



FCC TEST REPORT

FCC ID: 2AJJ2-INVENIO

On Behalf of

NOKTA MUHENDISLIK INS. ELEK. PLAS. GIDA VE

REKLAM SAN. TIC. LTD. STI.

METAL DETECTOR

Model No.: INVENIO, INVENIO LITE, INVENIO PRO

Prepared for : NOKTA MUHENDISLIK INS. ELEK. PLAS. GIDA VE REKLAM
SAN. TIC. LTD. STI.

Address : EMEK MAH SIVATYOLU CAD SAKIZ SOK NO4 SANCAKTEPE
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TEST REPORT DECLARATION

Applicant : NOKTA MUHENDISLIK INS. ELEK. PLAS. GIDA VE REKLAM
SAN. TIC. LTD. STI.

Address : EMEK MAH SIVATYOLU CAD SAKIZ SOK NO4 SANCAKTEPE
ISTANBUL 34785 TURKEY

Manufacturer : NOKTA MUHENDISLIK INS. ELEK. PLAS. GIDA VE REKLAM
SAN. TIC. LTD. STI.

Address : EMEK MAH SIVATYOLU CAD SAKIZ SOK NO4 SANCAKTEPE
ISTANBUL 34785 TURKEY

EUT Description : METAL DETECTOR

(A) Model No. : INVENIO, INVENIO LITE, INVENIO PRO

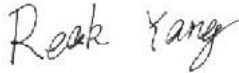
(B) Trademark : NOKTA&MAKRO DETECTION
TECHNOLOGIES

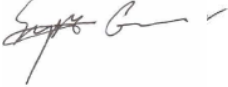
Measurement Standard Used:

FCC Rules and Regulations Part 15 Subpart C Section 15.249: 2018
ANSI C63.10:2013

The device described above is tested by Shenzhen Alpha Product Testing Co., Ltd. to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The test results are contained in this test report and Shenzhen Alpha Product Testing Co., Ltd. is assumed full responsibility for the accuracy and completeness of test. Also, this report shows that the EUT is technically compliant with the FCC Part15 requirements.

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen Alpha Product Testing Co., Ltd.

Tested by (name + signature).....: Reak Yang
Project Engineer 

Approved by (name + signature).....: Simple Guan
Project Manager 

Date of issue.....: November 16, 2018

Revision History

Revision	Issue Date	Revisions	Revised By
00	November 16, 2018	Initial released Issue	Simple Guan

1. SUMMARY OF STANDARDS AND RESULTS

1.1. Description of Standards and Results

The EUT have been tested according to the applicable standards as referenced below:

EMISSION			
Description of Test Item	Test Requirement	Standard Paragraph	Results
Power Line Conducted Emission Test	FCC Part 15:2018	Section 15.207	P
Spurious Emission Test	FCC Part 15:2018	Section 15.249&15.209	P
Occupied bandwidth	FCC Part 15:2018	Section 15.215	P
Band edge Requirement	FCC Part 15:2018	Section 15.249	P
Antenna Requirement	FCC Part 15:2018	Section 15.203	P
Note: 1. P is an abbreviation for Pass. 2. F is an abbreviation for Fail. 3. N/A is an abbreviation for Not Applicable.			

2. GENERAL INFORMATION

2.1. Description of Device (EUT)

EUT Name	: METAL DETECTOR
Trademark	: NOKTA&MAKRO DETECTION TECHNOLOGIES
Model No. DIFF.	: INVENIO, INVENIO LITE, INVENIO PRO : There is no difference between all the models, except model number, this report performs the model INVENIO.
Power supply	: DC 7.4V From Battery, DC 12V From Adapter
Radio Technology	: 2.4G
Operation frequency	: 2402MHz-2480MHz
Channel spacing	: 1MHz
Channel No.	: 79CH
Modulation	: GFSK
Antenna Type	: Antenna 1: Ceramics Antenna, Maximum Gain is 0dBi Antenna 2: Ceramics Antenna, Maximum Gain is 0dBi ANT1 and ANT2 cannot be simultaneously transmitted.
Software	: V1.0
Hardware	: V1.0

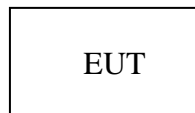
2.2. Accessories of Device (EUT)

Accessories1 : Switching power adapter
 Manufacturer : WARNUNG
 Model : FY1205000
 Power supply : Input: AC 100-240V, 50/60Hz, 2.5A
 Output: DC 12V/7.0A

2.3. Tested Supporting System Details

No.	Description	Manufacturer	Model	Serial Number	Certification or DOC
1	N/A	N/A	N/A	N/A	N/A

2.4. Block Diagram of connection between EUT and simulators



2.5. Test Mode Description

Test mode:

Mode	Channel	Frequency (MHz)
GFSK	CH0	2402
GFSK	CH40	2441
GFSK	CH79	2480

Note:

1. The test was used to control EUT work in Continuous TX mode, and select test channel, wireless mode
2. The EUT has been tested as an independent unit. And Continual Transmitting in maximum power.
3. For the relevant Conducted Measurement, the temporary antenna connector is used during the measurement. Antenna Connector Impedance: 50Ω , Cable Loss: 1.0 dB
4. EUT should be tested with a fully charged battery when performing independent tests.

2.6. Test Conditions

Temperature range	21-25°C
Humidity range	40-75%
Pressure range	86-106kPa

2.7. Test Facility

Shenzhen Alpha Product Testing Co., Ltd.

Building i, No.2, Lixin Road, Fuyong Street, Bao'an District,
518103, Shenzhen, Guangdong, China

June 21, 2018 File on Federal Communication Commission
Registration Number: 293961

July 25, 2017 Certificated by IC
Registration Number: 12135A

2.8. Measurement Uncertainty

(95% confidence levels, k=2)

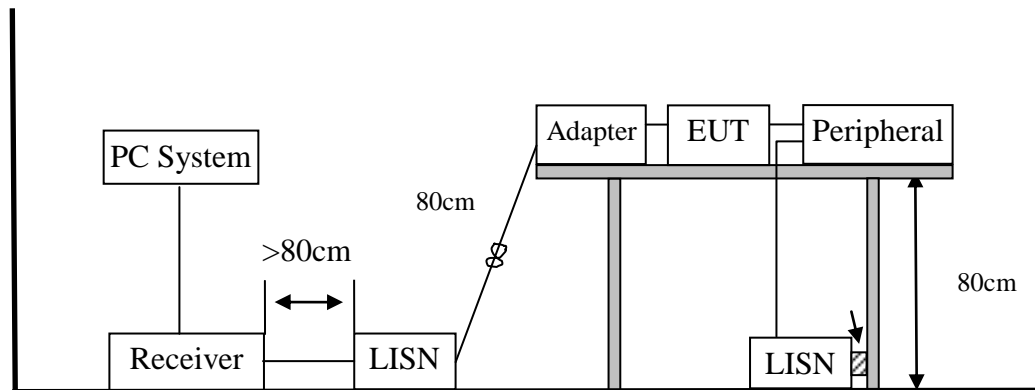
Item	Uncertainty
Uncertainty for Power point Conducted Emissions Test	2.74dB
Uncertainty for Radiation Emission test in 3m chamber (below 30MHz)	2.13 dB(Polarize: V)
	2.57dB(Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.77 dB (Distance: 3m Polarize: V)
	3.80 dB (Distance: 3m Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	4.16 dB (Distance: 3m Polarize: V)
	4.13 dB (Distance: 3m Polarize: H)
Uncertainty for radio frequency	5.8×10^{-8}
Uncertainty for conducted RF Power	0.37dB
Uncertainty for temperature	0.2°C
Uncertainty for humidity	1%
Uncertainty for DC and low frequency voltages	0.06%

2.9. Test Equipment List

Equipment	Manufacture	Model No.	Serial No.	Last cal.	Cal Interval
3m Semi-Anechoic	ETS-LINDGREN	N/A	SEL0017	2018.09.21	1 Year
Spectrum analyzer	Agilent	E4407B	MY46185649	2018.09.21	1 Year
Receiver	R&S	ESCI	1166.5950K03-10 11	2018.09.21	1 Year
Receiver	R&S	ESCI	101202	2018.09.21	1 Year
Bilog Antenna	Schwarzbeck	VULB 9168	VULB9168-438	2018.09.29	2 Year
Horn Antenna	EMCO	3115	640201028-06	2018.09.29	2 Year
Active Loop Antenna	Beijing Daze	ZN30900A	SEL0097	2018.09.29	2 Year
Cable	Resenberger	N/A	No.1	2018.09.21	1 Year
Cable	SCHWARZBECK	N/A	No.2	2018.09.21	1 Year
Cable	SCHWARZBECK	N/A	No.3	2018.09.21	1 Year
Pre-amplifier	Schwarzbeck	BBV9743	9743-019	2018.09.21	1 Year
Pre-amplifier	R&S	AFS33-18002	SEL0080	2018.09.21	1 Year
Temperature	Terchy	MHQ	120	2018.09.21	1 Year
20db Attenuator	ICPROBING	IATS1	82347	2018.09.21	1 Year
18-40 Horn Antenna	18-40G antenna	Sas-574	571	2018.3.14	3 Year
L.I.S.N.#1	Schwarzbeck	NSLK8126	8126466	2017.09.21	1 Year

3. POWER LINE CONDUCTED EMISSION TEST

3.1. Block Diagram of Test Setup



3.2. Test Limits

Frequency	Maximum RF Line Voltage	
	Quasi-Peak Level dB(μ V)	Average Level dB(μ V)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

- Notes:
1. Emission level=Read level + LISN factor-Preamp factor + Cable loss
 2. * Decreasing linearly with logarithm of frequency.
 3. The lower limit shall apply at the transition frequencies.

3.3. Configuration of EUT on Test

The following equipment are installed on Power Line Conducted Emission Test to meet the commission requirement and operating regulations in a manner which tends to maximize its emission characteristics in a normal application.

3.4. Operating Condition of EUT

- (1) Setup the EUT as shown as Section 3.1.
- (2) Turn on the power of all equipment.
- (3) Let the EUT work in test mode taking the test.

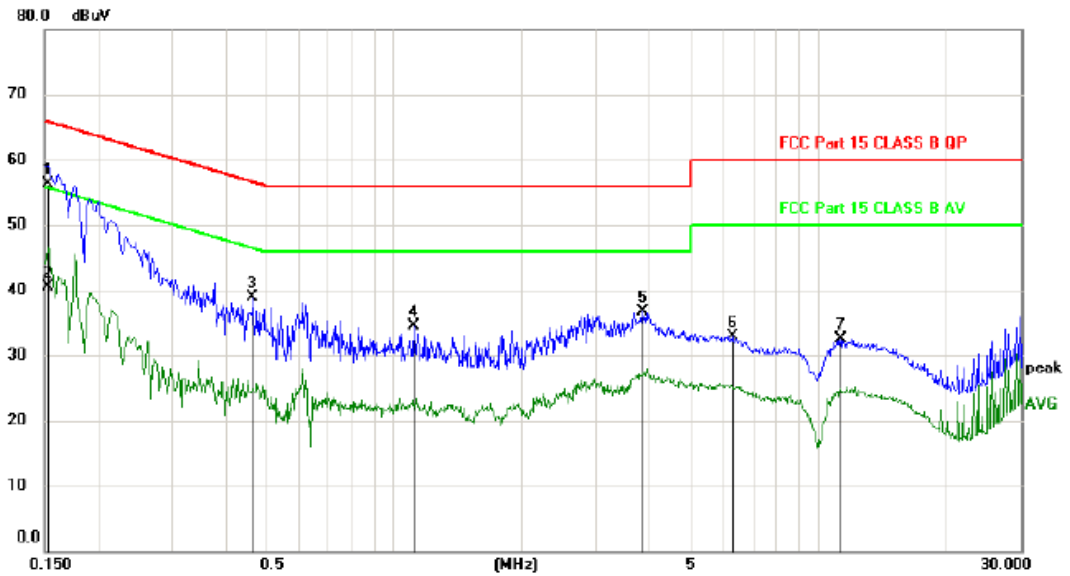
3.5. Test Procedure

- (1) The EUT was placed on a non-metallic table, 80cm above the ground plane. The EUT Power connected to the power mains through a line impedance stabilization network (L.I.S.N. 1#). This provided a 50-ohm coupling impedance for the EUT (Please refer to the block diagram of the test setup and photographs). The other peripheral devices power cord connected to the power mains through a line impedance stabilization network (L.I.S.N.#2). Both sides of power line were checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10:2013 on conducted Emission test.
- (2) The frequency range from 150kHz to 30MHz is checked, the bandwidth of test receiver (R&S TEST RECEIVER ESCI) is set at 9kHz.
- (3) The frequency range from 30MHz to 1000MHz was pre-scanned with a Peak detector and all final readings of measurement from Test Receiver are Quasi-Peak and Average values.
- (4) The test results are reported on Section 3.6.

3.6. Test Results

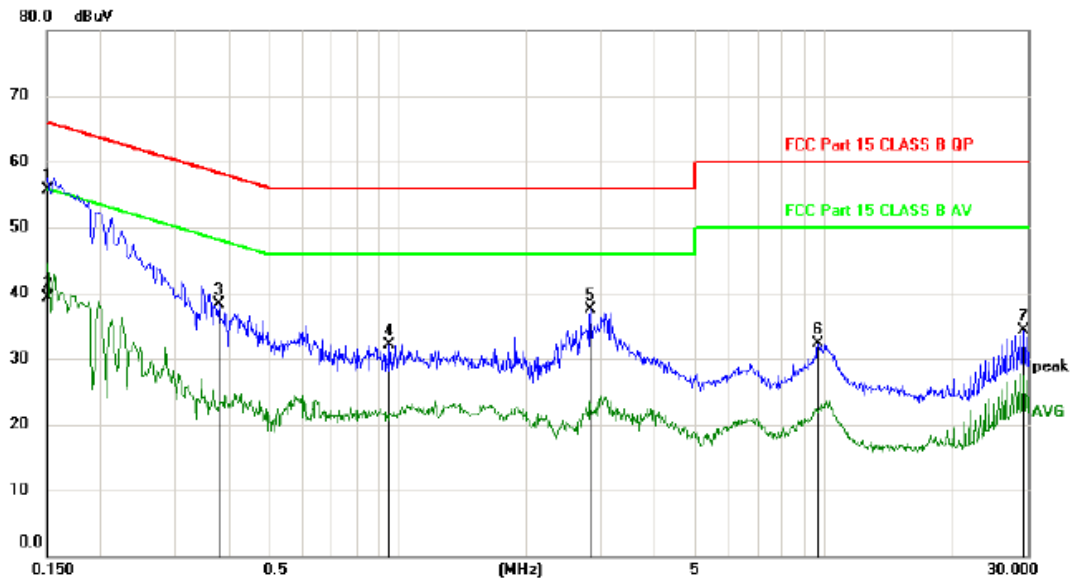
EUT	: METAL DETECTOR	Test Date	: 2018.10.28
M/N	: INVENIO	Temperature	: 23.9°C
Test Engineer	: Reak Yang	Humidity	: 41%
Test Mode	: Charging + Link mode		
Test Voltage	: DC 7.4V from adapter(AC120V/60Hz)		
Test Results	: PASS		
Note:	<ol style="list-style-type: none"> 1. The test results are listed in next pages. 2. If the limits for the measurement with the average detector are met when using a receiver with a peak detector, the test unit shall be deemed to meet both limits and the measurement with the average detector and quasi-peak detector need not be carried out. 3. If the limits for the measurement with the average detector are met when using a receiver with a quasi-peak detector, the test unit shall be deemed to meet both limits and the measurement with the average detector need not be carried out. 		

L



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1	*	0.1530	46.54	9.73	56.27	65.84	-9.57	QP	
2		0.1530	30.79	9.73	40.52	55.84	-15.32	AVG	
3		0.4650	29.11	9.78	38.89	56.60	-17.71	peak	
4		1.1160	24.71	9.84	34.55	56.00	-21.45	peak	
5		3.8550	26.56	10.11	36.67	56.00	-19.33	peak	
6		6.2850	22.71	10.27	32.98	60.00	-27.02	peak	
7		11.3100	22.15	10.35	32.50	60.00	-27.50	peak	

N

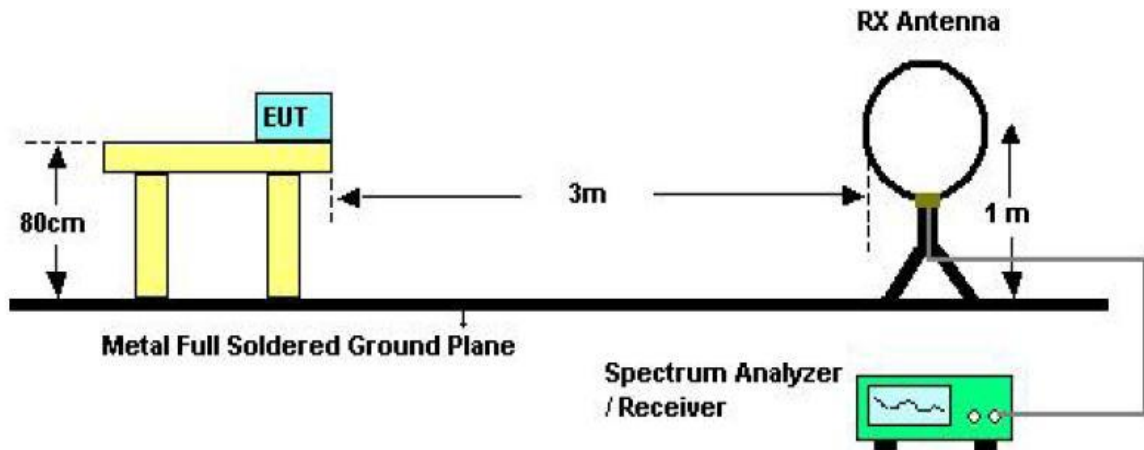


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1	*	0.1500	45.98	9.73	55.71	66.00	-10.29	QP	
2		0.1500	29.63	9.73	39.36	56.00	-16.64	AVG	
3		0.3810	28.51	9.77	38.28	58.26	-19.98	peak	
4		0.9540	22.18	9.83	32.01	56.00	-23.99	peak	
5		2.8320	27.46	10.03	37.49	56.00	-18.51	peak	
6		9.6750	21.94	10.33	32.27	60.00	-27.73	peak	
7		29.2560	23.24	11.14	34.38	60.00	-25.62	peak	

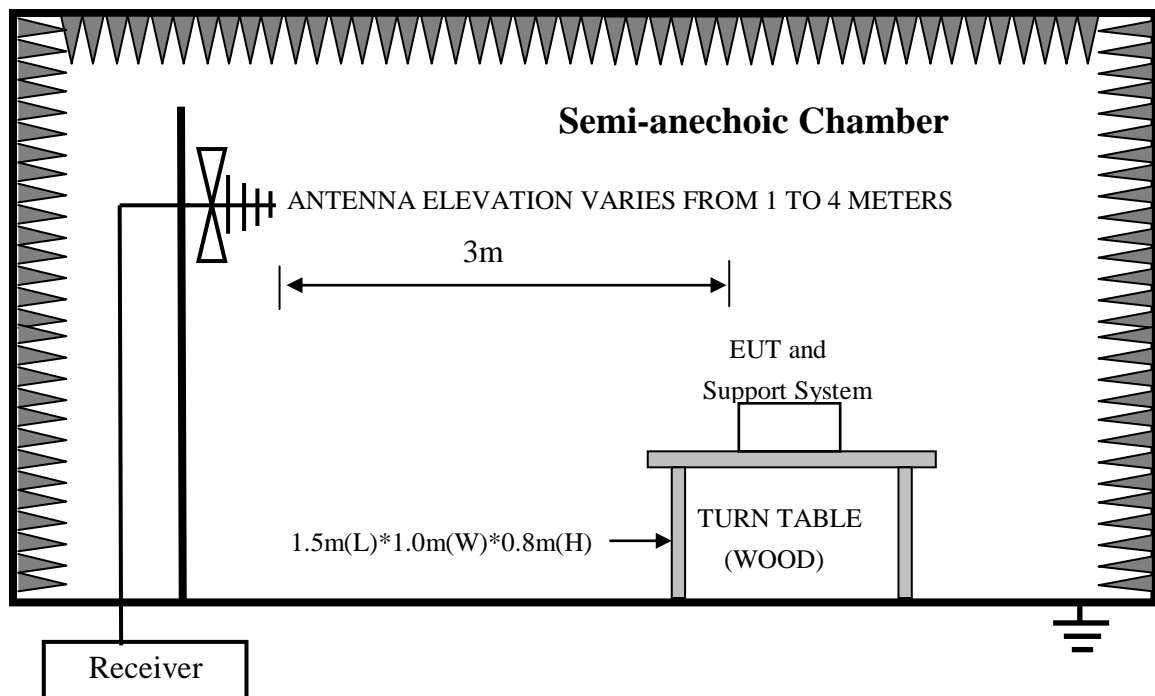
4. RADIATED EMISSION TEST

4.1. Block Diagram of Test Setup

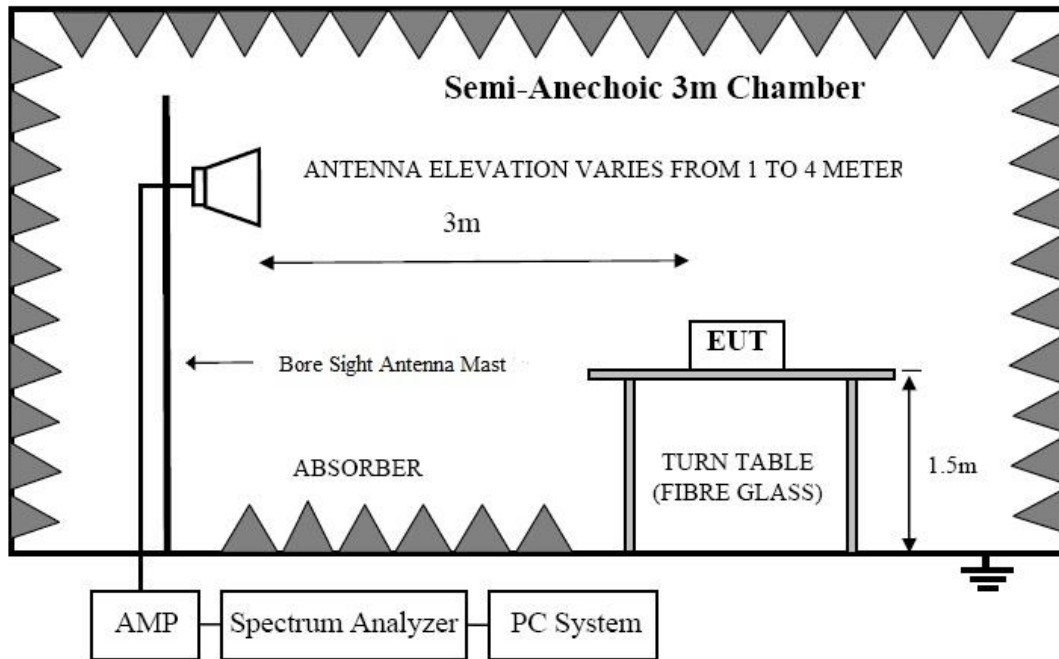
In Semi Anechoic Chamber (3m) Test Setup Diagram for 9KHz~30MHz



In Semi Anechoic Chamber (3m) Test Setup Diagram for 30MHz~1000MHz



In Semi Anechoic Chamber (3m) Test Setup Diagram for Above 1GHz



4.2. Test Limit

Frequency MHz	Distance (Meters)	Field Strengths Limits	
		uV/m	dB uV/m
0.009 ~ 0.490	300	2400/F(kHz)	---
0.490 ~ 1.705	30	24000/F(kHz)	----
1.705 ~ 30	30	30	29.5
30 ~ 88	3	100(3nW)	40
88 ~ 216	3	150(6.8nW)	43.5
216 ~ 960	3	200(12nW)	46
Above 960	3	500(75nW)	54
Carrier frequency	3	50000(avg)	113.97(peak) 93.97(avg)

Notes:

1. Emission level = Read level + Antenna Factor - Preamp Factor + Cable Loss
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.
4. For frequencies above 1000 MHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

4.3. Configuration of EUT on Test

The following equipment are installed on Radiated Emission Test to meet the commission requirements and operating regulations in a manner that tends to maximize its emission characteristics in normal application.

4.4. Operating Condition of EUT

- (1) Setup the EUT as shown as Section 4.1.
- (2) Turn on the power of all equipment.
- (3) Let the EUT work in test mode taking the test.

4.5. Test Procedure

- (1) The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber for below 1GHz and 150 cm above the ground plane inside a semi-anechoic chamber for above 1GHz. An antenna was located 3m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT were rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10: 2013 on Radiated Emission test.
- (2) For the radiated emission test above 1GHz:
Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- (3) Test antenna was located 4m from the EUT on an adjustable mast. Below pre-scan procedure was first performed in order to find prominent radiated emissions.
 - (a) Change work frequency or channel of device if practicable.
 - (b) Change modulation type of device if practicable.
 - (c) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions
- (4) For harmonic emissions test a appropriate high pass filter was inserted in the input port of AMP

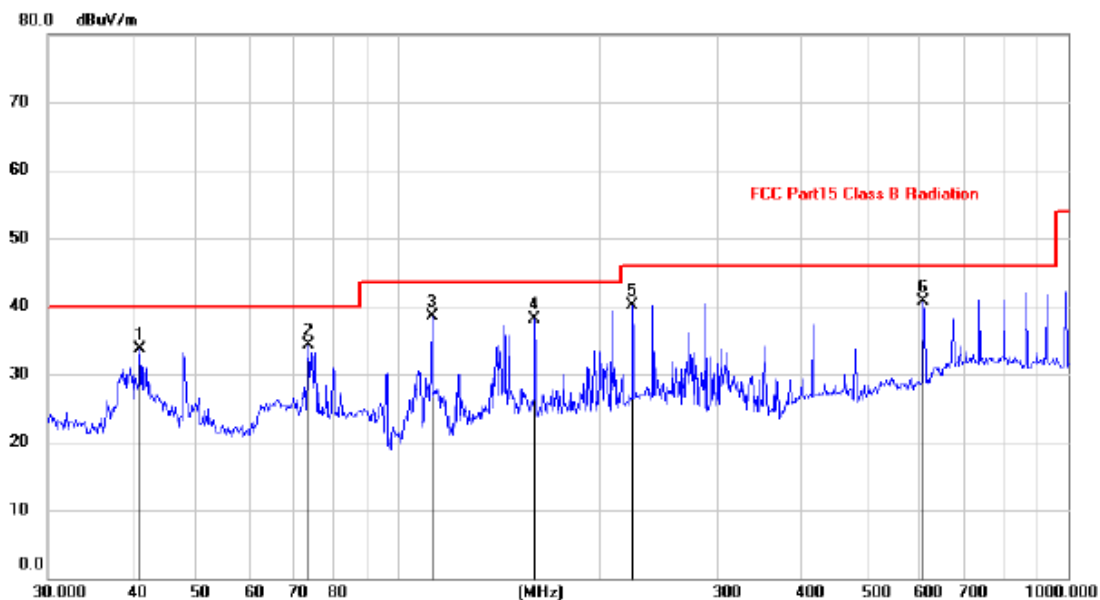
- (5) The frequency range from 9KHz to 150KHz is checked, the bandwidth of test receiver (R&S TEST RECEIVER ESCI) is set at 200Hz.
The frequency range from 150KHz to 30MHz is checked, the bandwidth of test receiver (R&S TEST RECEIVER ESCI) is set at 9KHz.
The frequency range from 30MHz to 1000MHz is checked, the bandwidth of test receiver (R&S TEST RECEIVER ESCI) is set at 120kHz.
The frequency range from above 1GHz is checked, the bandwidth of Signal Analyzer (Signal Analyzer N9020A) is set at 1MHz.
- (6) The frequency range from 30MHz to 1000MHz was pre-scanned with a peak detector and all final readings of measurement from Test Receiver are Quasi-Peak values, the frequency range from 1GHz to 6GHz was pre-scanned with a peak detector and all final readings of measurement from Spectrum Analyzer are peak and average values checked, all measurement distance is 3m in 3m semi anechoic chamber.
- (7) Test for all x, y, z axes is performed and only the worst case of X axes was recorded in the test report.
- (8) The test results are reported on Section 4.6.

4.6. Test Results

Frequency Range : 9KHz~30MHz	
EUT : METAL DETECTOR	Test Date : 2018.10.28
M/N : INVENIO	Temperature : 23.9°C
Test Engineer : Reak Yang	Humidity : 56%
Test Mode : ANT 1 TX CH1	
Test Results : PASS	
Note: 1. Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.	

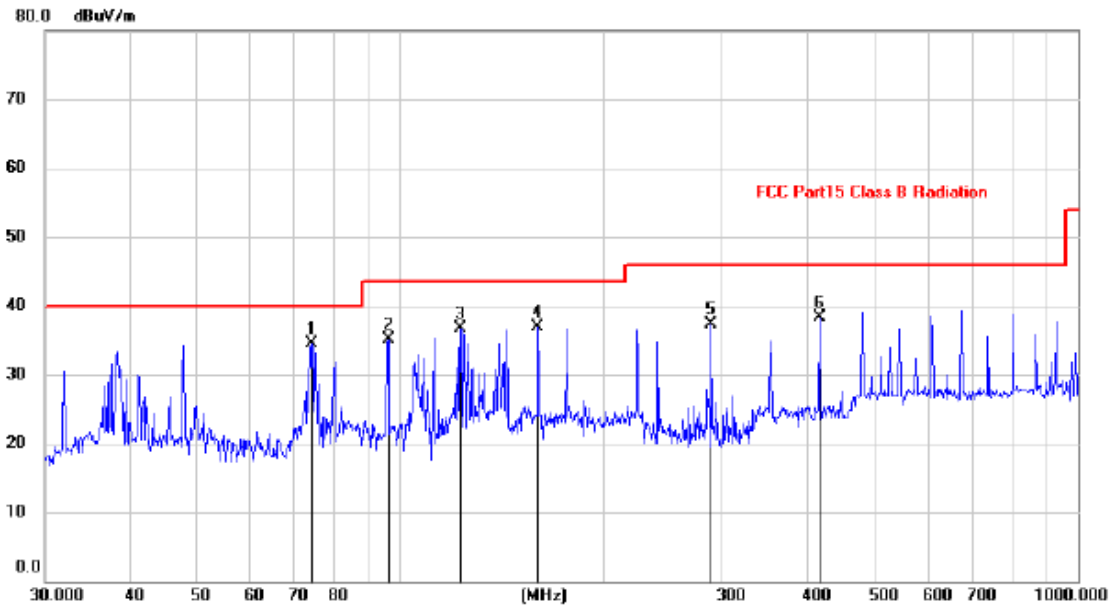
Frequency Range : 30MHz~1000MHz	
EUT : METAL DETECTOR	Test Date : 2018.10.28
M/N : INVENIO	Temperature : 23.9°C
Test Engineer : Reak Yang	Humidity : 56%
Test Mode : ANT 1 TX CH1	
Test Results : PASS	
Note: 1. The test results are listed in next pages. 2. This mode is worst case mode, and this report only reflected the worst mode. 3. If the limits for the measurement with the quasi-peak detector are met when using a receiver with a peak detector, the test unit shall be deemed to meet both limits and the measurement with the quasi-peak detector need not be carried out. 4. Only show the test data of the worst Channel in this report.	

Vertical:



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Antenna Height cm	Table Degree	Comment
1		41.1319	19.67	14.11	33.78	40.00	-6.22	peak			
2		73.3593	23.80	10.43	34.23	40.00	-5.77	peak			
3	*	112.5241	26.63	11.78	38.41	43.50	-5.09	peak			
4		159.7844	23.49	14.58	38.07	43.50	-5.43	peak			
5		224.5192	28.55	11.53	40.08	46.00	-5.92	peak			
6		607.7866	21.07	19.67	40.74	46.00	-5.26	peak			

Horizontal:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	*	74.1350	24.15	10.41	34.56	40.00	-5.44			peak
2		96.4360	24.75	10.31	35.06	43.50	-8.44			peak
3		123.2653	23.87	12.81	36.68	43.50	-6.82			peak
4		159.7844	22.36	14.58	36.94	43.50	-6.56			peak
5		287.9904	24.30	13.09	37.39	46.00	-8.61			peak
6		416.1791	22.28	16.00	38.28	46.00	-7.72			peak

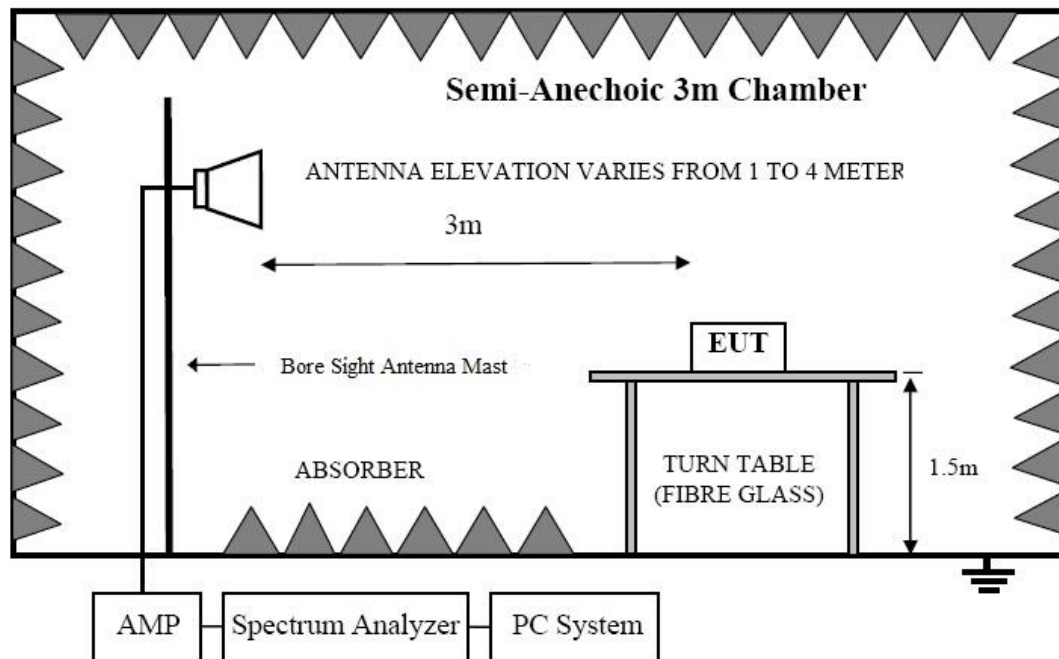
Frequency Range : 1GHz~25GHz								
EUT : METAL DETECTOR					Test Date : 2018.10.28			
M/N : INVENIO					Temperature : 23.9°C			
Test Engineer : Reak Yang					Humidity : 56%			
Test Mode : ANT1 TX 2402MHz								
Test Results : PASS								
No.	Freq MHz	Polarity	Reading (dBuV/m)	Correct Factor	Result (dBuV/m)	Limit (dBuV/m)	Margin	Remark
1	2402	H	86.36	-3.38	82.98	113.97	-30.99	Peak
2	2402	H	72.95	-3.38	69.57	93.97	-24.40	Avg
3	4804	H	43.07	3.23	46.30	74	-27.70	Peak
4	4804	H	--	3.23	--	54	--	Avg
5	7206	H	38.74	10.57	49.31	74	-24.69	Peak
6	7206	H	--	10.57	--	54	--	Avg
1	2402	V	78.90	-3.38	75.52	113.97	-38.45	Peak
2	2402	V	66.15	-3.38	62.77	93.97	-31.20	Avg
3	4804	V	46.43	3.23	49.66	74	-24.34	Peak
4	4804	V	--	3.23	--	54	--	Avg
5	7206	V	37.72	10.57	48.29	74	-25.71	Peak
6	7206	V	--	10.57	--	54	--	Avg
Note:	<p>1. Means other frequency and mode comply with standard requirements and at least have 20dB margin.</p> <p>2. Correct Factor=Cable Loss+ Antenna Factor-Amplifier Gain. Result=Reading + Correct Factor. Margin= Result-Limit.</p> <p>3. Spectrum Set for PK measure: RBW=1MHz, VBW=1MHz, Sweep time=Auto, Detector: PK.</p> <p>4. Spectrum Set for AV measure: RBW=1MHz, VBW=3MHz, Sweep time=Auto, Detector: Avg.</p> <p>5. If the limits for the measurement with the average detector are met when using a receiver with a peak detector, the test unit shall be deemed to meet both limits and the measurement with the average detector need not be carried out.</p>							

Frequency Range : 1GHz~25GHz								
EUT : METAL DETECTOR						Test Date : 2018.10.28		
M/N : INVENIO						Temperature : 23.9°C		
Test Engineer : Reak Yang						Humidity : 56%		
Test Mode : ANT1 TX 2441MHz								
Test Results : PASS								
No.	Freq MHz	Polarity	Reading (dBuV/m)	Correct Factor	Result (dBuV/m)	Limit (dBuV/m)	Margin	Remark
1	2441	H	75.56	-3.38	72.18	113.97	-41.79	Peak
2	2441	H	65.53	-3.38	62.15	93.97	-31.82	Avg
3	4882	H	41.10	3.23	44.33	74	-29.67	Peak
4	4882	H	--	3.23	--	54	--	Avg
5	7323	H	40.16	10.57	50.73	74	-23.27	Peak
6	7323	H	--	10.57	--	54	--	Avg
1	2441	V	74.17	-3.38	70.79	113.97	-43.18	Peak
2	2441	V	61.68	-3.38	58.30	93.97	-35.67	Avg
3	4882	V	44.47	3.23	47.70	74	-26.30	Peak
4	4882	V	--	3.23	--	54	--	Avg
5	7323	V	37.14	10.57	47.71	74	-26.29	Peak
6	7323	V	--	10.57	--	54	--	Avg
Note:	<p>1. Means other frequency and mode comply with standard requirements and at least have 20dB margin.</p> <p>2. Correct Factor=Cable Loss+ Antenna Factor-Amplifier Gain. Result=Reading + Correct Factor. Margin= Result-Limit.</p> <p>3. Spectrum Set for PK measure: RBW=1MHz, VBW=1MHz, Sweep time=Auto, Detector: PK.</p> <p>4. Spectrum Set for AV measure: RBW=1MHz, VBW=3MHz, Sweep time=Auto, Detector: Avg.</p> <p>5. If the limits for the measurement with the average detector are met when using a receiver with a peak detector, the test unit shall be deemed to meet both limits and the measurement with the average detector need not be carried out.</p>							

Frequency Range : 1GHz~25GHz								
EUT : METAL DETECTOR						Test Date : 2018.10.28		
M/N : INVENIO						Temperature : 23.9°C		
Test Engineer : Reak Yang						Humidity : 56%		
Test Mode : ANT1 TX 2480MHz								
Test Results : PASS								
No.	Freq MHz	Polarity	Reading (dBuV/m)	Correct Factor	Result (dBuV/m)	Limit (dBuV/m)	Margin	Remark
1	2480	H	86.93	-3.38	85.55	113.97	-30.42	Peak
2	2480	H	70.81	-3.38	67.43	93.97	-26.54	Avg
3	4960	H	43.17	3.23	46.40	74	-27.60	Peak
4	4960	H	--	3.23	--	54	--	Avg
5	7440	H	39.99	10.57	50.56	74	-23.44	Peak
6	7440	H	--	10.57	--	54	--	Avg
1	2480	V	89.74	-3.38	86.36	113.97	-27.61	Peak
2	2480	V	66.62	-3.38	63.24	93.97	-30.73	Avg
3	4960	V	43.08	3.23	46.31	74	-27.67	Peak
4	4960	V	--	3.23	--	54	--	Avg
5	7440	V	41.32	10.57	51.89	74	-22.11	Peak
6	7440	V	--	10.57	--	54	--	Avg
Note:	<p>1. Means other frequency and mode comply with standard requirements and at least have 20dB margin.</p> <p>2. Correct Factor=Cable Loss+ Antenna Factor-Amplifier Gain. Result=Reading + Correct Factor. Margin= Result-Limit.</p> <p>3. Spectrum Set for PK measure: RBW=1MHz, VBW=1MHz, Sweep time=Auto, Detector: PK.</p> <p>4. Spectrum Set for AV measure: RBW=1MHz, VBW=3MHz, Sweep time=Auto, Detector: Avg.</p> <p>5. If the limits for the measurement with the average detector are met when using a receiver with a peak detector, the test unit shall be deemed to meet both limits and the measurement with the average detector need not be carried out.</p>							

5. BAND EDGE TEST

5.1. Block Diagram of Test Setup



5.2. Test Limit

Please refer section 15.249 and section 15.205.

249(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in section 15.209, whichever is the lesser attenuation.

249(e) As show in section 15.35(b), for frequencies above 1000MHz, the above field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak filed strength shall not exceed 2500 millivolts/meter at 3meters along the antenna azimuth.

5.3. Configuration of EUT on Test

The following equipment are installed on Radiated Emission Test to meet the commission requirements and operating regulations in a manner that tends to maximize its emission characteristics in normal application.

5.4. Operating Condition of EUT

- (1) Setup the EUT as shown as Section 5.1.
- (2) Turn on the power of all equipment.
- (3) Let the EUT work in test mode taking the test.

5.5. Test Procedure

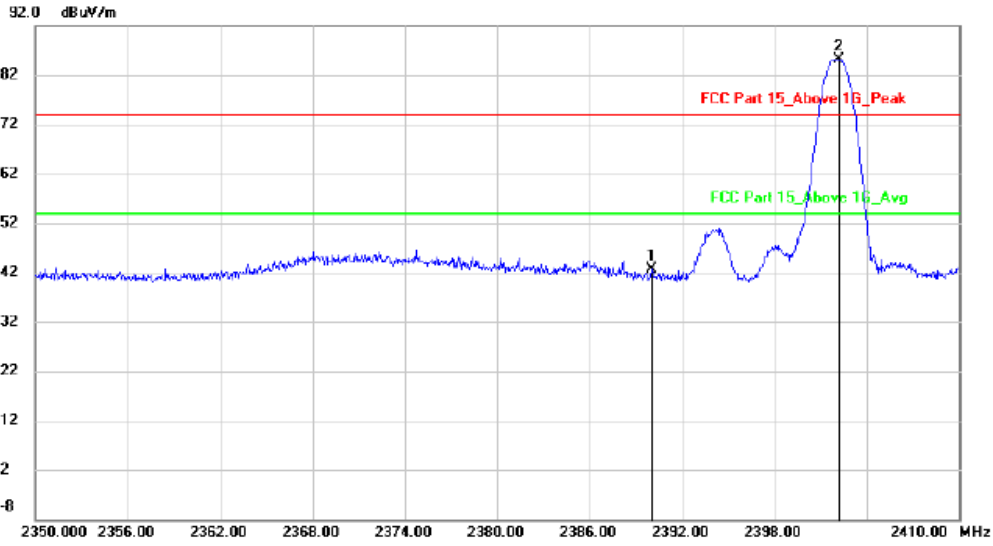
- (1) The EUT was placed on a non-metallic table, 150 cm above the ground plane inside a semi-anechoic chamber. An antenna was located 3m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT were rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10: 2013 on Radiated Emission test.
- (2) For the radiated emission test above 1GHz:
Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- (3) Test antenna was located 4m from the EUT on an adjustable mast. Below pre-scan procedure was first performed in order to find prominent radiated emissions.
 - (a) Change work frequency or channel of device if practicable.
 - (b) Change modulation type of device if practicable.
 - (c) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions

- (5) The frequency range from above 1GHz is checked, the bandwidth of Signal Analyzer (Signal Analyzer N9020A) is set at 1MHz.
- (6) The frequency range from 1GHz to 6GHz was pre-scanned with a peak detector and all final readings of measurement from Spectrum Analyzer are peak and average values checked, all measurement distance is 3m in 3m semi anechoic chamber.
- (7) Test for all x, y, z axes is performed and only the worst case of X axes was recorded in the test report.
- (8) The test results are reported on Section 5.6.
- (9) Only show the test data of the worst Channel in this report.

5.6. Test Results

Polarization: Vertical

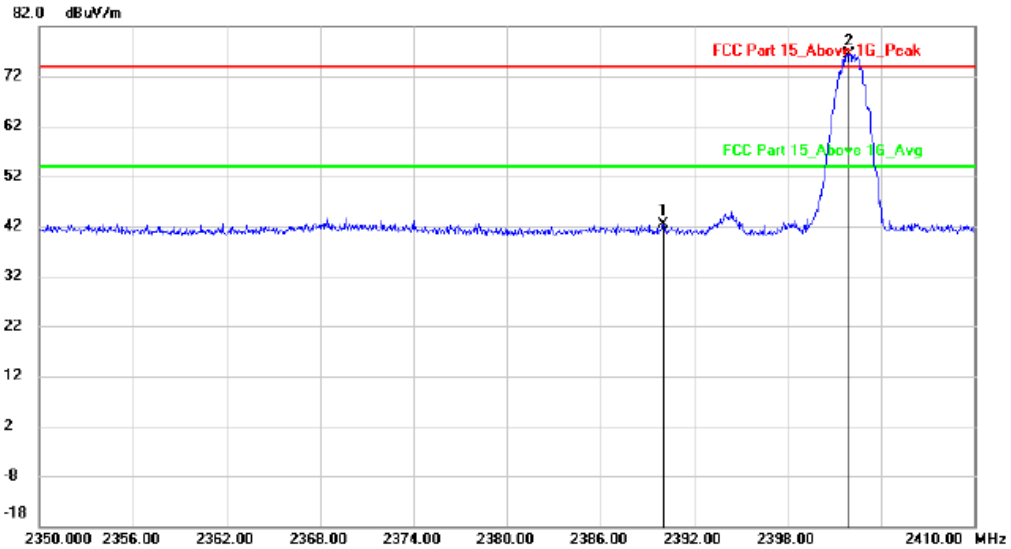
Test Mode: GFSK-Low



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		2390.000	45.99	-3.40	42.59	74.00	-31.41			peak
2	*	2402.200	88.59	-3.41	85.18	74.00	11.18			peak

Polarization: Horizontal

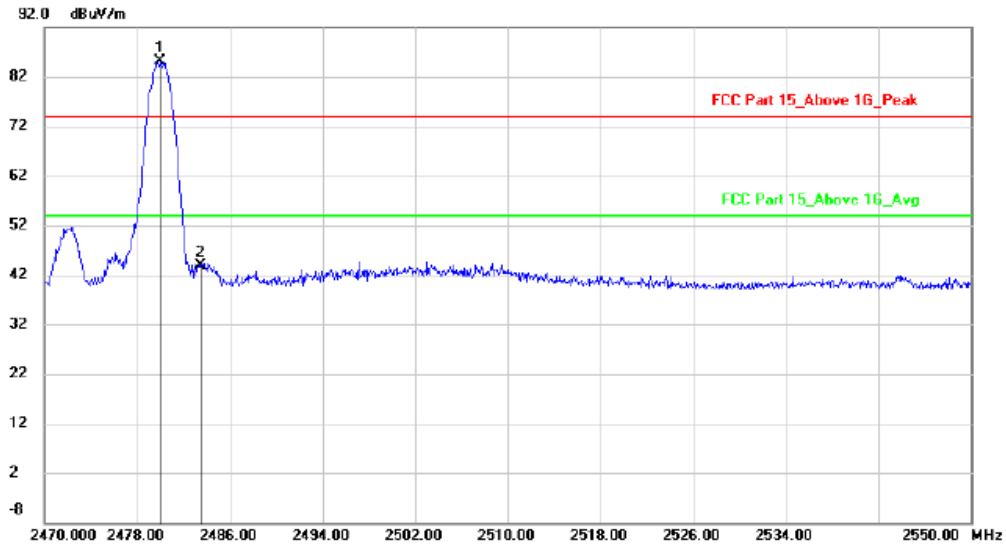
Test Mode: GFSK-Low



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		2390.000	45.67	-3.40	42.27	74.00	-31.73			peak
2	*	2401.960	79.90	-3.41	76.49	74.00	2.49			peak

Polarization: Vertical

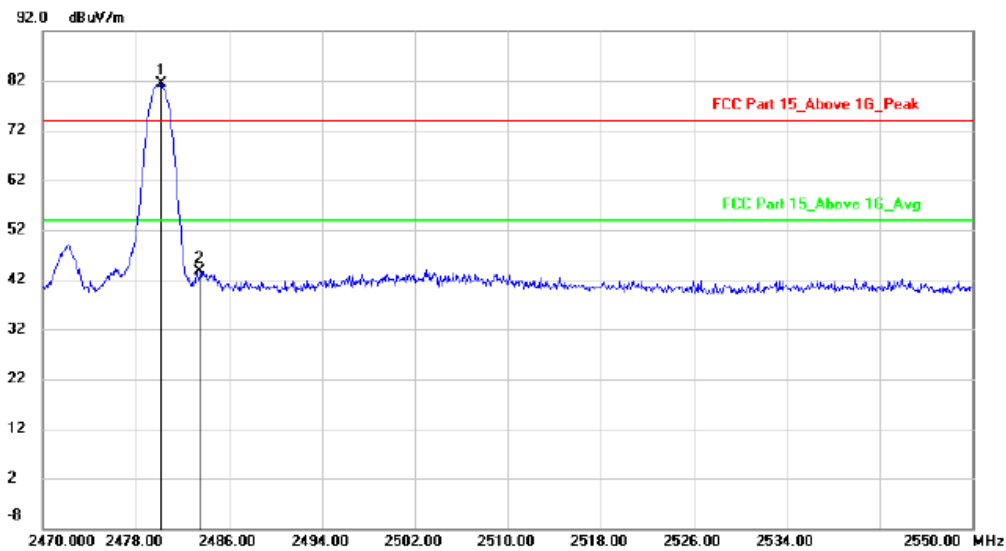
Test Mode: GFSK-High



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	*	2480.000	88.39	-3.38	85.01	74.00	11.01			peak
2		2483.500	47.16	-3.38	43.78	74.00	-30.22			peak

Polarization: Horizontal

Test Mode: GFSK-High



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	*	2480.160	84.69	-3.38	81.31	74.00	7.31			peak
2		2483.500	46.89	-3.38	43.51	74.00	-30.49			peak

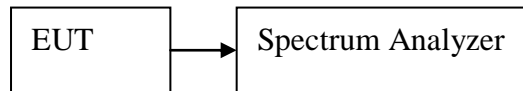
Note: 1. *:Maximum data; x:Over limit; !:over margin.

2. Measurement=Reading Level+Correct Factor; Correct Factor=Antenna Factor+Cable Loss.

3. Antenna 1 transmission is the worst mode

6. OCCUPIED BANDWIDTH TEST

6.1. Block Diagram of Test Setup



6.2. Test Limit

Please refer section 15.249 and section 15.205.

6.3. Test Procedure

- (1) The bandwidth is measured at an amplitude level reduced 20dB from the reference level. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.
- (2) The test receiver RBW set 30KHz, VBW set 100KHz, Sweep time set auto.

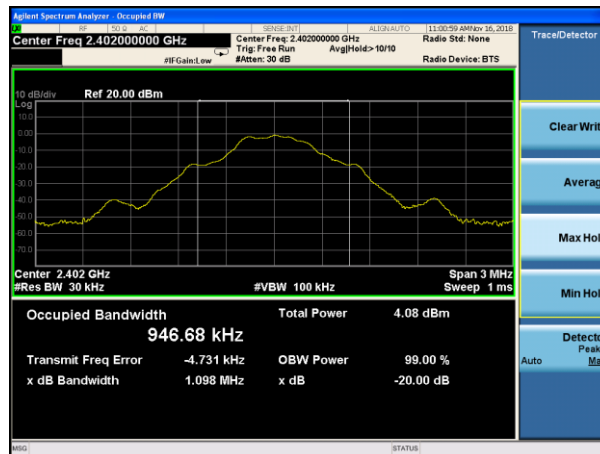
6.4. Test Results

Mode		Frequency MHz	20dB Bandwidth (MHz)	99% Bandwidth (KHz)	Limit (kHz)
GFSK	ANT1	2402	1.098	946.68	/
		2441	1.095	955.98	/
		2480	1.097	947.84	/
GFSK	ANT2	2402	1.101	946.19	/
		2441	1.099	952.31	/
		2480	1.095	966.17	/

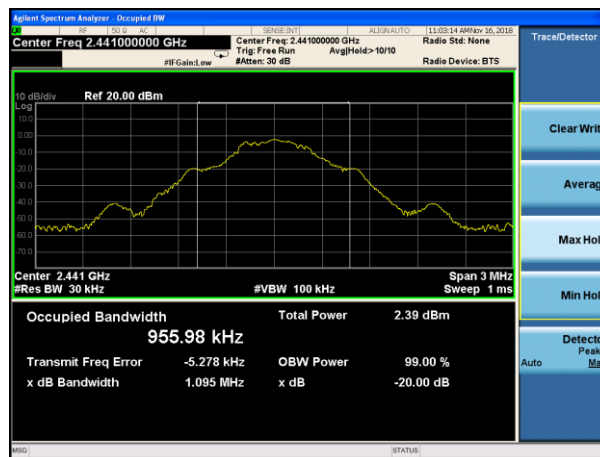
Note: 1. The test results are listed in next pages.

ANT1:

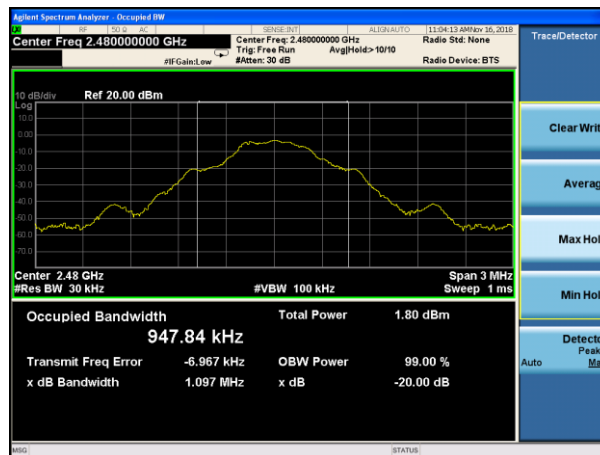
Frequency: 2402MHz



Frequency: 2441MHz

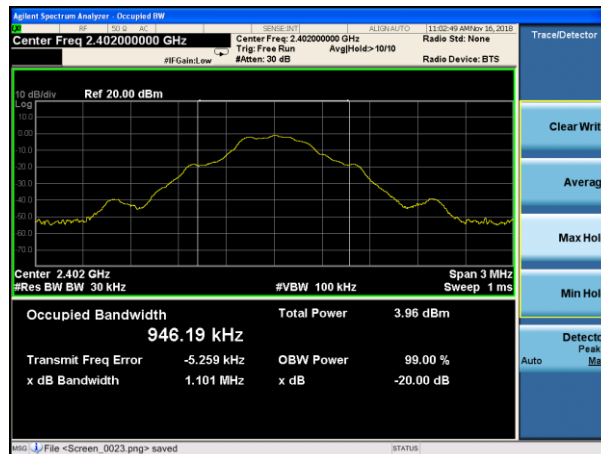


Frequency: 2480MHz

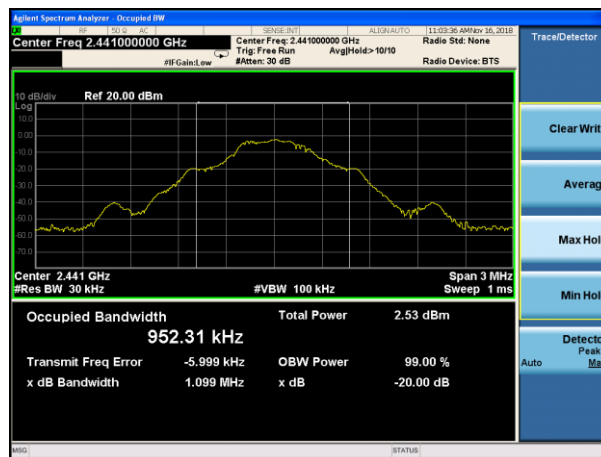


ANT2:

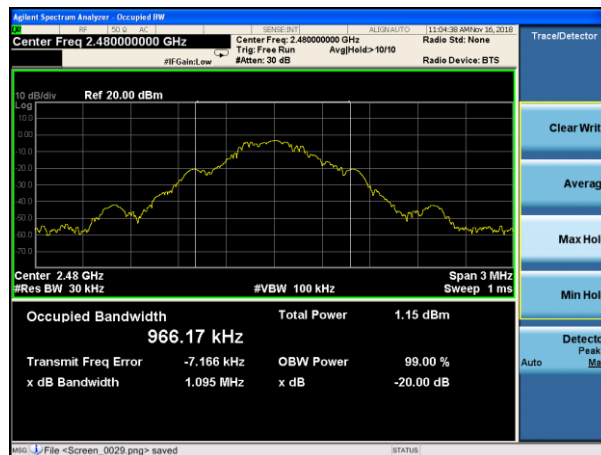
Frequency: 2402MHz



Frequency: 2441MHz



Frequency: 2480MHz



7. ANTENNA REQUIREMENT

7.1. Standard Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

7.2. Antenna Connected Construction

The directional gains of antenna used for transmitting is 0dBi, and the antenna is fixed antenna no consideration of replacement. Please see EUT photo for details.

7.3. Results

The EUT antenna is Ceramics Antenna. It complies with the standard requirement.

8. PHOTOGRAPH

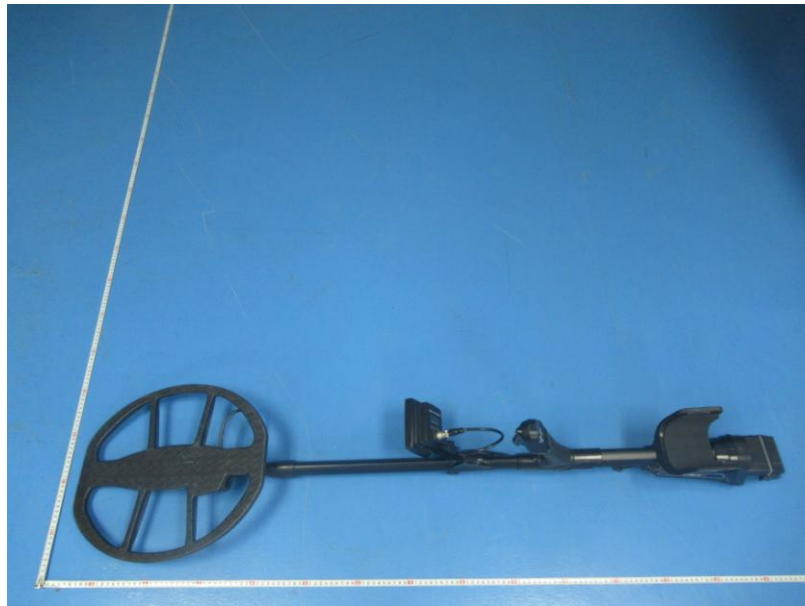
8.1.Photos of Radiated Emission Test



8.2.Photos of Power Line Conducted Emission Test



9. PHOTOS OF THE EUT



----END OF REPORT----