FCC TEST REPORT

for

Onyx Beacon SRL.

Onyx Beacon

Model Number: S1501

FCC ID: 2ACG4S1501

Prepared for	:	Onyx Beacon SRL.
Address	:	Str. Onisifor Ghibu Nr. 1, Cluj-Napoca, Cluj,400185, Romania
Prepared by	:	Keyway Testing Technology Co., Ltd.
Address	:	Baishun Industrial Zone, Zhangmutou Town, Dongguan, Guangdong, China

Report No.	**:**	14KWE051372F
Date of Test	**:**	May 16~ 20, 2014
Date of Report	**:**	May 21, 2014

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Keyway Testing Technology Co., Ltd.

Applicant: **Address:**	Onyx Beacon SRL. Str. Onisifor Ghibu Nr. 1, Cluj-Napoca, Cluj,400185, Romania		
Manufacturer: **Address:**	Onyx Beacon SRL. Str. Onisifor Ghibu Nr. 1, Cluj-Napoca, Cluj,400185, Romania		
E.U.T:	Onyx Beacon		
Model Number:	S1501		
Trade Name:	Onyx Beacon	**Serial No.:**	------
Date of Receipt:	May 16, 2014	**Date of Test:**	May 16~ 20, 2014
Test Specification:	FCC Part 15, Subpart C: Oct. 1, 2013 ANSI C63.4:2009		
Test Result:	The equipment under test was found to be compliance with the requirements of the standards applied. **Issue Date: May 21, 2014**		

Tested by:	Reviewed by:	Approved by:
Andy Gao / Engineer	Jade Yang/ Supervisor	Chris Du / Manager

Other Aspects:

None.

Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested

1. TEST SUMMARY

Test Items	Test Requirement	Uncertainty	Result
Conducted Emissions	15.207 ANSI C63.4	±2.6dB	N/A
Radiated Emissions	15.209 15.249 ANSI C63.4	±3.6dB	PASS
20dB Bandwidth	15.249 ANSI C63.4	±1kHz	PASS
Band Edge Compliance Test	15.249 ANSI C63.4	±3.6dB	PASS
Antenna Requirement	15.203 ANSI C63.4	/	PASS

Note：N/A means not applicable.

2.GENERAL PRODUCT INFORMATION

2.1. Product Function

Refer to Technical Construction Form and User Manual.

2.2. Description of Device (EUT)

Description:	Onyx Beacon
M/N:	S1501
Operation Frequency:	2402~2480MHz
Channel numbers:	79
Channel separation:	1M
Modulation Technology:	GFSK, Pi/4DQPSK, 8-DQPSK
Antenna Type:	PCB antenna
Antenna Gain:	0dBi
Power Supply:	DC 3V (CR2032)

2.3. Independent Operation Modes

The basic operation modes are:

2.3.1. EUT work continues TX mode and frequency as below:

Channel	Frequency
Low	2402MHz
Middle	2441MHz
High	2480MHz

2.4. Difference between Model Numbers

None.

2.5. Test Supporting System

None.

3. TEST SITES

3.1. Test Facilities

Lab Qualifications : 944 Shielded Room built by ETS-Lindgren, USA
Date of completion: March 28, 2011

966 Chamber built by ETS-Lindgren, USA
Date of completion: March 28, 2011

Certificated by TUV Rheinland, Germany.
Registration No.: UA 50207153
Date of registration: July 13, 2011

Certificated by UL, USA
Registration No.: 100567-237
Date of registration: September 1, 2011

Certificated by Intertek
Registration No.: 2011-RTL-L1-31
Date of registration: October 11, 2011

Certificated by Industry Canada
Registration No.: 9868A
Date of registration: December 8, 2011

Certificated by FCC, USA
Registration No.: 370994
Date of registration: February 21, 2012

Certificated by CNAS China
Registration No.: CNAS L5783
Date of registration: August 8, 2012

Name of Firm : Keyway Testing Technology Co., Ltd.

Site Location : Baishun Industrial Zone, Zhangmutou Town,
Dongguan, Guangdong, China

3.2. List of Test and Measurement Instruments

3.2.1. For radiated emission, band edge, 20dB bandwidth test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 27,14	Apr. 27,15
Bilog Antenna	ETS-LINDGREN	3142D	00135452	Apr. 27,14	Apr. 27,15
Horn Antenna	DAZE	ZN30701	11003	Apr. 27,14	Apr. 27,15
Horn Antenna	SCHWARZBECK	BBHA9170	9170-068	Apr. 27,14	Apr. 27,15
Spectrum Analyzer	Agilent	8593E	3911A04271	Apr. 27,14	Apr. 27,15
Spectrum Analyzer	Agilent	E4408B	MY44211125	Apr. 27,14	Apr. 27,15
Spectrum Analyzer	Rohde&Schwarz	FSP	100394	Apr. 29,14	Apr. 29,15
3m Semi-anechoic Chamber	ETS-LINDGREN	966	KW01	Apr. 27,14	Apr. 27,15
Signal Amplifier	DAZE	ZN3380C	11001	Apr. 27,14	Apr. 27,15
Signal Amplifier	Agilent	8449B	3008A00251	Apr. 27,14	Apr. 27,15
High Pass filter	Micro	HPM50111	324216	Apr. 27,14	Apr. 27,15
Power Meter	R&S	NRVS	101824	Apr. 29,14	Apr. 29,15
Peak and Avg Power Sensor	Rohde&Schwarz	URV5-Z7	100655	Apr. 29,14	Apr. 29,15
RF Cable	IMRO	IMRO-400	966 Cable 1#	Apr. 27,14	Apr. 27,15
MULTI-DEVICE Controller	ETS-LINDGREN	2090	126913	N/A	N/A
Antenna Holder	ETS-LINDGREN	2070B	00109601	N/A	N/A

4. TEST SET-UP AND OPERATION MODES

4.1. Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the Operating Instructions.

4.2. Block Diagram of Test Set-up

System Diagram of Connections between EUT and Simulators

EUT

(EUT: Onyx Beacon)

Note: By preliminary testing three modulation of EUT transmitted status, it was found that “GFSK” modulation was the worst, then the final test was executed the worst condition and test data were recorded in this report. Test data as below.

For all test used new battery.

Frequency (MHz)	Axis	Field Strength (dBuV/m)	Antenna Polarization
2402	GFSK	103.4	Horizontal
2402	Pi/4DQPSK	99.27	Horizontal
2402	8-DQPSK	100.38	Horizontal

4.3. Test Operation Mode and Test Software

None.

4.4. Special Accessories and Auxiliary Equipment

None.

4.5. Countermeasures to Achieve EMC Compliance

None.

5. EMISSION TEST RESULTS

5.1. Radiated Emission Test

5.1.1. Limit 15.209 limits

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μV/m	dB(μV)/m
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	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

5.1.2. Fundamental and harmonics emission limits

Fundamental Frequency	Field Strength of Fundamental		Field Strength of Harmonics	
	mV/m	dBuV/m	uV/m	dBuV/m
902~928 MHz	50	94	500	54
2400~2483.5 MHz	50	94	500	54
5725~5875MHz	50	94	500	54
24.0~24.25GHz	250	108	2500	68

5.1.3. Restricted bands of operation

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

5.1.4. Test setup

The EUT was placed on a turn table which was 0.8 m above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

The EUT was tested in the Chamber Site. It was pre-scanned with a Peak detector from the spectrum, and all the final readings from the test receiver were measured with the Quasi-Peak detector.

The bandwidth of the EMI test receiver is set at 120kHz for frequency range from 30MHz to 1000 MHz.

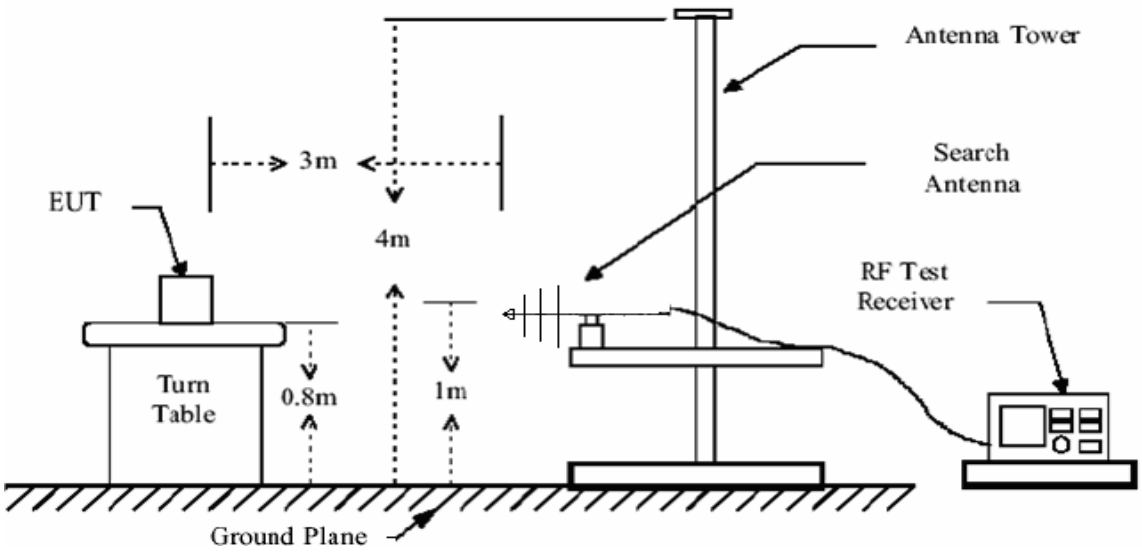
The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz.

By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "Y axis" position was the worst, then the final test was executed the worst condition and test data were recorded in this report.

The frequency range from 30MHz to 10th harmonic (25GHz) are checked. and no any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

The test data of the worst case condition(s) was reported on the following pages.
Notes: 1. Emission Level = Antenna Factor + Cable Loss + Meter Reading-Preamp Factor.

2. Measurement Uncertainty: ±3.6 dB at a level of confidence of 95%.



Below 1GHz
Horizontal

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	59.10	31.35	36.76	0.75	7.44	13.60	40.00	-26.40	QP
2	248.25	30.96	34.11	1.70	12.85	17.70	46.00	-28.30	QP
3	481.05	30.59	36.43	2.77	18.40	27.01	46.00	-18.99	QP
4	626.55	30.69	41.93	3.47	21.31	36.02	46.00	-9.98	QP
5	675.05	30.77	39.79	3.69	22.00	34.71	46.00	-11.29	QP
6	769.14	30.64	38.50	4.21	22.72	34.79	46.00	-11.21	QP

Vertical

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	44.55	31.40	50.63	0.56	11.03	30.82	40.00	-9.18	QP
2	267.65	30.95	44.06	1.78	12.97	27.86	46.00	-18.14	QP
3	493.66	30.59	41.81	2.77	18.60	32.59	46.00	-13.41	QP
4	626.55	30.69	39.90	3.47	21.31	33.99	46.00	-12.01	QP
5	675.05	30.77	39.12	3.69	22.00	34.04	46.00	-11.96	QP
6	720.64	30.65	38.34	3.96	22.48	34.13	46.00	-11.87	QP

Above 1Hz
GFSK 2402MHz Horizontal

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2402.00	26.32	78.53	7.34	28.72	88.27	94.00	-5.73	Average
2	2402.00	26.32	93.66	7.34	28.72	103.40	114.00	-10.60	Peak
3	4804.00	27.49	31.21	11.96	32.94	48.62	74.00	-25.38	Peak
4	6950.00	27.89	17.97	16.60	37.07	43.75	74.00	-30.25	Peak
5	8820.00	28.34	15.63	16.84	37.18	41.31	74.00	-32.69	Peak
6	14719.00	29.51	14.30	19.83	39.69	44.31	74.00	-29.69	Peak

GFSK 2402MHz Vertical

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2402.00	26.32	79.13	7.34	28.72	88.87	94.00	-5.13	Average
2	2402.00	26.32	88.94	7.34	28.72	98.68	114.00	-15.32	Peak
3	4804.00	27.49	30.53	11.96	32.94	47.94	74.00	-26.06	Peak
4	6491.00	27.80	17.09	16.60	35.88	41.77	74.00	-32.23	Peak
5	8344.00	28.20	16.88	16.73	36.68	42.09	74.00	-31.91	Peak
6	12951.00	29.19	15.15	18.17	40.58	44.71	74.00	-29.29	Peak

GFSK 2441MHz Horizontal

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2441.00	26.33	78.82	7.48	28.76	88.73	94.00	-5.27	Average
2	2441.00	26.33	88.37	7.48	28.76	98.28	114.00	-15.72	Peak
3	4880.00	27.53	30.95	12.14	33.11	48.67	74.00	-25.33	Peak
4	9279.00	28.51	16.96	16.90	37.73	43.08	74.00	-30.92	Peak
5	12169.00	29.03	16.58	17.52	39.43	44.50	74.00	-29.50	Peak
6	14855.00	29.53	16.76	19.91	39.13	46.27	74.00	-27.73	Peak

GFSK 2441MHz Vertical

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2441.00	26.33	78.68	7.48	28.76	88.59	94.00	-5.41	Average
2	2441.00	26.33	89.00	7.48	28.76	98.91	114.00	-15.09	Peak
3	4880.00	27.53	30.34	12.14	33.11	48.06	74.00	-25.94	Peak
4	7341.00	27.97	16.69	16.62	37.34	42.68	74.00	-31.32	Peak
5	10146.00	28.82	18.45	16.99	38.64	45.26	74.00	-28.74	Peak
6	12237.00	29.05	19.77	17.56	39.45	47.73	74.00	-26.27	Peak

GFSK 2480MHz Horizontal

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2480.00	26.34	79.19	7.57	28.79	89.21	94.00	-4.79	Average
2	2480.00	26.34	88.64	7.57	28.79	98.66	114.00	-15.34	Peak
3	4960.00	27.58	30.85	12.36	33.32	48.95	74.00	-25.05	Peak
4	7358.00	27.97	15.76	16.62	37.34	41.75	74.00	-32.25	Peak
5	10911.00	28.89	14.63	17.15	39.45	42.34	74.00	-31.66	Peak
6	14226.00	29.43	11.84	19.51	42.20	44.12	74.00	-29.88	Peak

GFSK 2480MHz Vertical

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2480.00	26.34	79.52	7.57	28.79	89.54	94.00	-4.46	Average
2	2480.00	26.34	88.64	7.57	28.79	98.66	114.00	-15.34	Peak
3	4960.00	27.58	30.46	12.36	33.32	48.56	74.00	-25.44	Peak
4	7460.00	27.99	17.72	16.62	37.39	43.74	74.00	-30.26	Peak
5	11132.00	28.91	15.55	17.19	39.61	43.44	74.00	-30.56	Peak
6	13818.00	29.36	10.96	19.14	43.32	44.06	74.00	-29.94	Peak

6. 20DB OCCUPY BANDWIDTH

6.1. Limits

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

6.2. Test setup

1. Set the RBW =30kHz.
2. Set the VBW = 100kHz
3. Span=2.5MHz
4. Detector = peak.
5. Sweep time = auto couple.
6. Allow trace to fully stabilize ,and view the plot.
7. Measure and record the result in the test report.

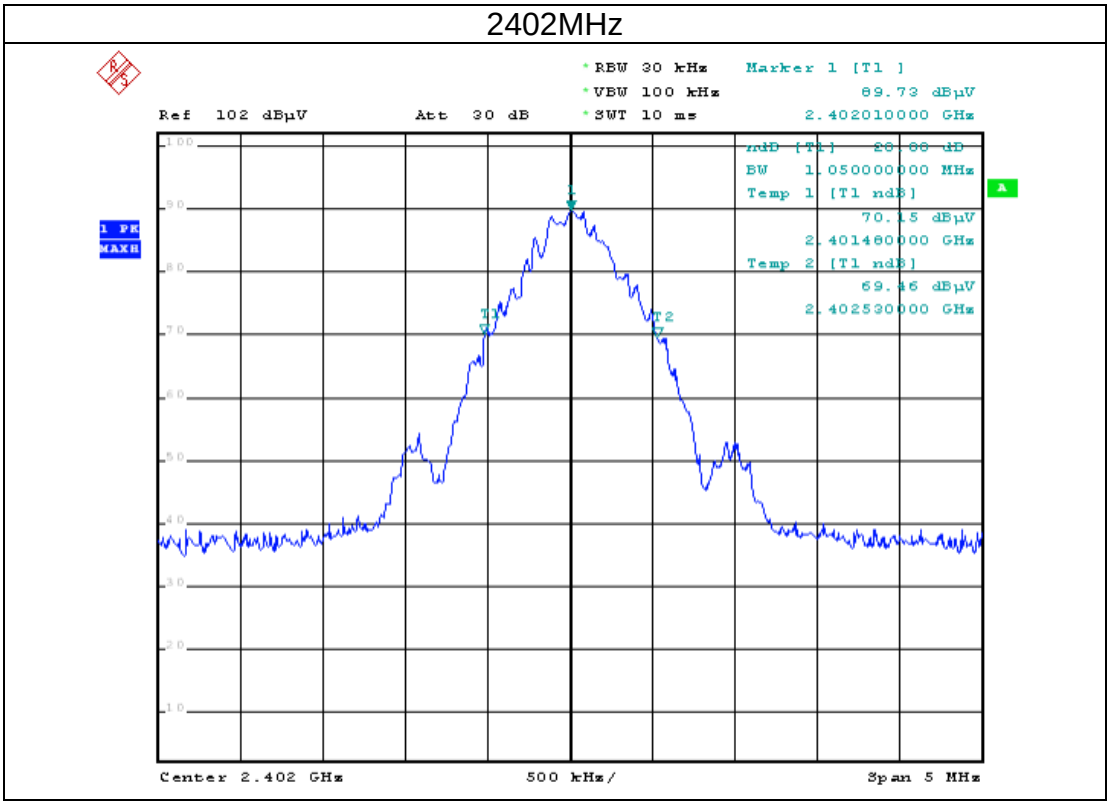
For pretest, the worst mode was GFSK, the data only show the GFSK mode.

Test data:

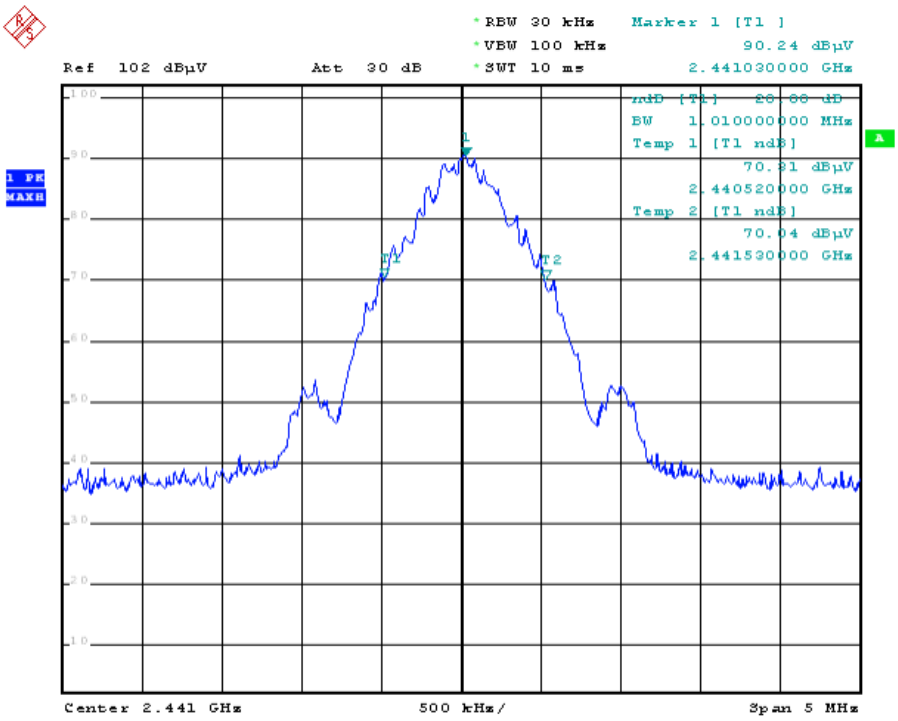
Channel Frequency (MHz)	20dB Bandwidth (MHz)	Limit (MHz)
2402	1.05	N/A
2441	1.01	N/A
2480	0.98	N/A

Test plot as follows:

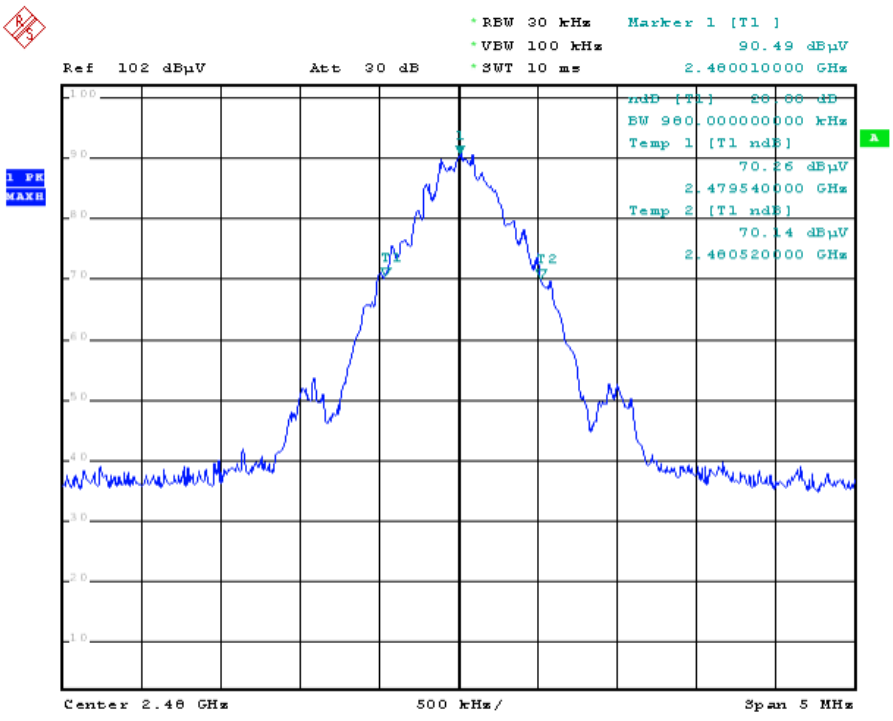
2402MHz



2441MHz



2480MHz



7. BAND EDGE COMPLIANCE TEST

7.1. Limits

All the lower and upper band-edges emissions appearing within 2310MHz to 2390MHz and 2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation frequency band 2400MHz to 2483.5MHz shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

7.2. Test setup

The EUT was placed on a turn table which was 0.8 m above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure.
For pretest, the worst mode was GFSK, the data only show the GFSK mode.

Note: If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

For radiated test as follows:

Unhopping

	Frequency (MHz)	Antenna polarization (H/V)	Emission (dBuV/m)	Band edge Limit (dBuV/m)	
			PK	PK	AV
GFSK	<2400	H	50.34	74.00	54.00
	<2400	V	49.78	74.00	54.00
	>2483.5	H	50.28	74.00	54.00
	>2483.5	V	50.16	74.00	54.00

Hopping

	Frequency (MHz)	Antenna polarization (H/V)	Emission (dBuV/m)	Band edge Limit (dBuV/m)	
			PK	PK	AV
GFSK	<2400	H	50.76	74.00	54.00
	<2400	V	50.04	74.00	54.00
	>2483.5	H	50.81	74.00	54.00
	>2483.5	V	50.11	74.00	54.00

8. ANTENNA REQUIREMENT:

Standard requirement:	FCC Part15 C Section 15.203 /249(c)
15.203 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, 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. 15.249 requirement: Antenna gain must be at least 33 dBi. Alternatively, the main lobe beamwidth must not exceed 3.5 degrees. The beamwidth limit shall apply to both the azimuth and elevation planes. At antenna gains over 33 dBi or beamwidths narrower than 3.5 degrees, power must be reduced to ensure that the field strength does not exceed 2500 millivolts/meter.	
E.U.T Antenna:	
The antenna is PCB antenna, the best case gain of the antenna is 0dBi	

9. PHOTOGRAPHS OF TEST SET-UP

Please see annex.

10. PHOTOGRAPHS OF THE EUT

Please see annex.

END