pass	150.0	292.2
716.760	V	6.0	26.7	32.7	46.0	13.3	Pass	150.0	218.0
956.350	V	5.6	30.7	36.3	46.0	9.7	Pass	200.0	215.6

RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. The "Factor" value can be calculated automatically by software of measurement system.

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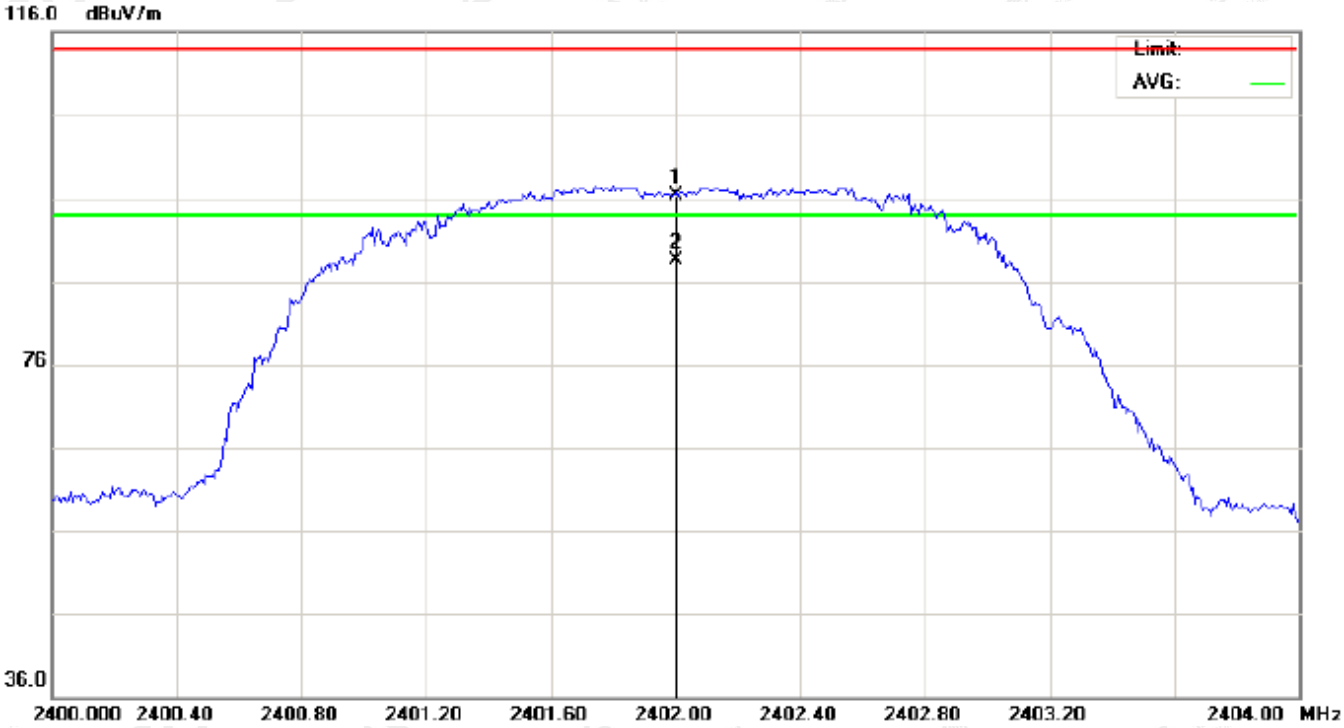
RADIATED EMISSION ABOVE 1GHz

(Worst modulation: GFSK)

For Fundamental

RADIATED EMISSION TEST- (ABOVE 1GHz)-LOW CHANNEL-HORIZONTAL



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		2402.000	86.04	10.32	96.36	114.00	-17.64	peak			
2	*	2402.000	78.11	10.32	88.43	94.00	-5.57	AVG	100	55	

RESULT: PASS

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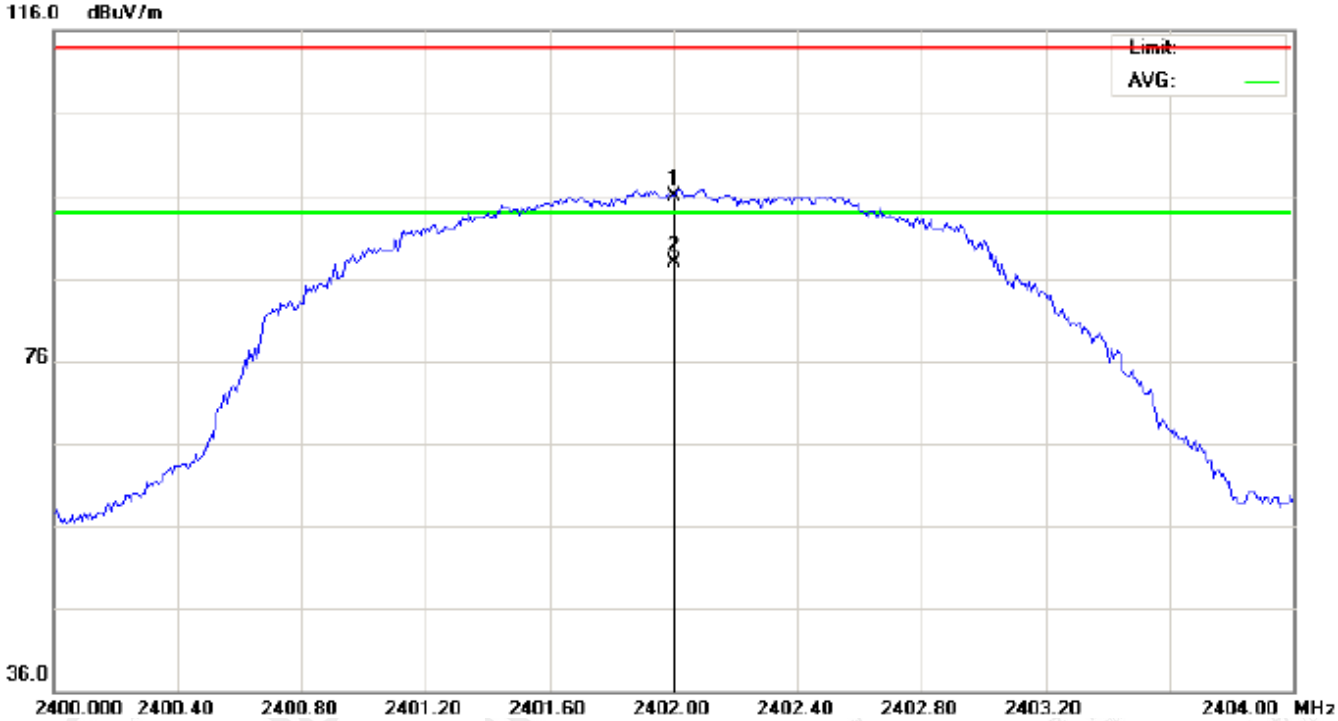
RADIATED EMISSION TEST- (ABOVE 1GHz)-LOW CHANNEL- VERTICAL



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	-	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		2402.000	85.63	10.32	95.95	114.00	-18.05	peak			
2	*	2402.000	77.60	10.32	87.92	94.00	-6.08	AVG	100	287	

RESULT: PASS

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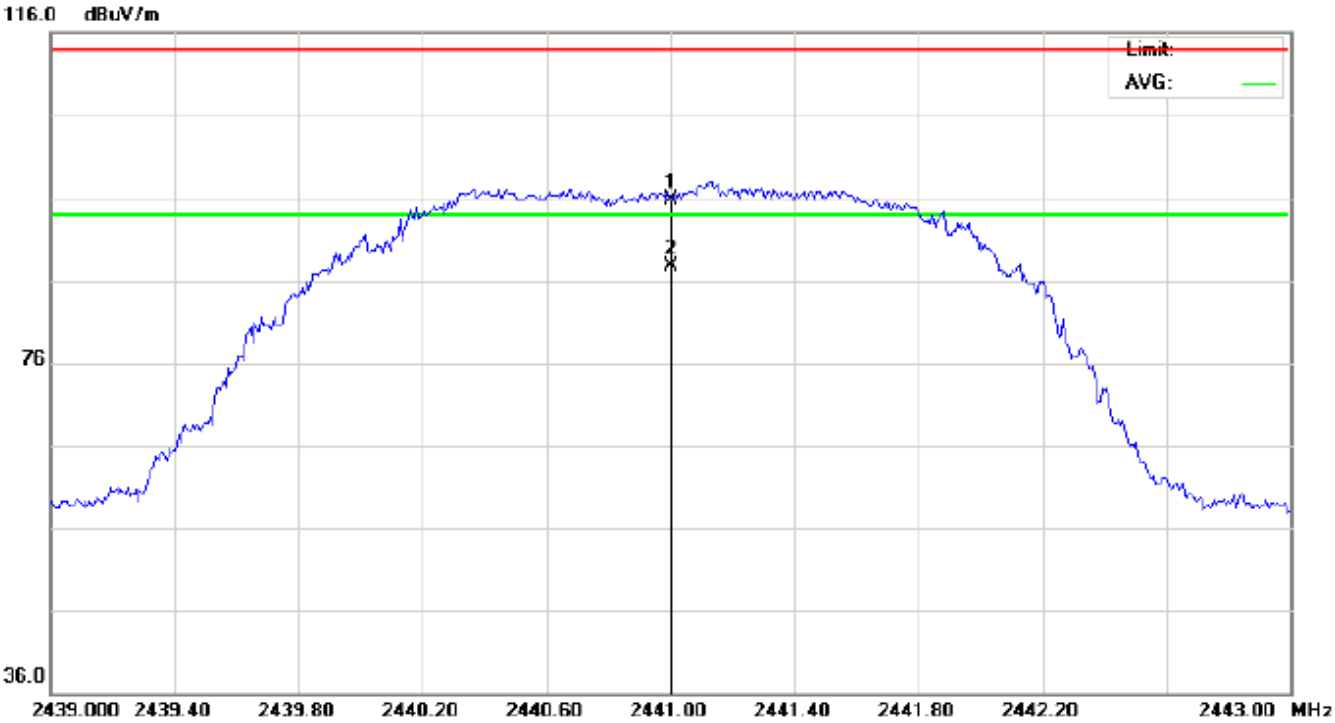
RADIATED EMISSION TEST- (ABOVE 1GHz)-MIDDLE CHANNEL-HORIZONTAL



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	-	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		2441.000	85.37	10.36	95.73	114.00	-18.27	peak			
2	*	2441.000	77.42	10.36	87.78	94.00	-6.22	AVG	100	42	

RESULT: PASS

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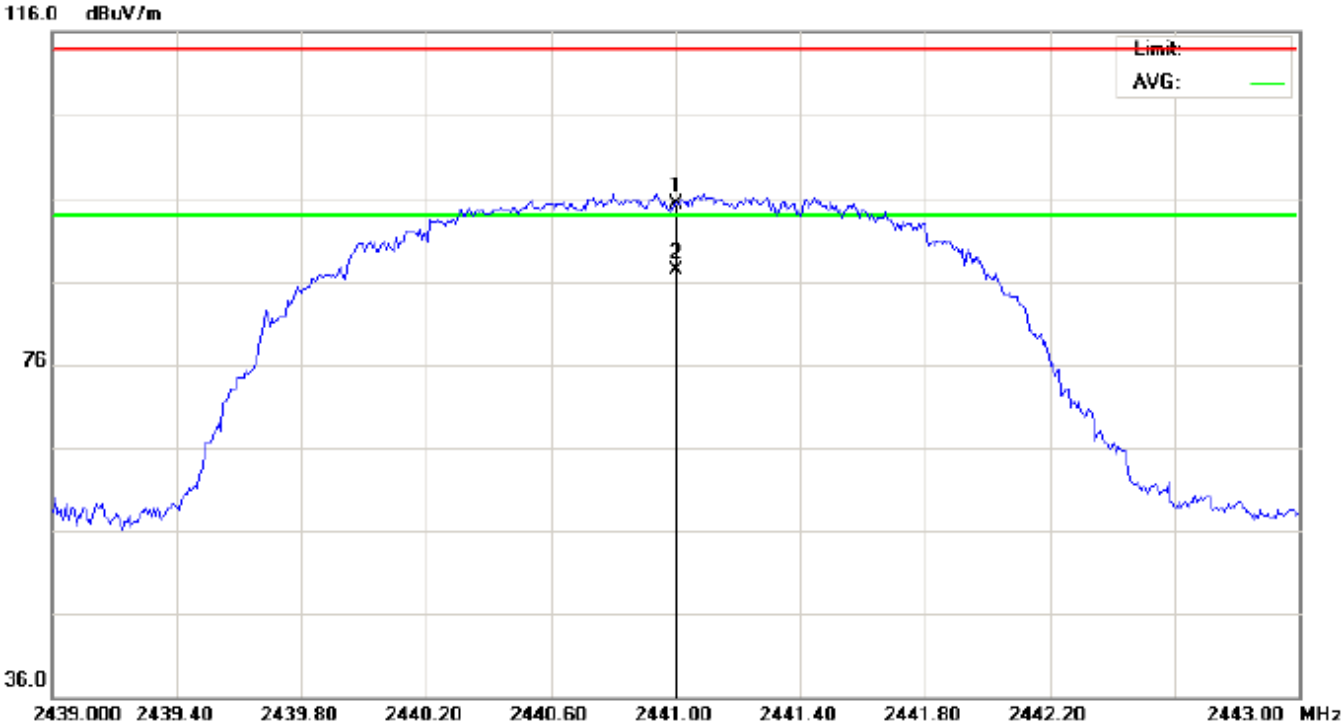
RADIATED EMISSION TEST- (ABOVE 1GHz)-MIDDLE CHANNEL- VERTICAL



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	-	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		2441.000	84.96	10.36	95.32	114.00	-18.68	peak			
2	*	2441.000	76.88	10.36	87.24	94.00	-6.76	AVG	100	289	

RESULT: PASS

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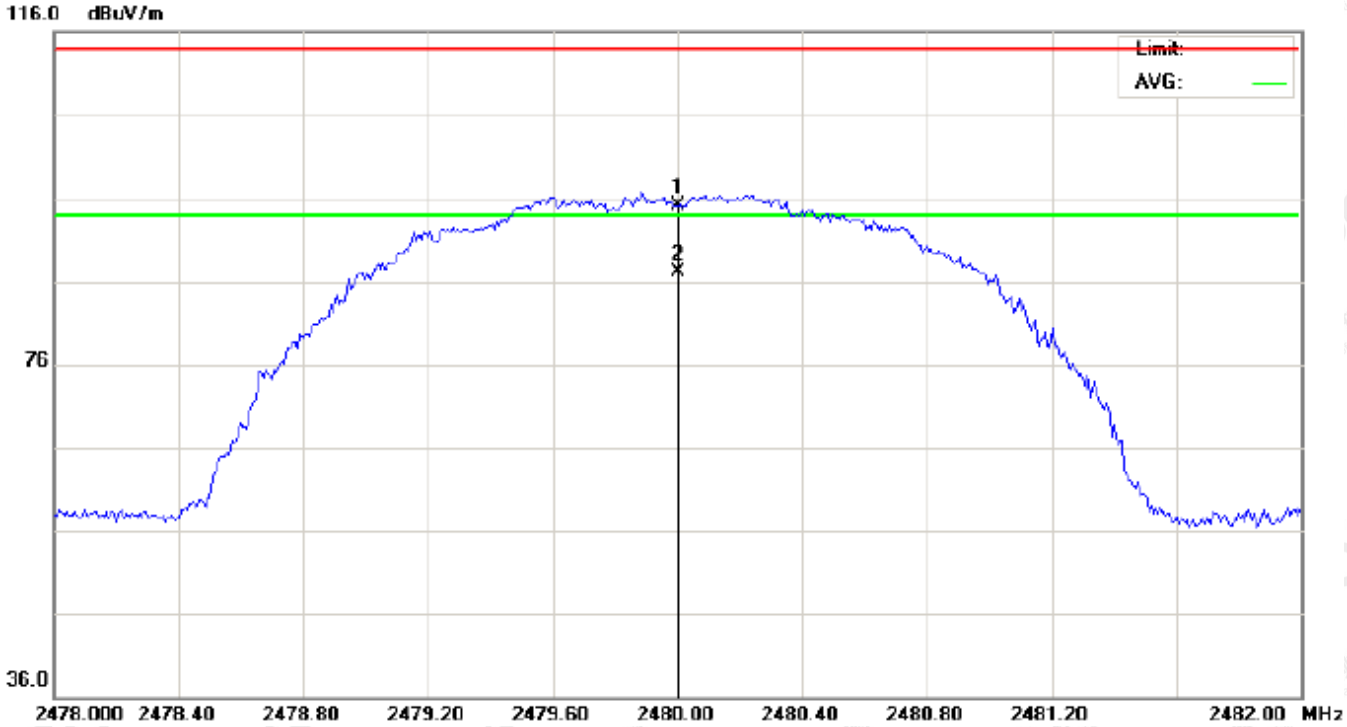
RADIATED EMISSION TEST- (ABOVE 1GHz)-HIGH CHANNEL-HORIZONTAL



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	-	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		2480.000	84.65	10.41	95.06	114.00	-18.94	peak			
2	*	2480.000	76.68	10.41	87.09	94.00	-6.91	AVG	100	53	

RESULT: PASS

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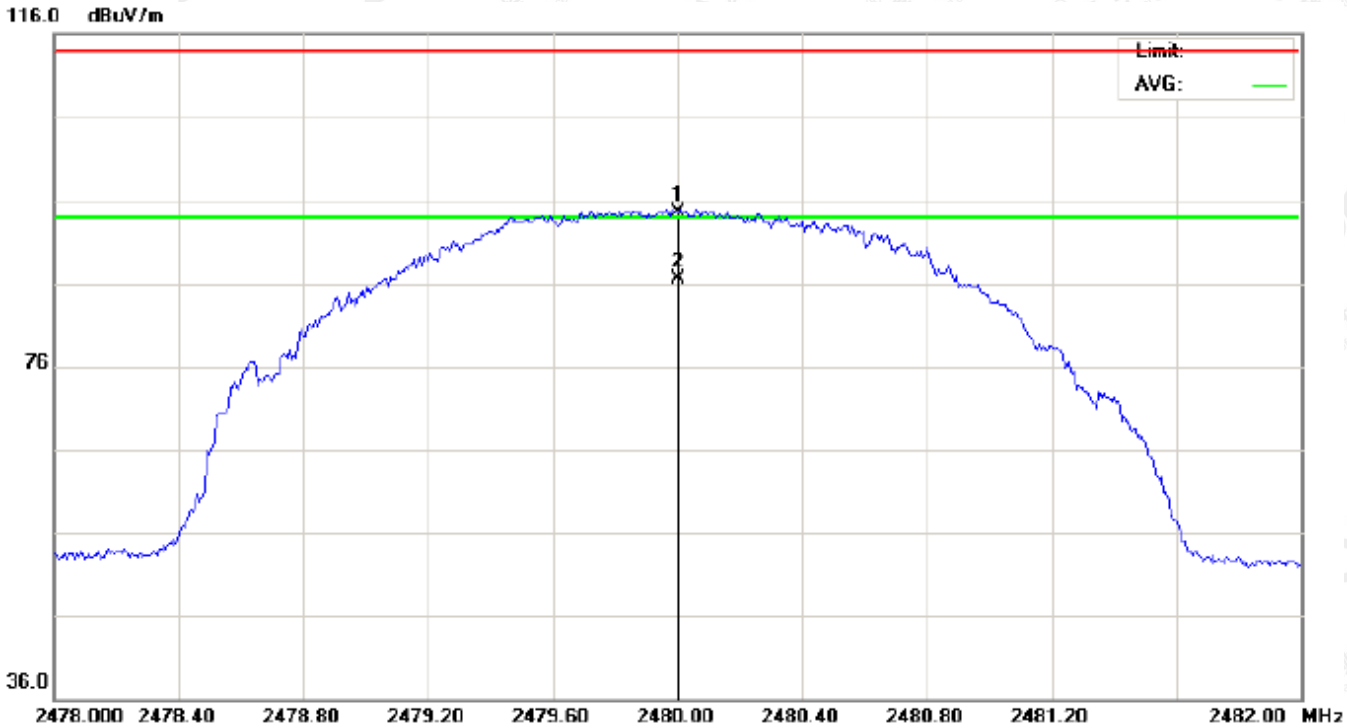
RADIATED EMISSION TEST- (ABOVE 1GHz)-HIGH CHANNEL- VERTICAL



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	-	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		2480.000	84.16	10.41	94.57	114.00	-19.43	peak			
2	*	2480.000	76.17	10.41	86.58	94.00	-7.42	AVG	100		

RESULT: PASS

Note: Factor=Antenna Factor + Cable loss - Amplifier gain, Margin=Measurement-Limit.

The “Factor” value can be calculated automatically by software of measurement system.

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Field strength of the fundamental signal

1Mbps Result:

Peak value

Frequency	Reading Level	Factor	Measurement	Limit	Over	Antenna
(MHz)	(dBuv)	(dB/m)	(dBuv/m)	(dBuv/m)	(dB)	Polarization
2402	86.04	10.32	96.36	114	-17.64	Horizontal
2402	85.63	10.32	95.95	114	-18.05	Vertical
2441	85.37	10.36	95.73	114	-18.27	Horizontal
2441	84.96	10.36	95.32	114	-18.68	Vertical
2480	84.65	10.41	95.06	114	-18.94	Horizontal
2480	84.16	10.41	94.57	114	-19.43	Vertical

Average value

Frequency	Reading Level	Factor	Measurement	Limit	Over	Antenna
(MHz)	(dBuv)	(dB/m)	(dBuv/m)	(dBuv/m)	(dB)	Polarization
2402	78.11	10.32	88.43	94	-5.57	Horizontal
2402	77.60	10.32	87.92	94	-6.08	Vertical
2441	77.42	10.36	87.78	94	-6.22	Horizontal
2441	76.88	10.36	87.24	94	-6.76	Vertical
2480	76.68	10.41	87.09	94	-6.91	Horizontal
2480	76.17	10.41	86.58	94	-7.42	Vertical

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2Mbps Result:

Peak value

Frequency	Reading Level	Factor	Measurement	Limit	Over	Antenna
(MHz)	(dBuv)	(dB/m)	(dBuv/m)	(dBuv/m)	(dB)	Polarization
2402	85.64	10.32	95.96	114	-18.04	Horizontal
2402	85.19	10.32	95.51	114	-18.49	Vertical
2441	84.98	10.36	95.34	114	-18.66	Horizontal
2441	84.47	10.36	94.83	114	-19.17	Vertical
2480	84.19	10.41	94.60	114	-19.40	Horizontal
2480	83.86	10.41	94.27	114	-19.73	Vertical

Average value

Frequency	Reading Level	Factor	Measurement	Limit	Over	Antenna
(MHz)	(dBuv)	(dB/m)	(dBuv/m)	(dBuv/m)	(dB)	Polarization
2402	77.80	10.32	88.12	94	-5.88	Horizontal
2402	77.10	10.32	87.42	94	-6.58	Vertical
2441	76.94	10.36	87.30	94	-6.70	Horizontal
2441	76.57	10.36	86.93	94	-7.07	Vertical
2480	76.16	10.41	86.57	94	-7.43	Horizontal
2480	75.82	10.41	86.23	94	-7.77	Vertical

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3Mbps Result:

Peak value

Frequency	Reading Level	Factor	Measurement	Limit	Over	Antenna
(MHz)	(dBuv)	(dB/m)	(dBuv/m)	(dBuv/m)	(dB)	Polarization
2402	85.32	10.32	95.64	114	-18.36	Horizontal
2402	84.70	10.32	95.02	114	-18.98	Vertical
2441	84.53	10.36	94.89	114	-19.11	Horizontal
2441	84.05	10.36	94.41	114	-19.59	Vertical
2480	83.83	10.41	94.24	114	-19.76	Horizontal
2480	83.51	10.41	93.92	114	-20.08	Vertical

Average value

Frequency	Reading Level	Factor	Measurement	Limit	Over	Antenna
(MHz)	(dBuv)	(dB/m)	(dBuv/m)	(dBuv/m)	(dB)	Polarization
2402	77.45	10.32	87.77	94	-6.23	Horizontal
2402	76.64	10.32	86.96	94	-7.04	Vertical
2441	76.48	10.36	86.84	94	-7.16	Horizontal
2441	76.23	10.36	86.59	94	-7.41	Vertical
2480	75.86	10.41	86.27	94	-7.73	Horizontal
2480	75.50	10.41	85.91	94	-8.09	Vertical

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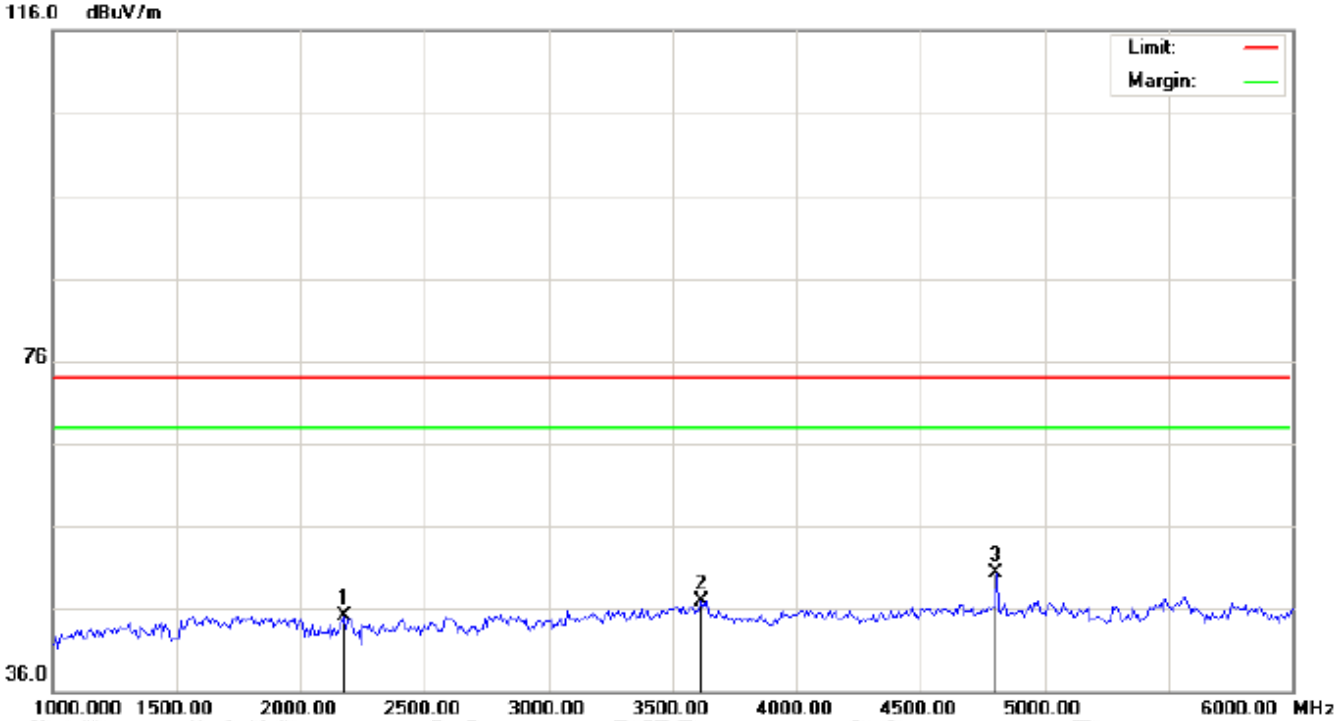
(Worst modulation: GFSK)

For Harmonics

RADIATED EMISSION TEST- (ABOVE 1GHz)-LOW CHANNEL-HORIZONTAL



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		2175.000	35.00	10.07	45.07	74.00	-28.93	peak			
2		3616.667	34.05	12.83	46.88	74.00	-27.12	peak			
3	*	4804.000	42.71	7.69	50.40	74.00	-23.60	peak			

RESULT: PASS

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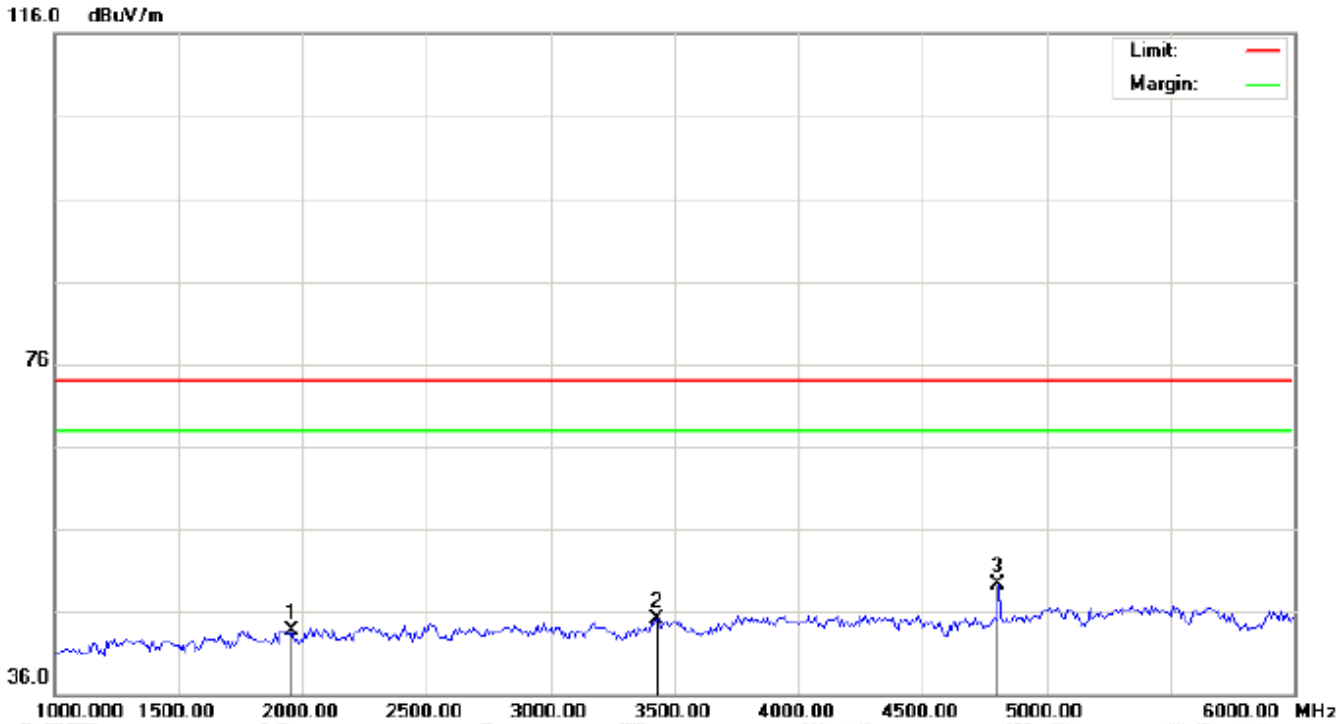
RADIATED EMISSION TEST- (ABOVE 1GHz)-LOW CHANNEL- VERTICAL



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	.	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		1958.333	34.35	9.44	43.79	74.00	-30.21	peak			
2		3433.333	33.04	12.05	45.09	74.00	-28.91	peak			
3	*	4804.000	41.55	7.69	49.24	74.00	-24.76	peak			

RESULT: PASS

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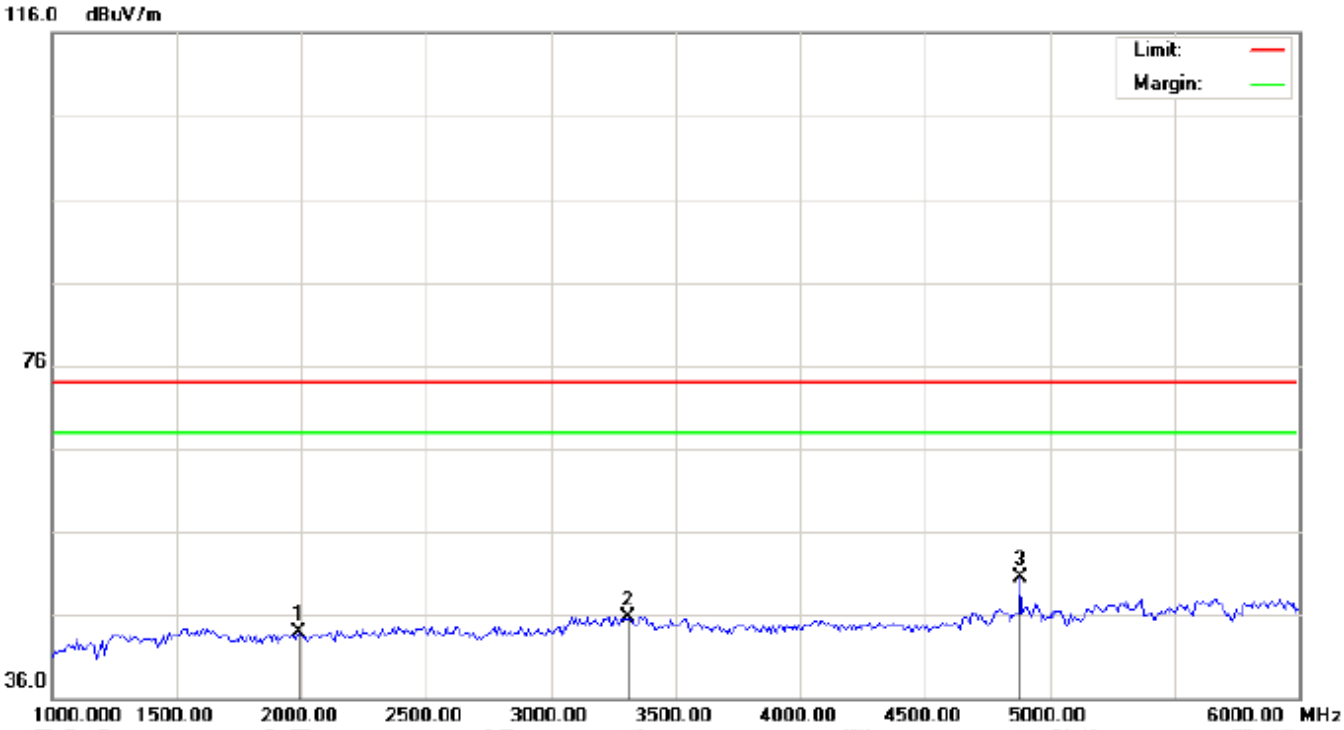
RADIATED EMISSION TEST- (ABOVE 1GHz)-MIDDLE CHANNEL-HORIZONTAL



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	.	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		1991.667	34.20	9.79	43.99	74.00	-30.01	peak			
2		3308.333	33.72	11.93	45.65	74.00	-28.35	peak			
3	*	4882.000	42.66	7.89	50.55	74.00	-23.45	peak			

RESULT: PASS

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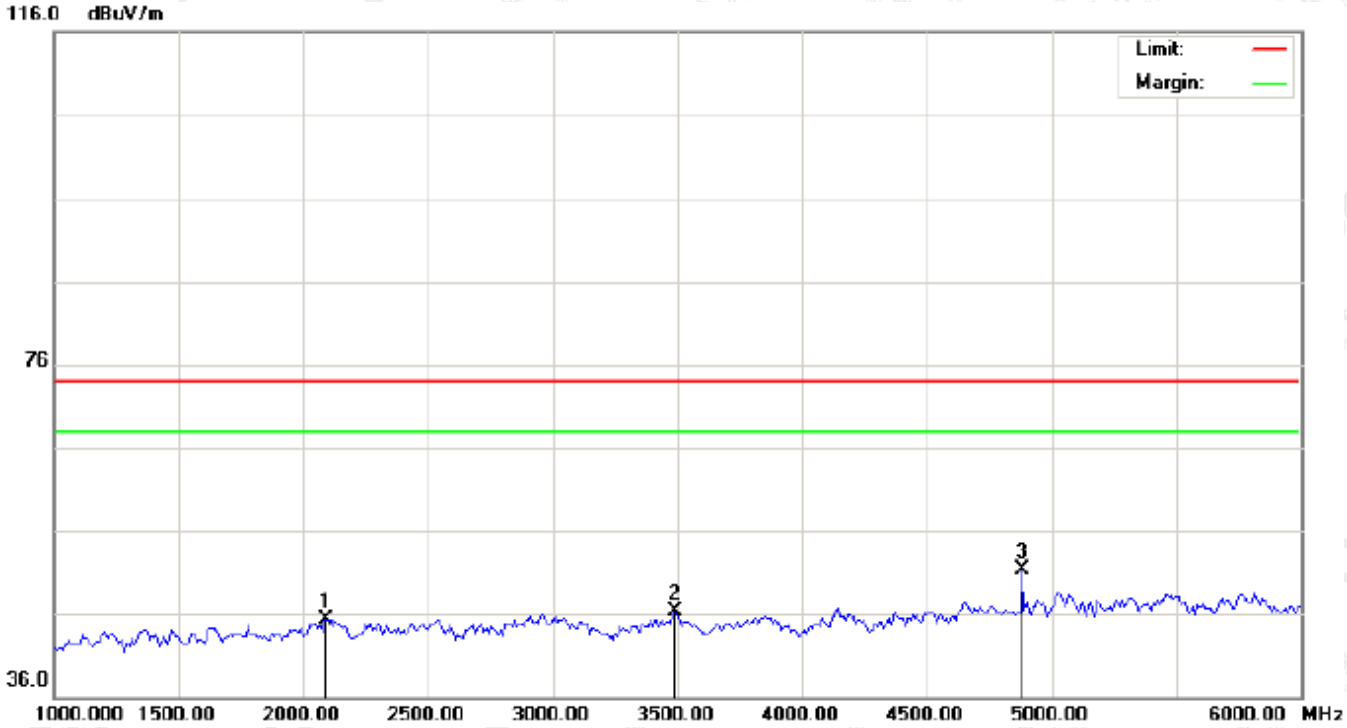
RADIATED EMISSION TEST- (ABOVE 1GHz)-MIDDLE CHANNEL- VERTICAL



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	.	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		2091.667	35.41	9.98	45.39	74.00	-28.61	peak			
2		3491.667	34.15	12.10	46.25	74.00	-27.75	peak			
3	*	4882.000	43.39	7.89	51.28	74.00	-22.72	peak			

RESULT: PASS

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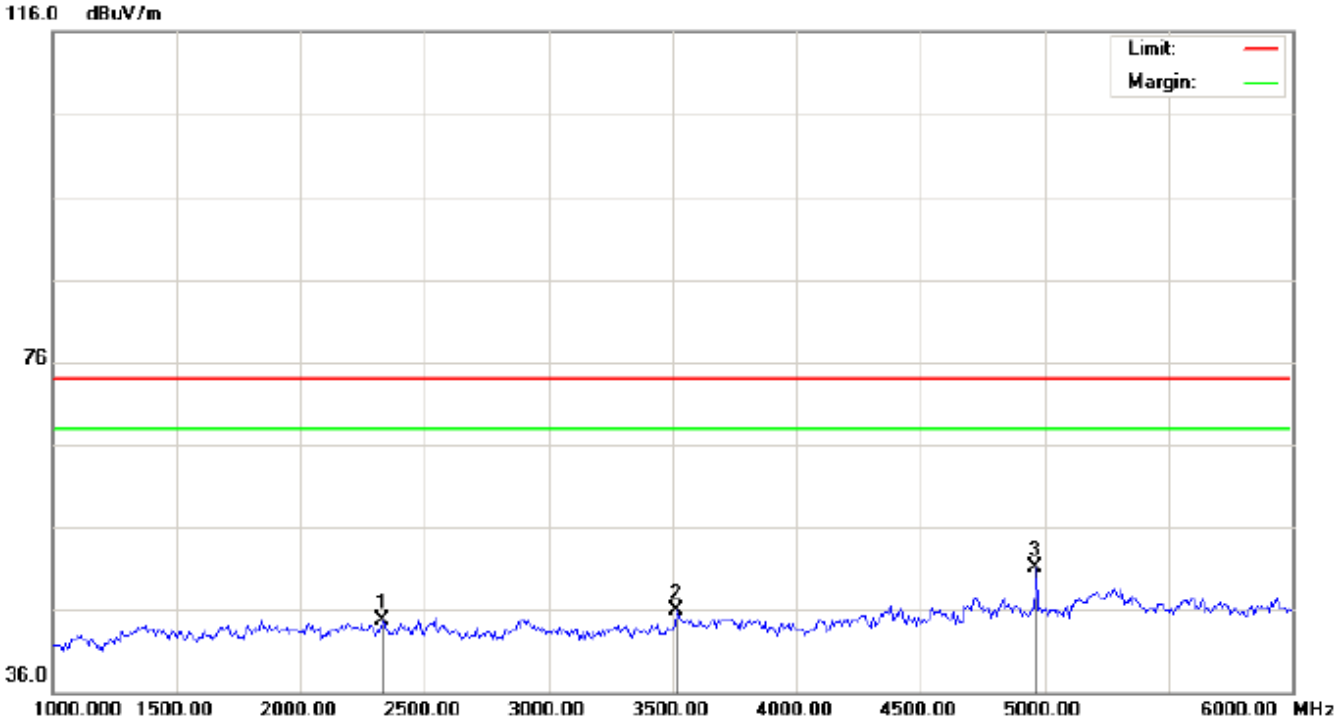
RADIATED EMISSION TEST- (ABOVE 1GHz)-HIGH CHANNEL-HORIZONTAL



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		2333.333	34.38	10.25	44.63	74.00	-29.37	peak			
2		3516.667	33.72	12.21	45.93	74.00	-28.07	peak			
3	*	4960.000	43.10	8.09	51.19	74.00	-22.81	peak			

RESULT: PASS

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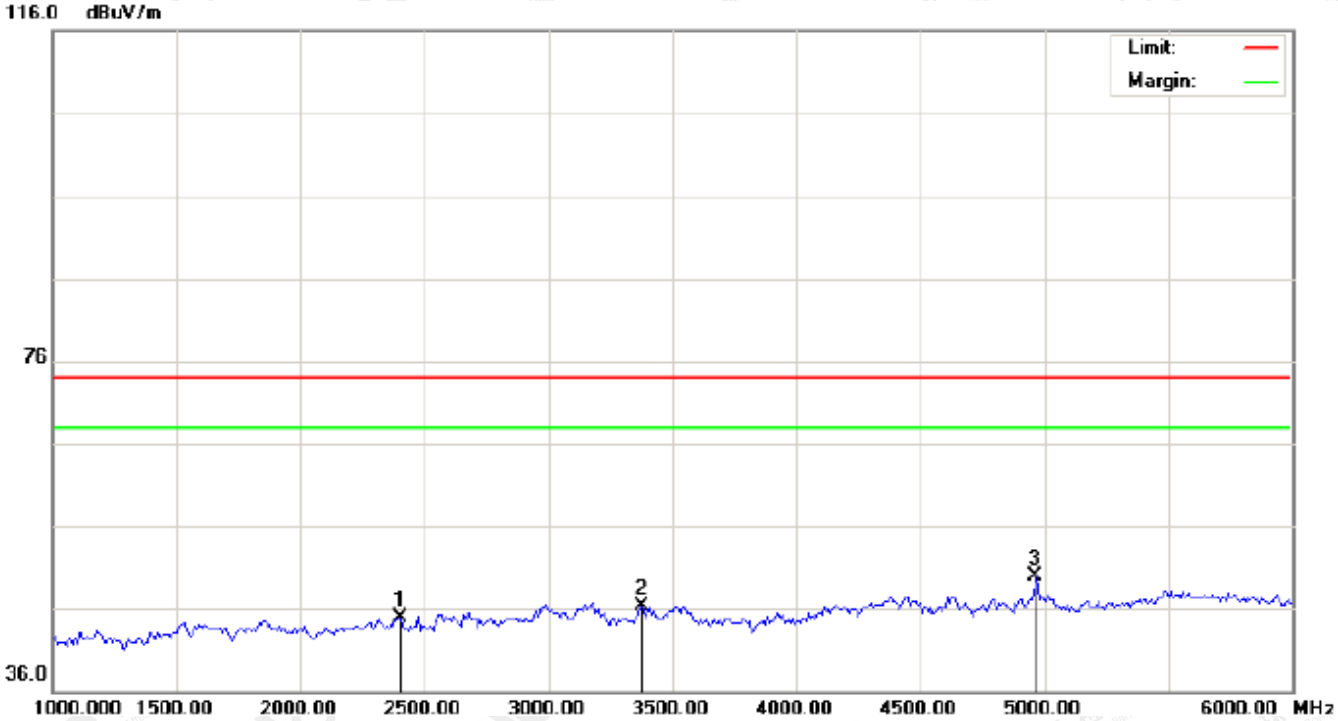
RADIATED EMISSION TEST- (ABOVE 1GHz)-HIGH CHANNEL- VERTICAL



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	-	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		2400.000	34.54	10.32	44.86	74.00	-29.14	peak			
2		3375.000	34.29	11.99	46.28	74.00	-27.72	peak			
3	*	4960.000	41.91	8.09	50.00	74.00	-24.00	peak			

RESULT: PASS

Note: 6~25GHz at least have 20dB margin. No recording in the test report.

Factor=Antenna Factor + Cable loss - Amplifier gain, Margin=Measurement-Limit.

The “Factor” value can be calculated automatically by software of measurement system.

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10. BAND EDGE EMISSION

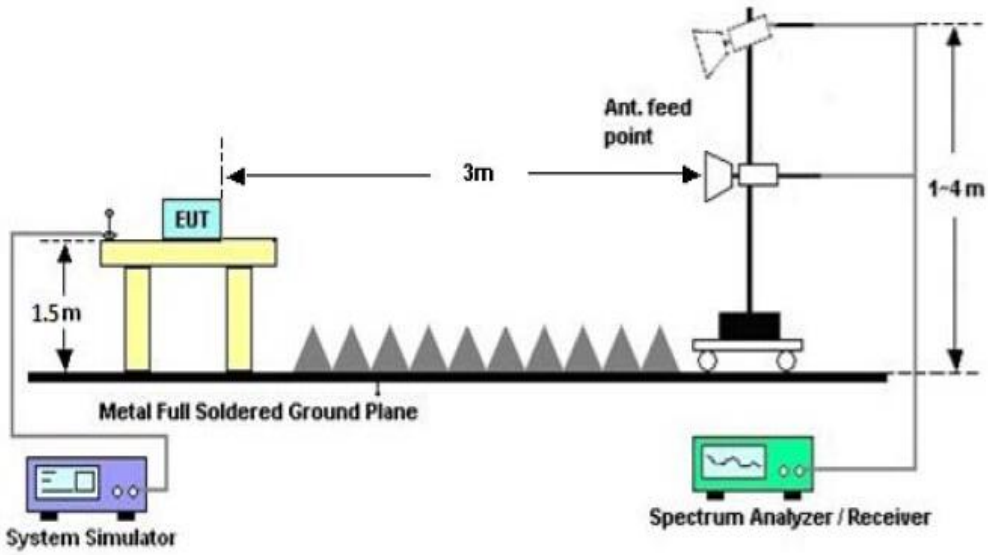
10.1. MEASUREMENT PROCEDURE

1. The EUT operates at hopping-off test mode. The lowest or highest channels are tested to verify the largest transmission and spurious emissions power at the continuous transmission mode.
2. Max hold the trace of the setup 1, and the EUT operates at hopping-on test mode to verify the largest spurious emissions power.
3. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission.

Start frequency(MHz)	Stop frequency(MHz)
2200	2405
2478	2500

10.2 TEST SETUP

RADIATED EMISSION TEST SETUP



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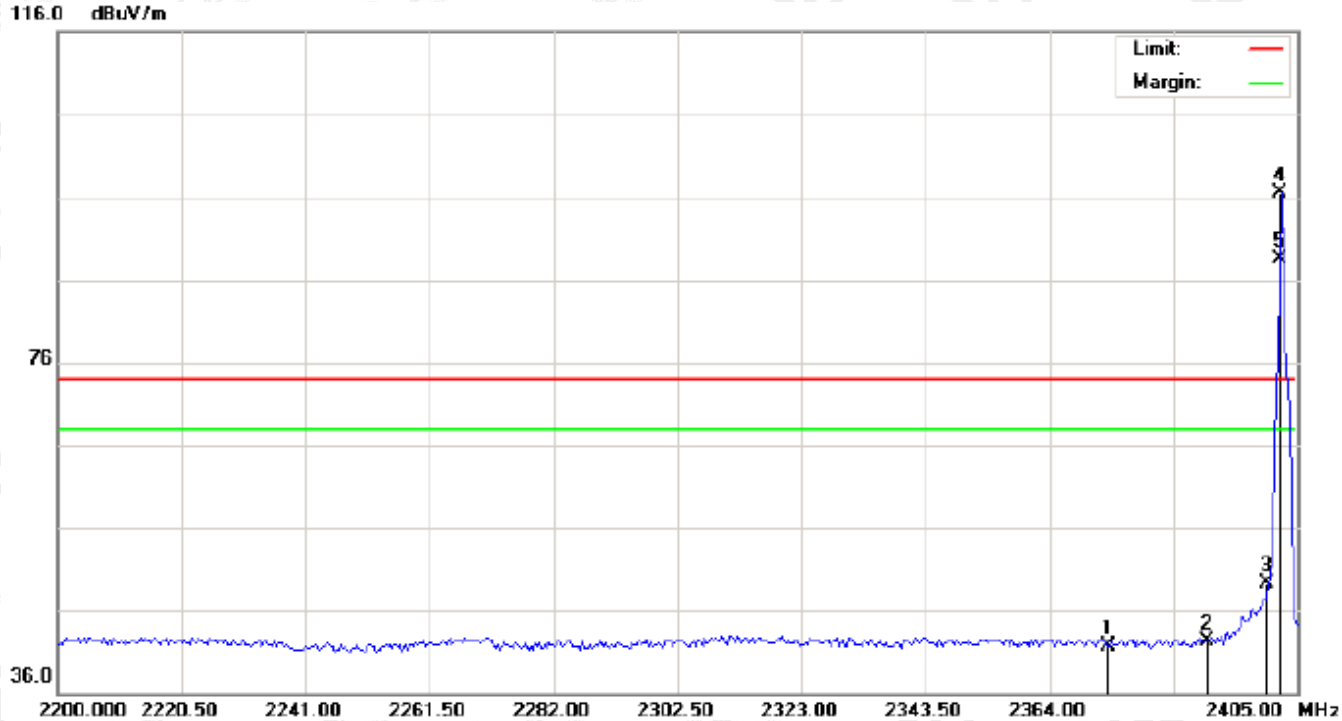
10.3 RADIATED TEST RESULT

(Worst modulation: GFSK)

TEST PLOT OF BAND EDGE FOR LOW CHANNEL-Horizontal



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	.	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		2373.567	31.43	10.29	41.72	74.00	-32.28	peak			
2		2390.000	32.00	10.31	42.31	74.00	-31.69	peak			
3		2400.000	38.97	10.32	49.29	74.00	-24.71	peak			
4	*	2402.000	86.22	10.32	96.54	74.00	22.54	peak			
5	X	2402.000	78.25	10.32	88.57	74.00	14.57	AVG	100	48	

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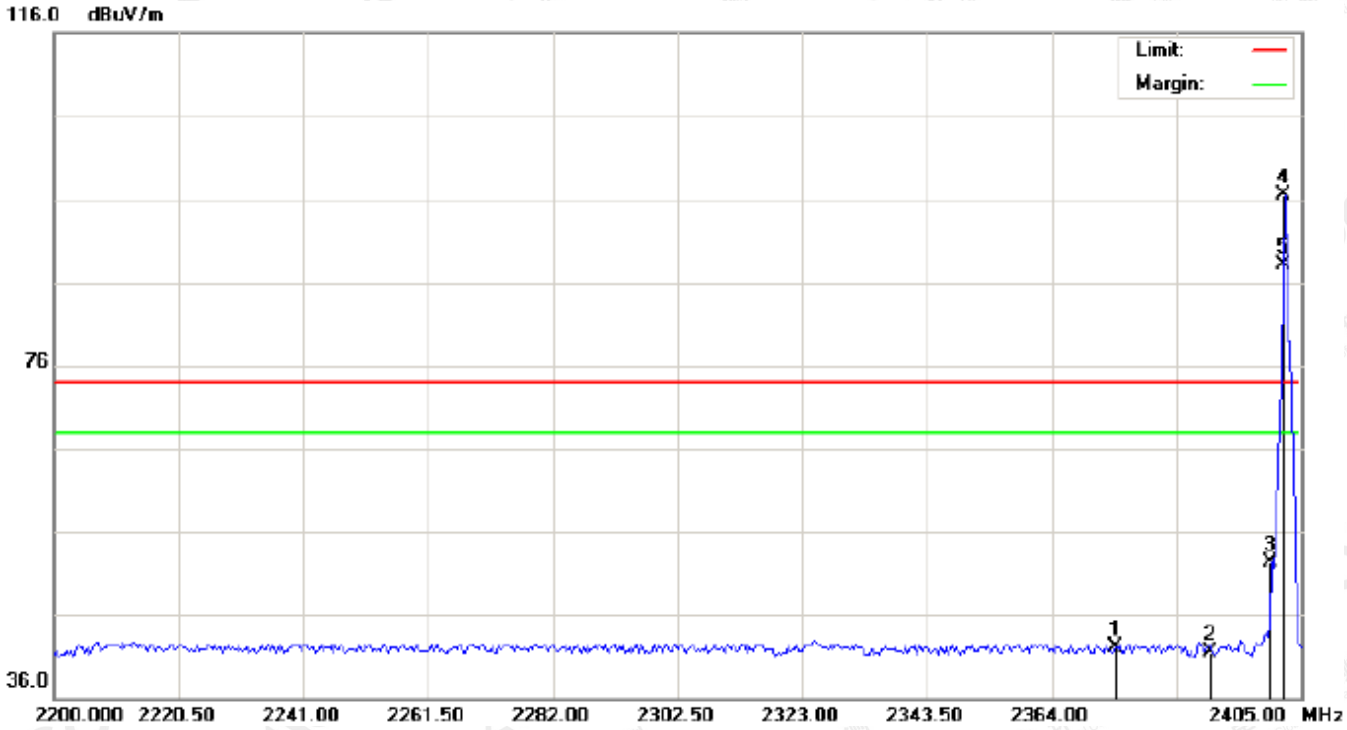
TEST PLOT OF BAND EDGE FOR LOW CHANNEL -Vertical



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	-	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		2374.591	31.76	10.29	42.05	74.00	-31.95	peak			
2		2390.000	31.21	10.31	41.52	74.00	-32.48	peak			
3		2400.000	42.06	10.32	52.38	74.00	-21.62	peak			
4	*	2402.000	86.09	10.32	96.41	74.00	22.41	peak			
5	X	2402.000	77.77	10.32	88.09	74.00	14.09	AVG	100		

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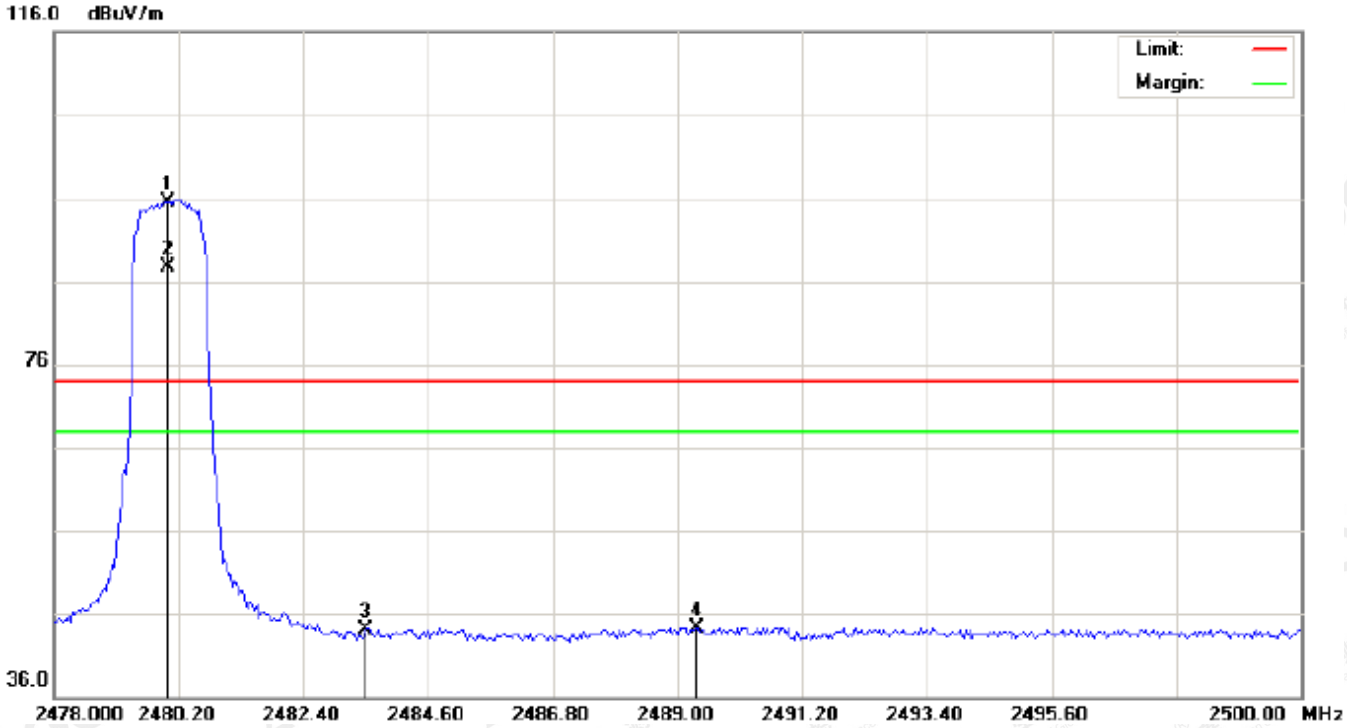
TEST PLOT OF BAND EDGE FOR HIGH CHANNEL -Horizontal



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	2480.000	85.05	10.41	95.46	74.00	21.46	peak			
2	X	2480.000	77.23	10.41	87.64	74.00	13.64	AVG	100	52	
3		2483.500	33.69	10.41	44.10	74.00	-29.90	peak			
4		2489.330	33.96	10.42	44.38	74.00	-29.62	peak			

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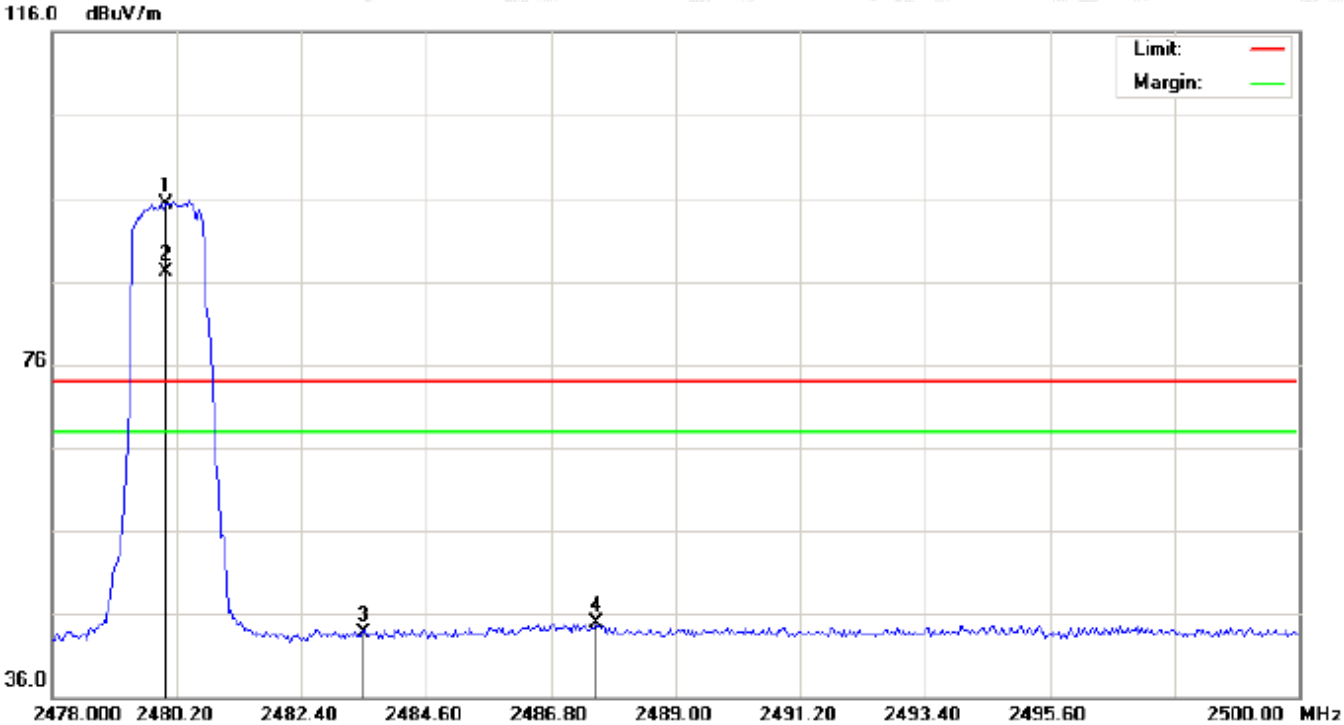
TEST PLOT OF BAND EDGE FOR HIGH CHANNEL-Vertical



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	2480.000	84.82	10.41	95.23	74.00	21.23	peak			
2	X	2480.000	76.73	10.41	87.14	74.00	13.14	AVG	100	291	
3		2483.500	33.26	10.41	43.67	74.00	-30.33	peak			
4		2487.607	34.41	10.42	44.83	74.00	-29.17	peak			

RESULT: PASS

Note: Factor=Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

The “Factor” value can be calculated automatically by software of measurement system.

Hopping on mode and Hopping off mode have been tested, but only worst case reported.

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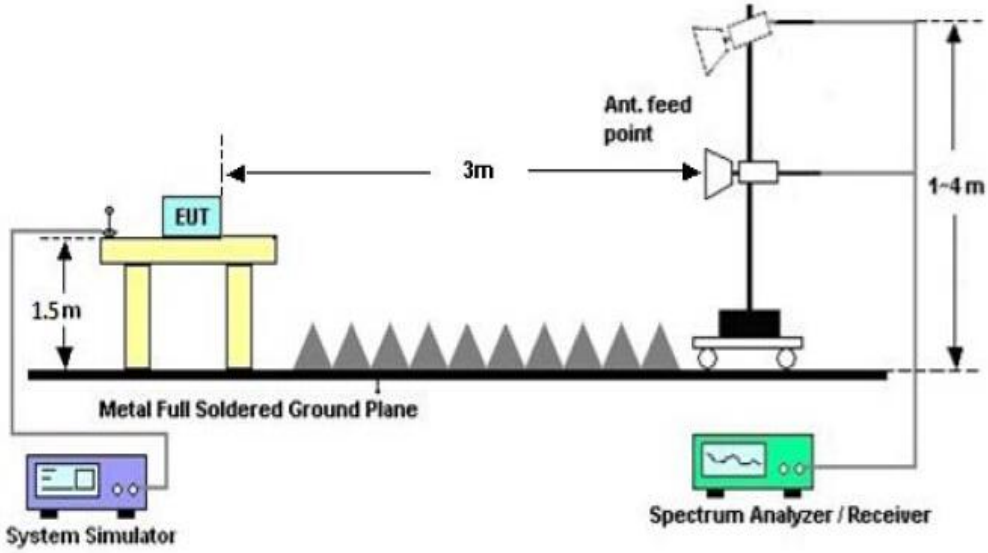
11. 20DB BANDWIDTH

11.1. MEASUREMENT PROCEDURE

1. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
2. Set Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hoping channel RBW ≥ 1% of the 20 dB bandwidth, VBW ≥ 3RBW; Sweep = auto; Detector function = peak
3. Set SPA Trace 1 Max hold, then View.

11.2. TEST SET-UP



11.3. LIMITS AND MEASUREMENT RESULTS

BLUETOOTH 1MBPS LIMITS AND MEASUREMENT RESULT				
Applicable Limits	Measurement Result			
	Test Data (MHz)			Result
		99%OBW (MHz)	-20dB BW(MHz)	
N/A	Low Channel	0.934	1.089	PASS
	Middle Channel	0.902	1.050	PASS
	High Channel	0.915	1.086	PASS

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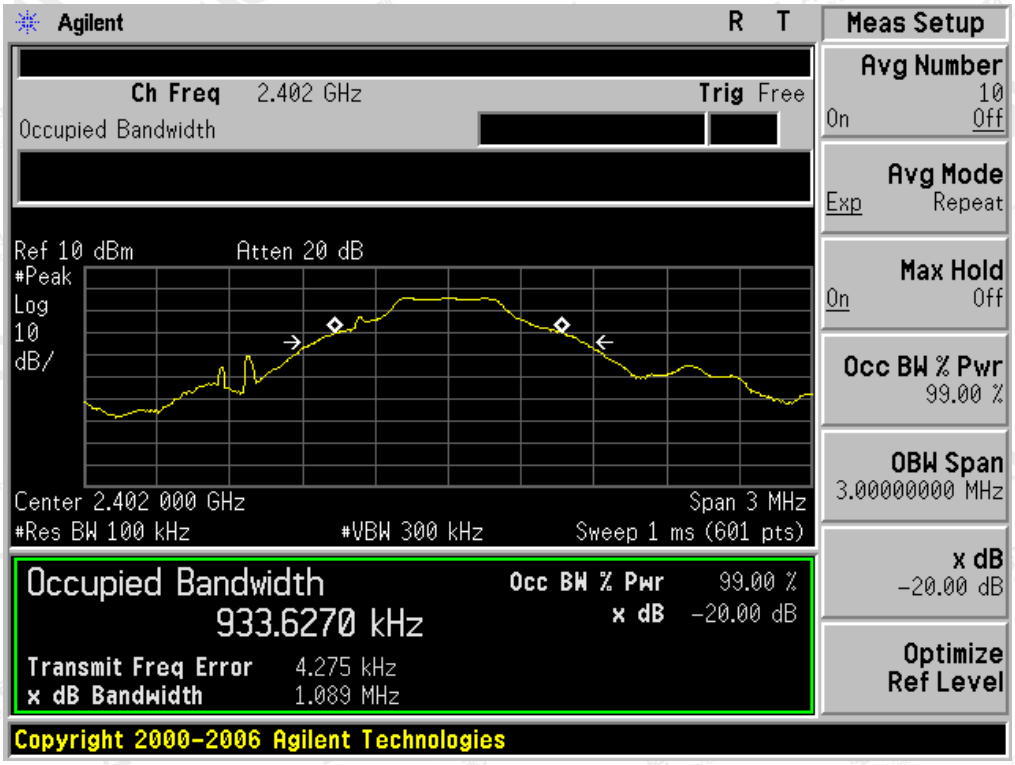
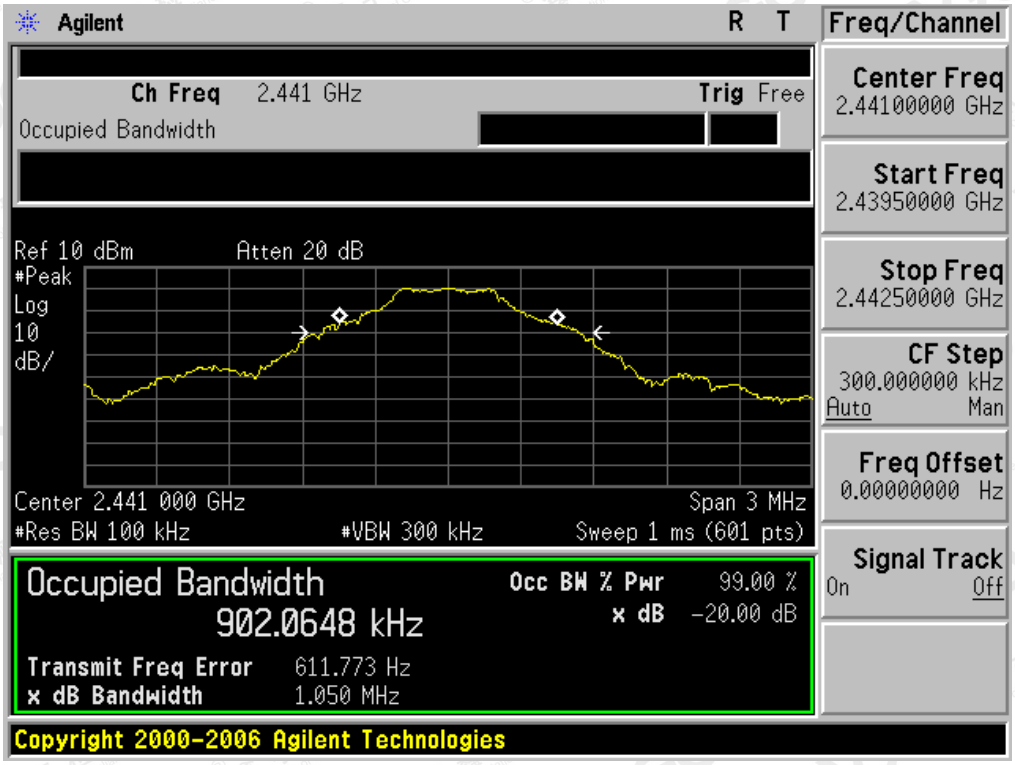
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



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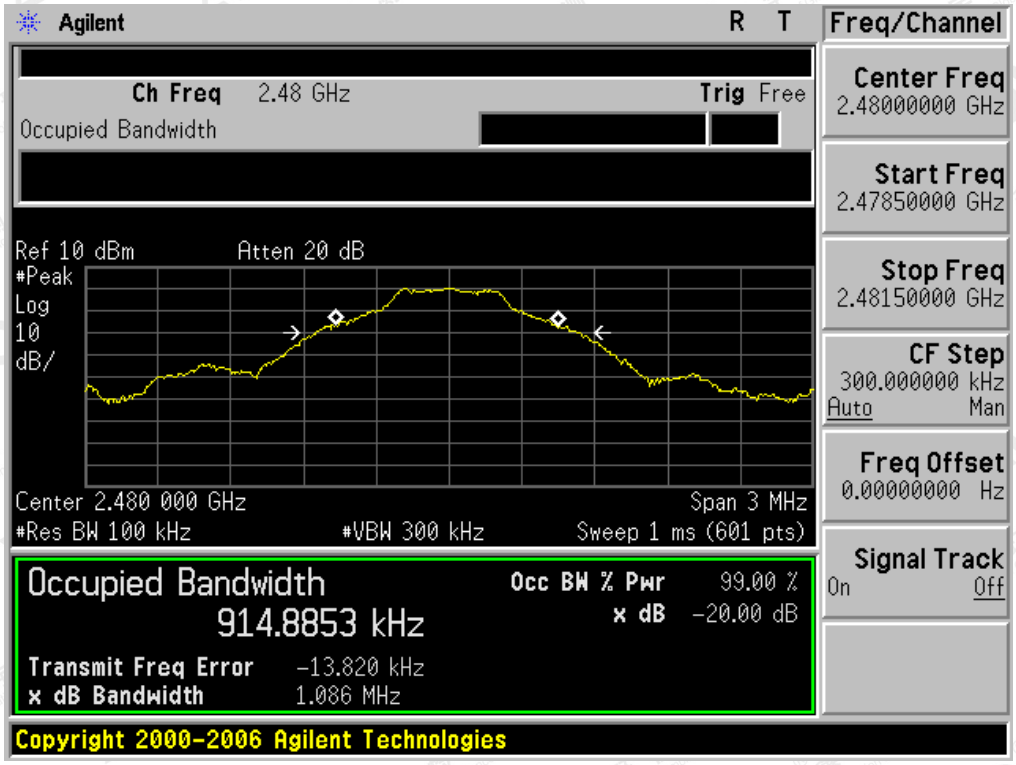
TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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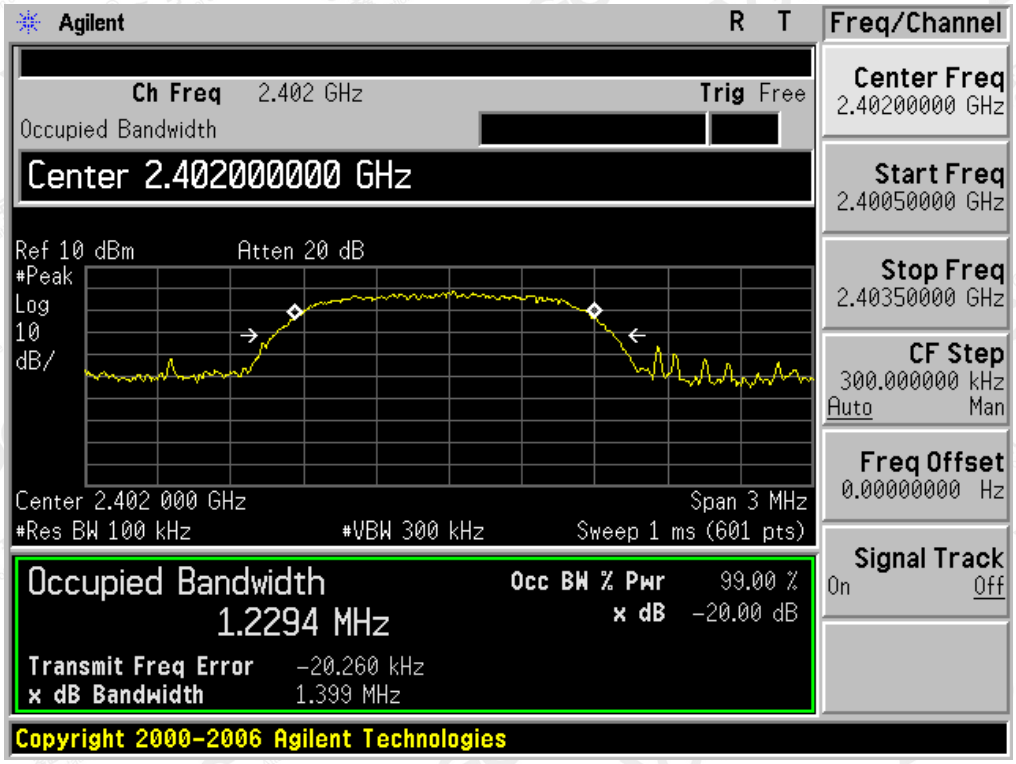
BLUETOOTH 2MBPS LIMITS AND MEASUREMENT RESULT				
Applicable Limits	Measurement Result			
	Test Data (MHz)			Result
		99%OBW (MHz)	-20dB BW(MHz)	
N/A	Low Channel	1.229	1.399	PASS
	Middle Channel	1.203	1.345	PASS
	High Channel	1.226	1.435	PASS

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



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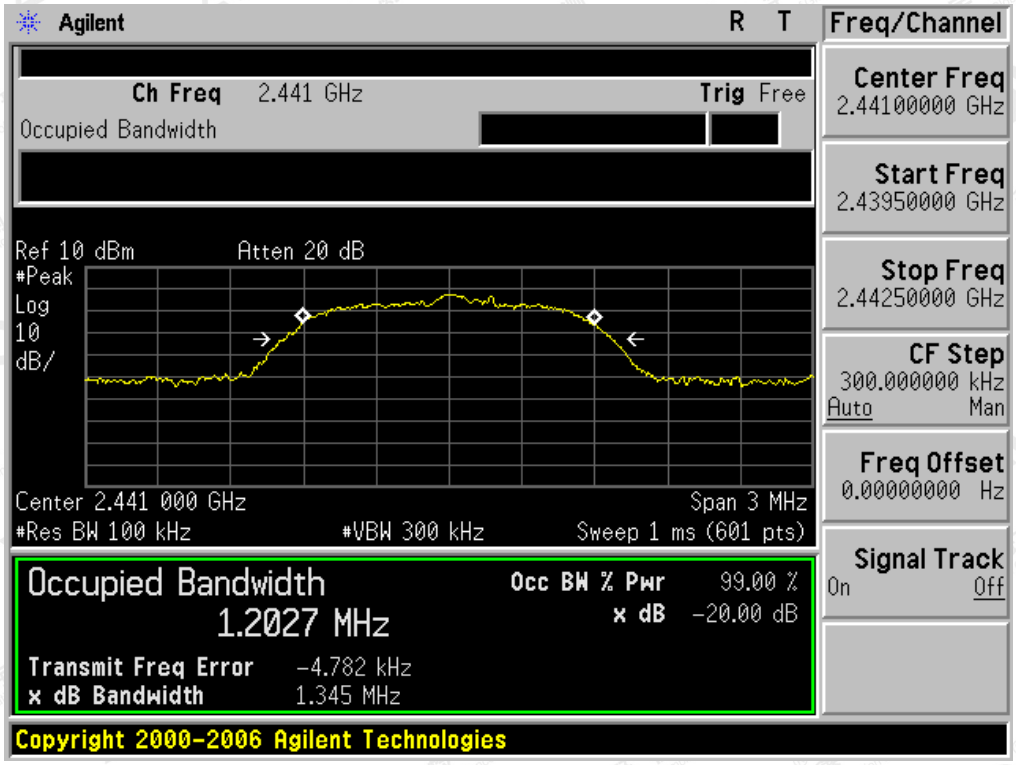
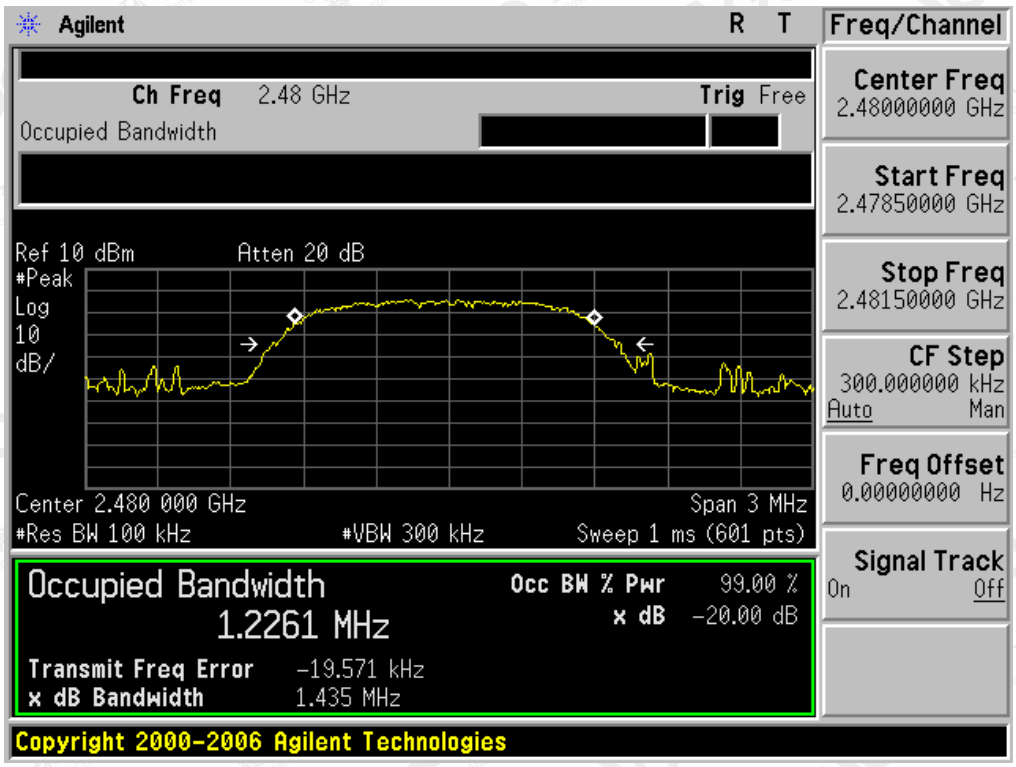
TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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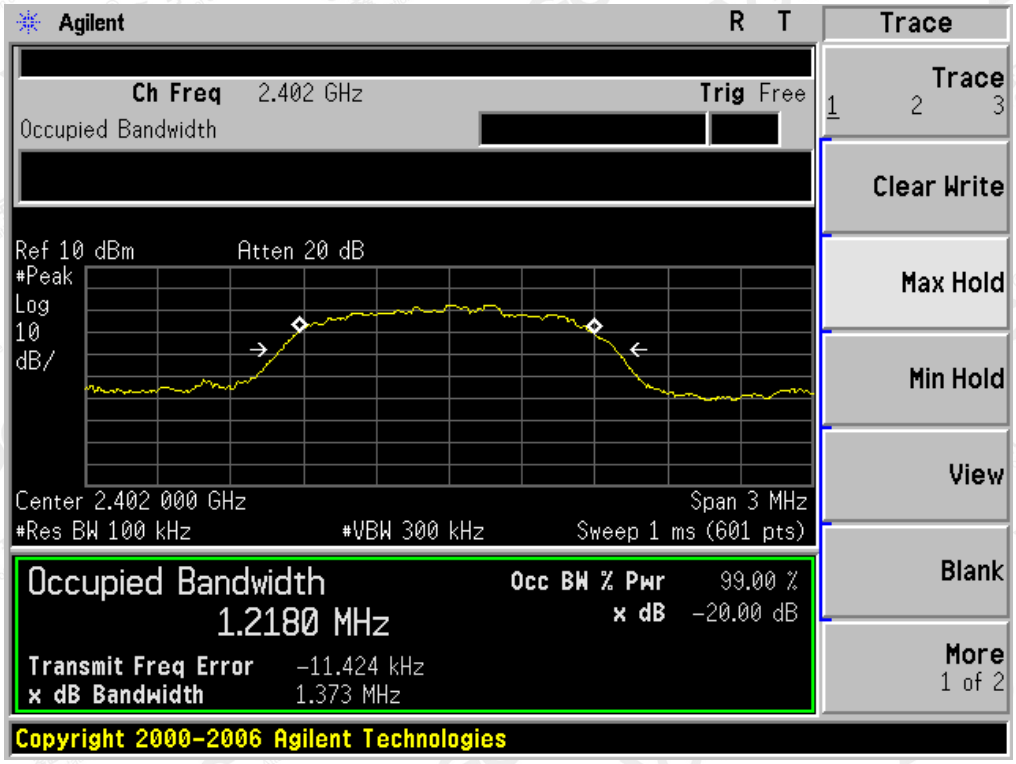
BLUETOOTH 3MBPS LIMITS AND MEASUREMENT RESULT				
Applicable Limits	Measurement Result			
	Test Data (MHz)			Result
		99%OBW (MHz)	-20dB BW(MHz)	
N/A	Low Channel	1.218	1.373	PASS
	Middle Channel	1.230	1.406	PASS
	High Channel	1.205	1.366	PASS

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



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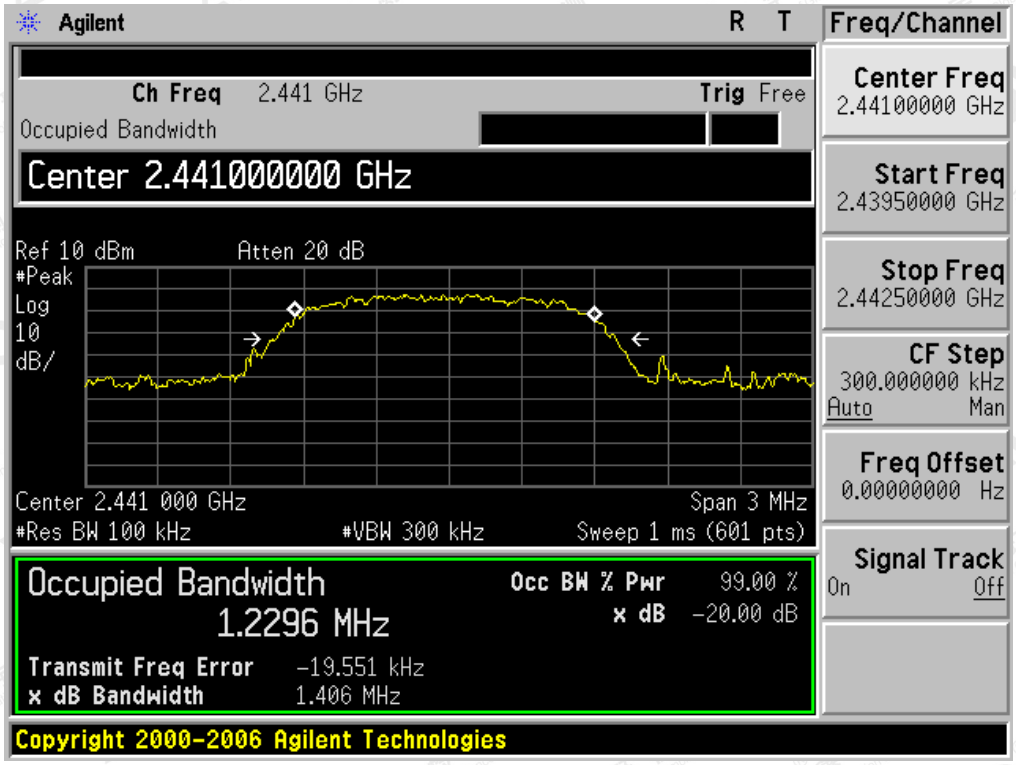
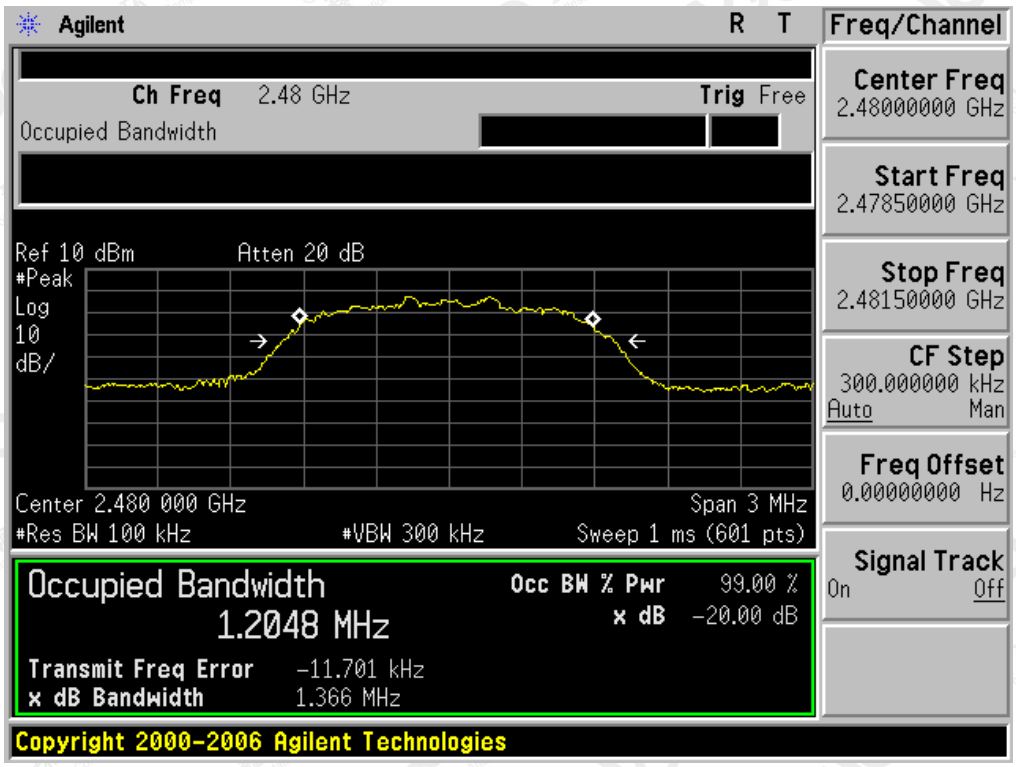
TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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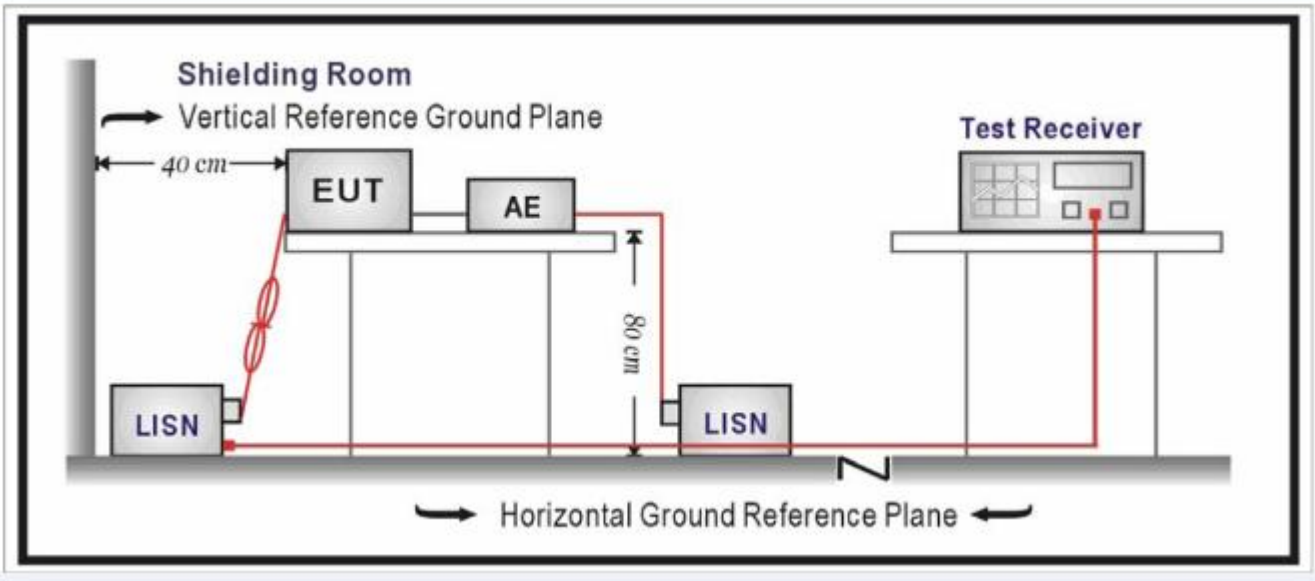
12. FCC LINE CONDUCTED EMISSION TEST

12.1. LIMITS OF LINE CONDUCTED EMISSION TEST

Frequency	Maximum RF Line Voltage	
	Q.P.(dBuV)	Average(dBuV)
150kHz~500kHz	66-56	56-46
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Note:
1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

12.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST



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12.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When 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 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
2. Support equipment, if needed, was placed as per ANSI C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. All support equipments received AC120V/60Hz power from a LISN, if any.
5. The EUT received DC charging voltage by adapter or PC which received 120V/60Hzpower by a LISN.
6. The 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.
9. The test mode(s) were scanned during the preliminary test.

Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

12.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
2. A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less –2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
3. The test data of the worst case condition(s) was reported on the Summary Data page.

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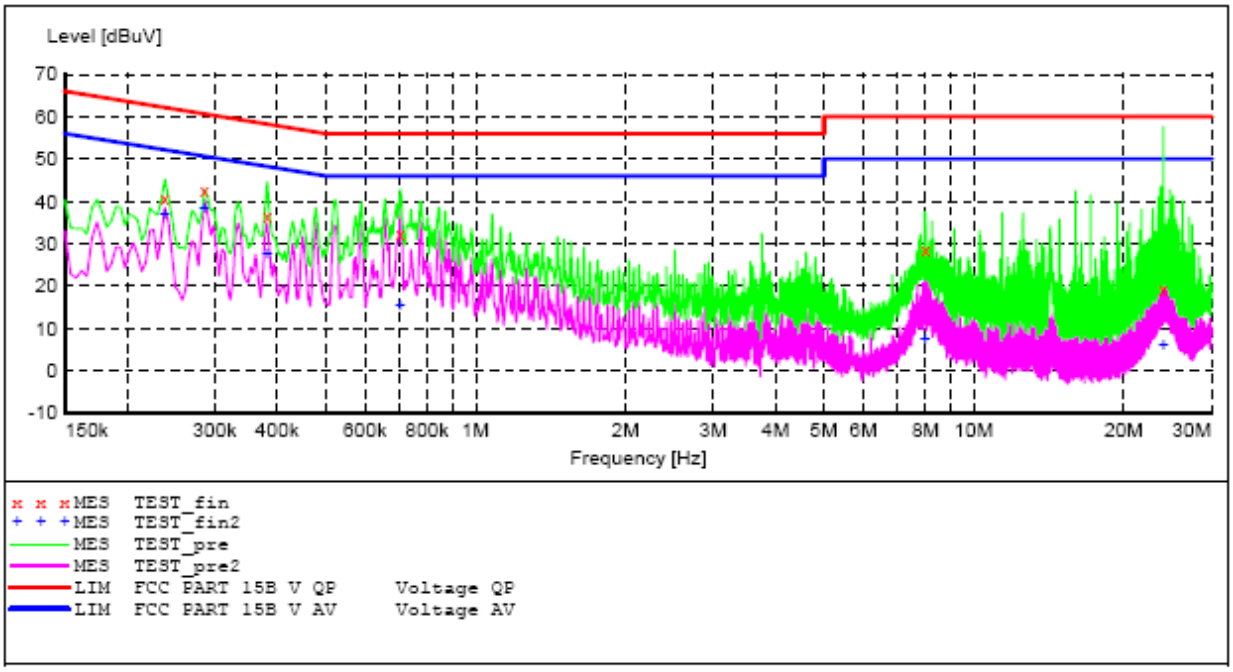
12.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST

By adapter(worst case)

Line Conducted Emission Test Line 1-L



MEASUREMENT RESULT:

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.238000	40.90	10.1	62	21.3	QP	L1	FLO
0.286000	42.80	10.1	61	17.8	QP	L1	FLO
0.382000	36.70	10.0	58	21.5	QP	L1	FLO
0.706000	32.10	9.9	56	23.9	QP	L1	FLO
7.998000	28.70	10.1	60	31.3	QP	L1	FLO
23.978000	19.30	10.2	60	40.7	QP	L1	FLO

MEASUREMENT RESULT:

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.238000	37.00	10.1	52	15.2	AV	L1	FLO
0.286000	38.40	10.1	51	12.2	AV	L1	FLO
0.382000	27.70	10.0	48	20.5	AV	L1	FLO
0.706000	15.50	9.9	46	30.5	AV	L1	FLO
7.978000	7.60	10.0	50	42.4	AV	L1	FLO
23.978000	6.30	10.2	50	43.7	AV	L1	FLO

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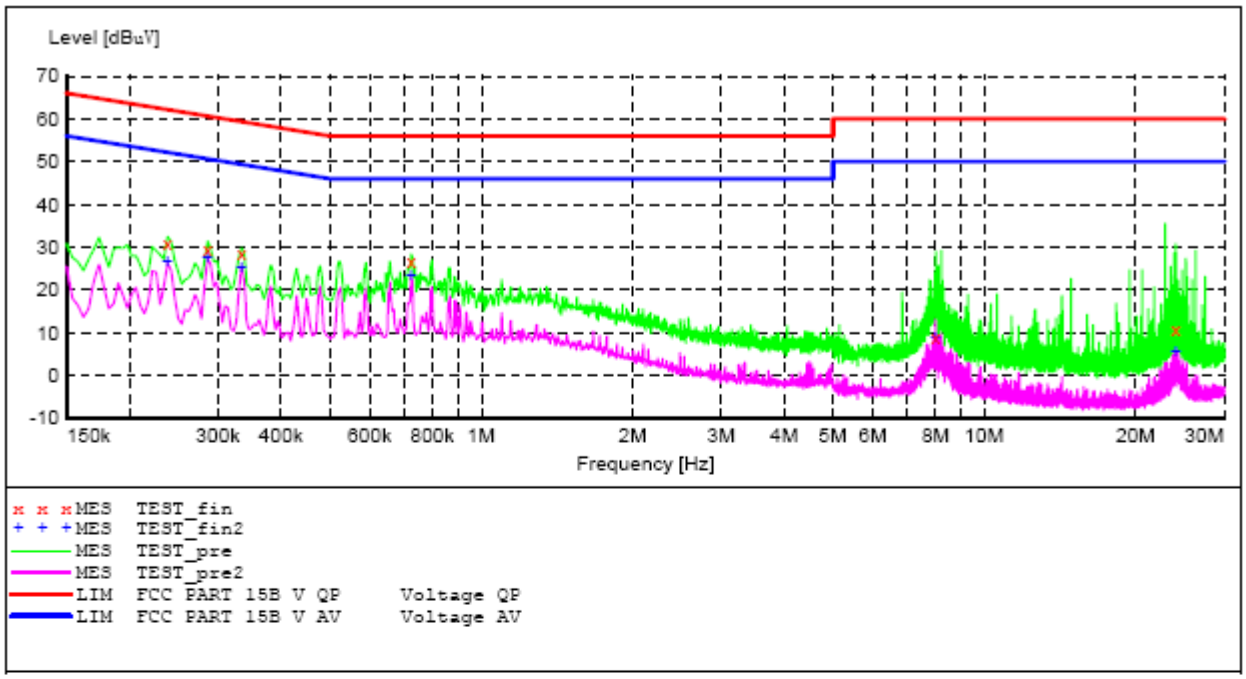
Line Conducted Emission Test Line 2-N



MEASUREMENT RESULT:

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.238000	30.90	10.1	62	31.3	QP	N	FLO
0.286000	29.70	10.1	61	30.9	QP	N	FLO
0.334000	28.50	10.0	59	30.9	QP	N	FLO
0.726000	26.90	9.9	56	29.1	QP	N	FLO
8.006000	9.10	10.1	60	50.9	QP	N	FLO
23.990000	10.80	10.2	60	49.2	QP	N	FLO

MEASUREMENT RESULT:

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.238000	26.80	10.1	52	25.4	AV	N	FLO
0.286000	27.70	10.1	51	22.9	AV	N	FLO
0.334000	25.10	10.0	49	24.3	AV	N	FLO
0.726000	23.20	9.9	46	22.8	AV	N	FLO
7.990000	8.70	10.1	50	41.3	AV	N	FLO
23.990000	5.60	10.2	50	44.4	AV	N	FLO

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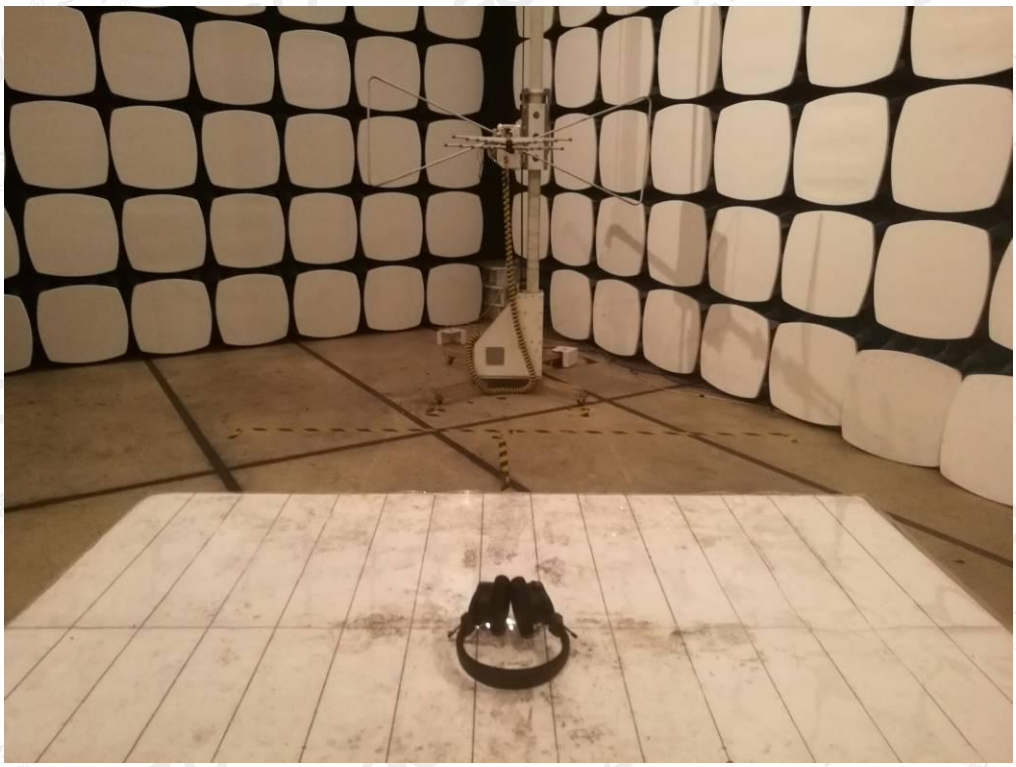
APPENDIX A: PHOTOGRAPHS OF TEST SETUP

FCC LINE CONDUCTED EMISSION TEST SETUP

FCC RADIATED EMISSION TEST SETUP



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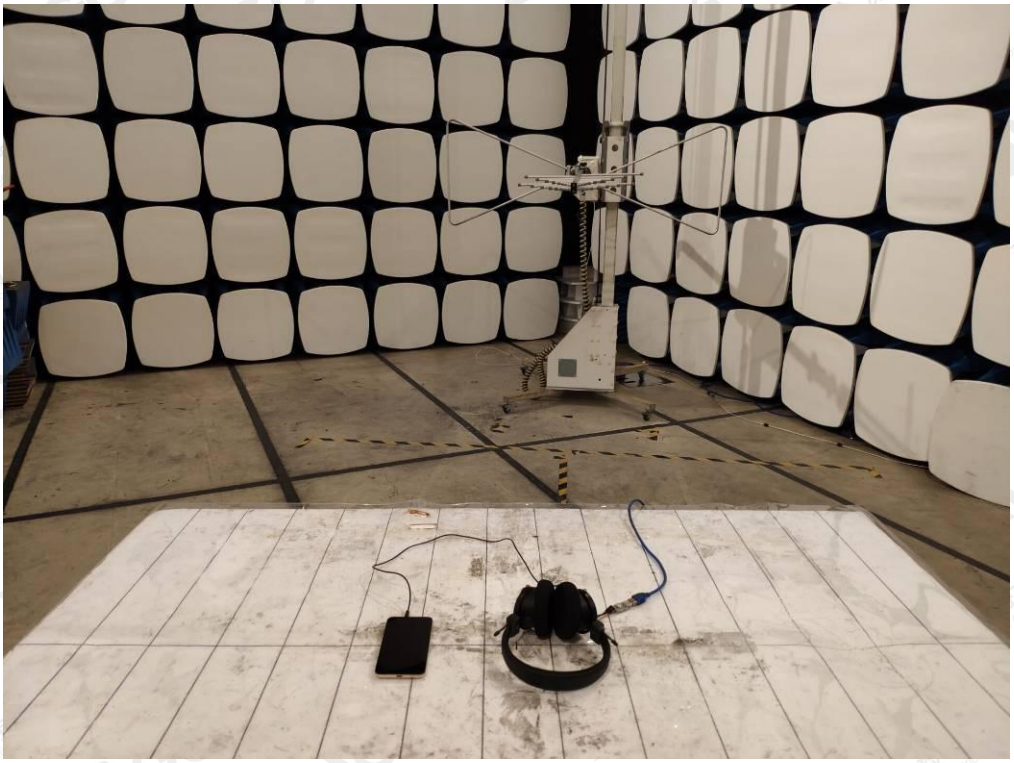

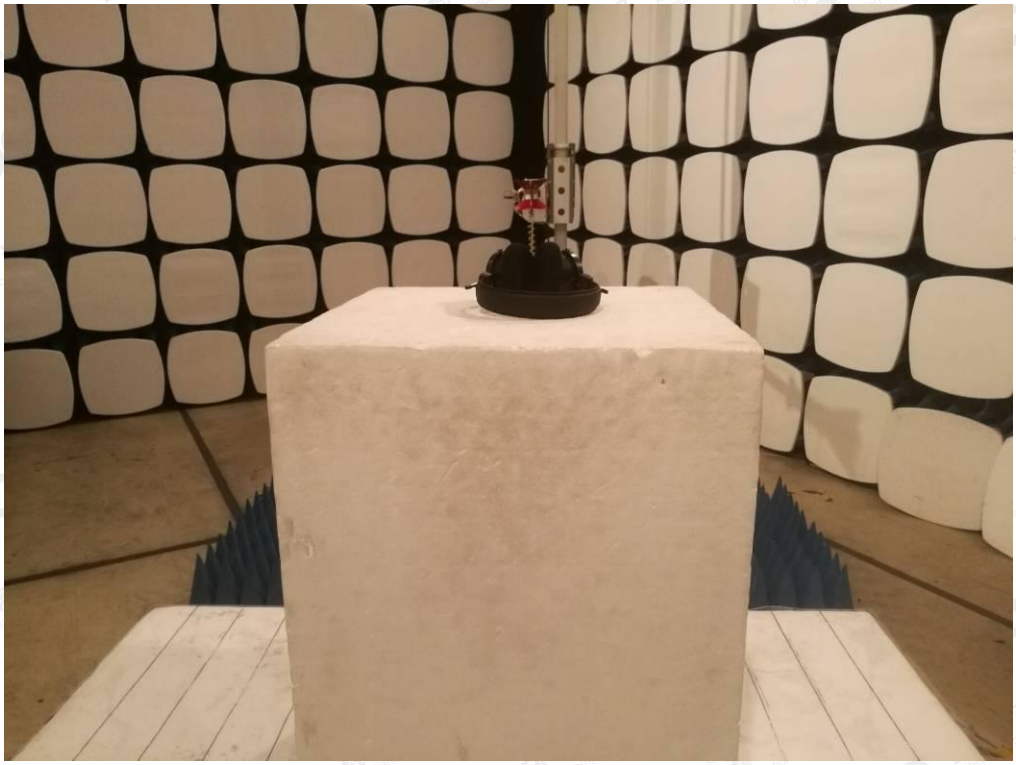

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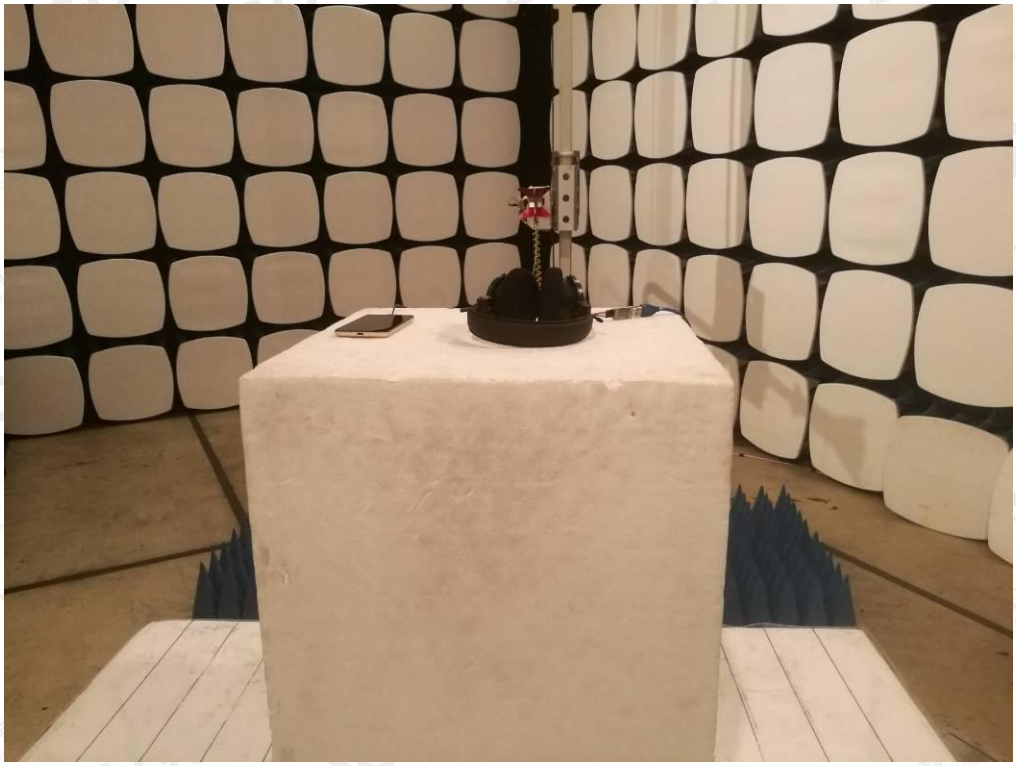

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APPENDIX B: PHOTOGRAPHS OF EUT

TOTAL VIEW OF EUT

TOP VIEW OF EUT

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BOTTOM VIEW OF EUT

FRONT VIEW OF EUT

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BACK VIEW OF EUT

LEFT VIEW OF EUT

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RIGHT VIEW OF EUT

VIEW OF EUT (PORT)-1

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VIEW OF EUT (PORT)-2

OPEN VIEW OF EUT

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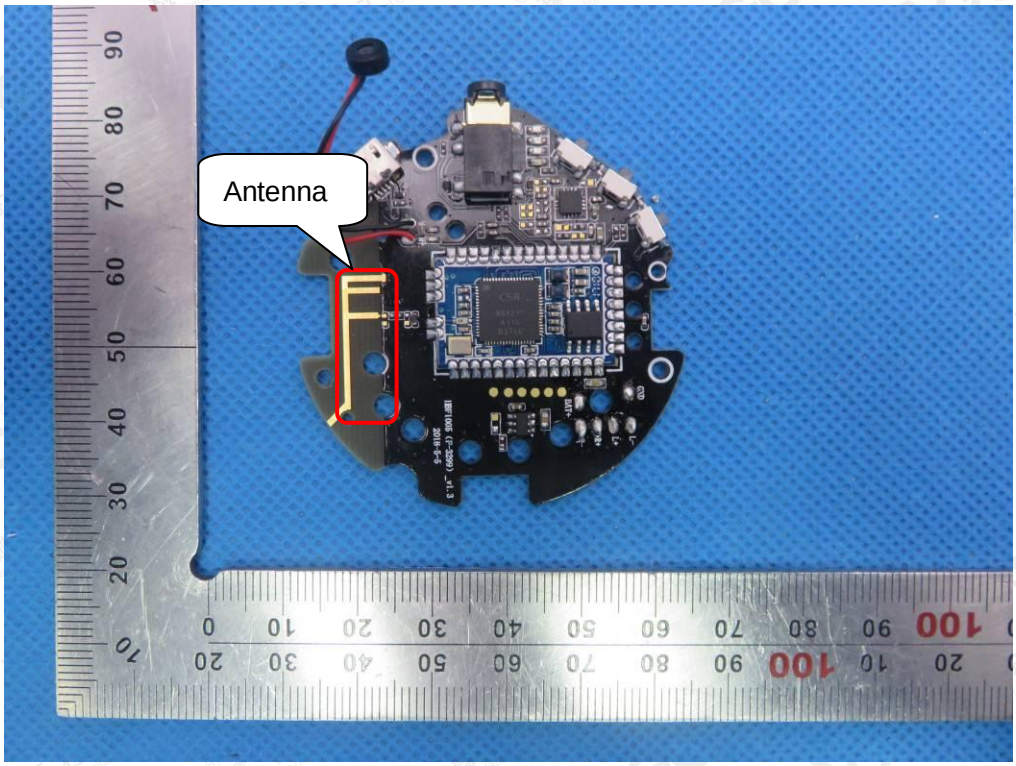
VIEW OF BATTERY

INTERNAL VIEW OF EUT-1



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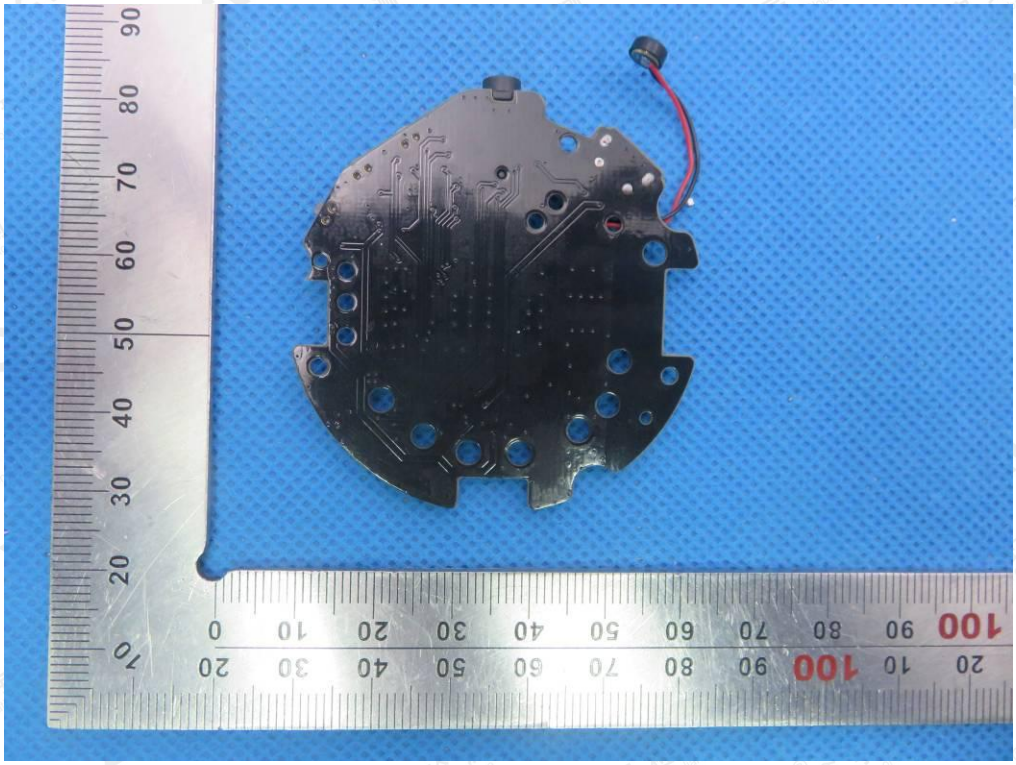
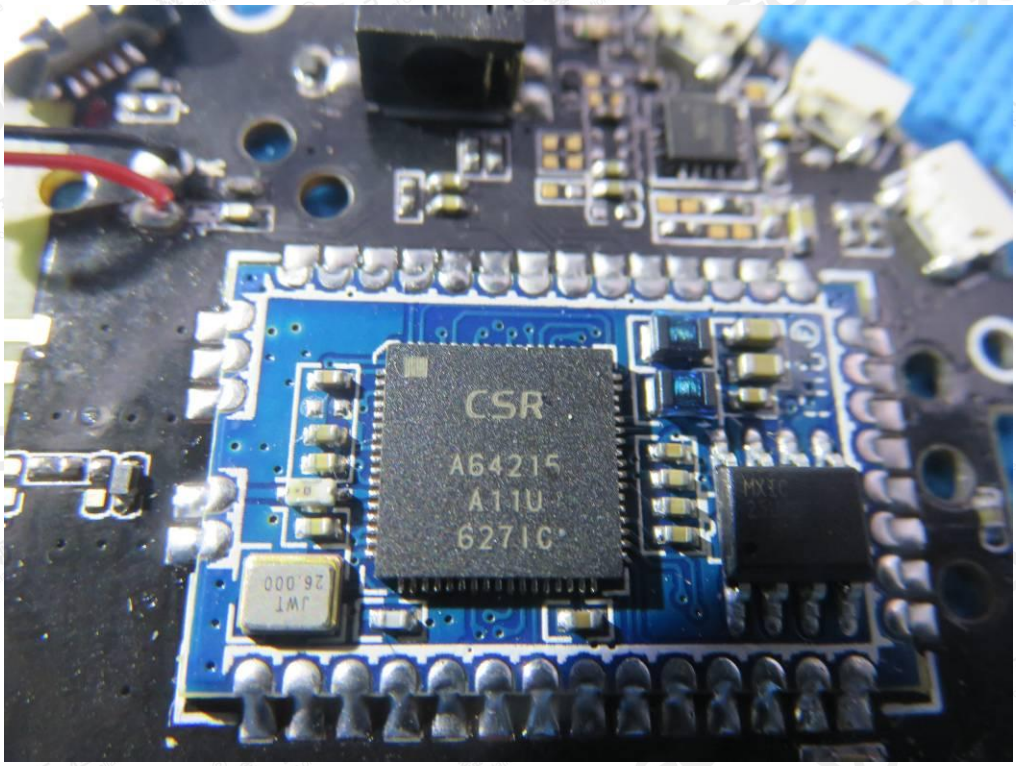
INTERNAL VIEW OF EUT-2



INTERNAL VIEW OF EUT-3



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VIEW OF ADAPTER (AE)

The adapter was supplied by AGC

----END OF REPORT----

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