Korea Technology Institute Co., Ltd.

Test Report

Test Report No.:	**KTI13EF04001**		
Registration No.:	**99058**		
Applicant:	**ROBOTIS**		
Applicant Address:	**#1505,1506, Ace High End Tower No.3, 371-50 Gasandong Geumcheongu, Seoul, Korea**		
Product:	**Bluetooth**		
FCC ID:	**SOD-BT-210**	**Model No.**	**BT-210**
Receipt No.:	**13-04002**	**Date of receipt:**	**Apr 03, 2013**
Date of Issue:	**Apr 23, 2013**		
Testing location	**Korea Technology Institute Co., Ltd. 51-19, Sanglim3-Ri, Docheok-Myeon, Gwangju-Si, Gyeonggi-Do, Korea**		
Test Standards:	**FCC/ANSI. C63.4: 2003**		
Rule Parts: FCC	**Part 15.247 Subpart C, ANSI C 63.4-2003**		
Method of Measurement	**FCC Public Notice DA 00-705**		
Test Result:	**The above-mentioned product has been tested with compliance.**		

Tested by: T. J. Kim
/ Engineer

Signature Date Apr 23, 2013

Approved by: S. H. Song
/Technical Manager

Signature Date Apr 23, 2013

Other Aspects:	
Abbreviations:	*** OK, Pass=passed * Fail=failed * N/A=not applicable**

☞ **- This test report is not permitted to copy partly without our permission.**

- This test result is dependent on only equipment to be used.

- This test result is based on a single evaluation of one sample of the above mentioned.

- This test report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S Government.

- We certify this test report has been based on the measurement standards that is traceable to the national or international standards.

≫≫ Contents ≪≪

1. Verification of compliance

Applicant : ROBOTIS

Address : #1505,1506, Ace High End Tower No.3, 371-50 Gasandong Geumcheongu, Seoul, Korea

FCC ID : SOD-BT-210

Model Name : BT-210

Brand Name : ROBOTIS

Serial Number : N/A

Date : April 08, 2013

Equipment Class	DSS – PART 15 SPREAD SPETRUM TRANSMITTER
Kind of Equipment	Bluetooth
Measurement Procedures	FCC Public Notice DA 00-705, ANSI C63.4-2003,
Type of Equipment Tested	Pre-Production
Kind of Equipment Authorization Requested	Certification
Equipment Will Be Operated Under FCC Rules Part(s)	FCC PART 15 SUBPART C Section 15.247
Modifications On The Equipment To Achieve Compliance	None
Final Test was Conducted On	10m Open area test site

- The above equipment was tested by Korea Technology Institute Co., Ltd. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanation from equipment are within the compliance requirements.

2. General Information

2.1 Product Description

The ROBOTIS Model BT-210 (referred to as the EUT in this report) is used to remote Toys controller which has a function of Bluetooth. The product specification described herein was obtained from product data sheet or user's manual.

Equipment Name	Bluetooth
Operating Frequency	2402 MHz ~ 2480 MHz
RF Output Power	8.00 dBm
Number of Channel	79 Channels
Mode of Operation	Duplex
Modulation Type	GFSK
Antenna Type / Gain	SMD Chip Antenna / 2.69 dBi (Max)
List of Each OSC. Or Crystal. Freq.	26 MHz
Rated Supply Voltage	DC 3.3 V

3. EUT MODIFICATION

- NONE.

4. Information about the FHSS characteristics

4.1 Pseudorandom frequency hopping sequence

The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF Channels. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master; the phase in the hopping sequence is determined by the Bluetooth clock of the master. The channel is divided into time slots where each slot corresponds to an RF hop frequency. Consecutive hops correspond to different RF hop frequencies. The nominal hop rate is 1600 hops/s.

Example of a 79 hopping sequence in data mode: 40, 21, 44, 23, 42, 53, 46, 55, 48, 33, 52, 35, 50, 65, 54…

4.2 Equal Hopping Frequency Use

All Bluetooth units participating in the piconet are time and hop-synchronized to the channel.

4.3 System Receiver Input Bandwidth

The input bandwidth of the receiver is 1 MHz. In every connection one Bluetooth device is the master and the other one is slave. The aster determines the hopping sequence. The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally the type of connection (e.g. single multisport (packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also the slave of the connection will use these settings. Repeating of a packet has no influence on the hopping sequence.. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.

4.4 Equipment Description

15.247(g): In accordance with the Bluetooth Industry Standard, the system is designed to comply With all of The regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.

15.247(h): In accordance with the Bluetooth Industry Standard, the system does not coordinate it channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

5. Test Summary

5.1 Test Items and results

SECTION	TEST ITEMS	RESULT
15.247(a)(1)	Carrier Frequency Separation	Compliance
15.247(a)(1)	20 dB Bandwidth	Compliance
15.247(a)(1)(iii)	Minimum Number of Hopping Channels	Compliance
15.247(a)(1)(iii)	Average Time of Occupancy	Compliance
15.247(b)(1)	Maximum Peak Conducted Output Power	Compliance
15.247(c)	Band-edge	Compliance
15.205(a) 15.209 15.247(d)	Radiated Emissions	Compliance
15.207	Conducted Emission	Compliance
15.247(c)	Antenna Requirement	Compliance

Notes: Compliance/pass : The EUT complies with the essential requirements in the standard.

Not Compliance : The EUT does not comply with the essential requirements in the standard.

N/A : The test was not applicable in the standard.

5.2 Additions, deviations, exclusions from standard

No additions, deviations or exclusions have been made from standard.

5.3 Related Submittal(s) / Grant(s)

Original submittal only

5.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in section 2.1.

5.5 Test Methodology

The radiated testing was performed according to the procedures in ANSI C63.4:2003 at a distance of 3 m from EUT to the antenna

5.6 Test Facility

The open area test site and conducted measurement facilities are located on at 51-19, Sanglim3-Ri, Docheok-Myeon, Gwangju-Shi, Gyeonggi-Do, Korea

6. System test Configuration

6.1 Characteristics of equipment

This equipment is Bluetooth. The BT-210 is an UART serial module implementing Bluetooth communications standards. It's used for control the electric toy to mount the BT-210. Bluetooth chip Communication type is frequency hopping spread spectrum system(FHSS), and it support the EDR mode (Enhanced data rate), used frequency band is 2 402 ㎒ - 2 480 ㎒ Power source is supplied 3.3 Vdc.

6.2 Used Peripherals list

DEVICE TYPE	Manufacturer	Model	S/N
Notebook PC	SAMSUNG	NT-RV511-S16R	HHA793QB600206F
4G SmartPhone	LG	LG-F180L	212KPZK9198325
PC	Yeonil	EvoD5M	6F28KN8ZH110
Monitor	LG	M2362DL	0012KCLH3F288
Mouse	Microsoft	1113	X817159-004
Keyboard	GP Electronics	SWT1300	W5082CPAJB8C007576
Jig Board	N / A	N / A	-

6.3 Mode of operation during the test

For Bluetooth function testing, software used to control the EUT for staying in continuous transmitting and receiving mode is programmed. The EUT was set at Low Channel (2 402 MHz), Middle Channel (2 441 MHz), and High Channel (2 480 MHz) with each data transfer rate. To get a maximum radiated emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes and rotated. The worst data was recorded in this test report.

6.4 Uncertainty

1) Radiated disturbance

Uc (Combined standard Uncertainty) = ± 1.8dB

Expanded uncertainty U=KUc

K = 2

∴ U = ± 3.6dB

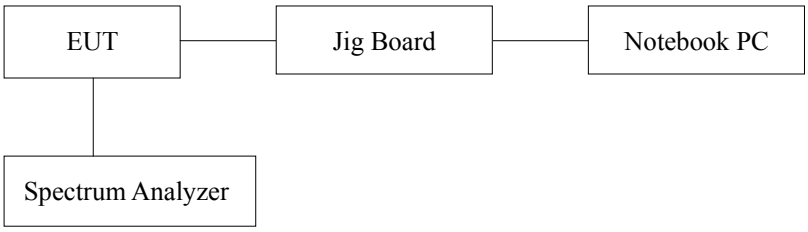
2) Conducted disturbance

Uc = ± 0.88dB

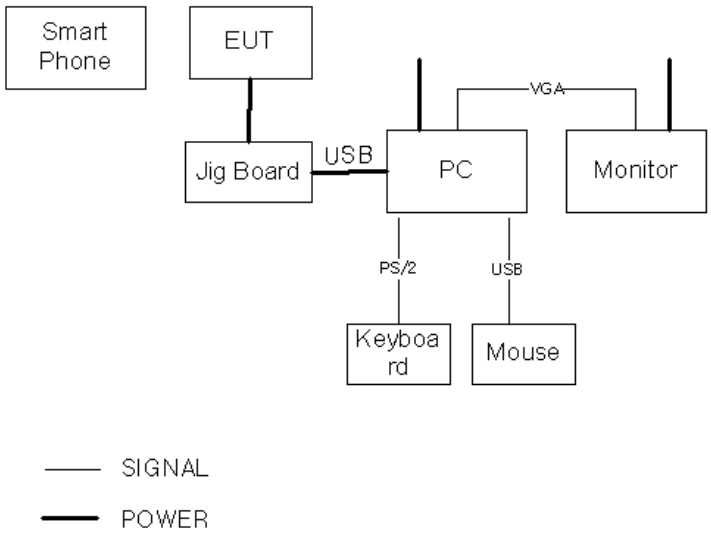
U = KUc=2 x Uc = ± 1.8dB

6.5 Test setup of EUT

6.5.1 Except Radiated Emissions and AC Conducted Emissions measurement, all measurements were taken in continuous transmit / receive mode using the TEST MODE.
For controlling the EUT as TEST MODE, the test program was provided by the applicant.
The jig board controlled EUT by Notebook PC in TEST MODE.



6.5.2 Radiated Emission and AC Conducted Emissions measurement setup



7. Measurement results

7.1 Carrier Frequency Separation

Temperature : 22℃

Relative Humidity : (40 - 42) % R.H.

Procedure

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled. After the trace being stable, the reading value between the peak of the adjacent channels using the marker-delta function was recorded as the measurement results.

The spectrum analyzer is set to:

Span = 3 MHz (wide enough to capture the peaks of two adjacent channels)

RBW = 30 kHz (1% of the span or more)

Sweep = auto

VBW = 30 kHz

Detector function = peak

Trace = max hold

Test equipment used

Model NO.	Mannufacturer	Description	S/N	Due to Cal. Date
8564E	H.P	Spectrum Analyzer	3745A01024	2014.04.03

Measurement Result

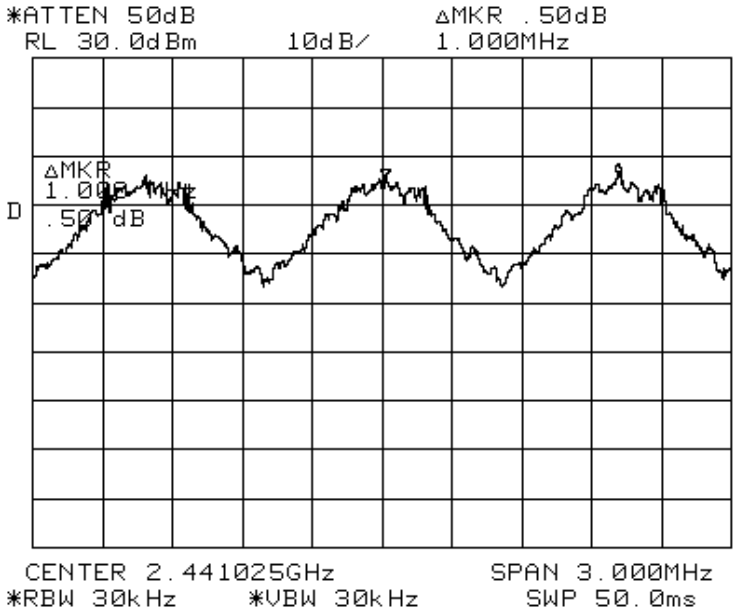
Mode	Frequency of marker #1 (MHz)	Frequency of marker #2 (MHz)	Test Results	
			Carrier Frequency Separation (MHz)	Results
BDR	2441.025	2442.025	1.000	Compliance
EDR	2441.025	2442.025	1.000	Compliance

- See next pages for actual measured spectrum plots.

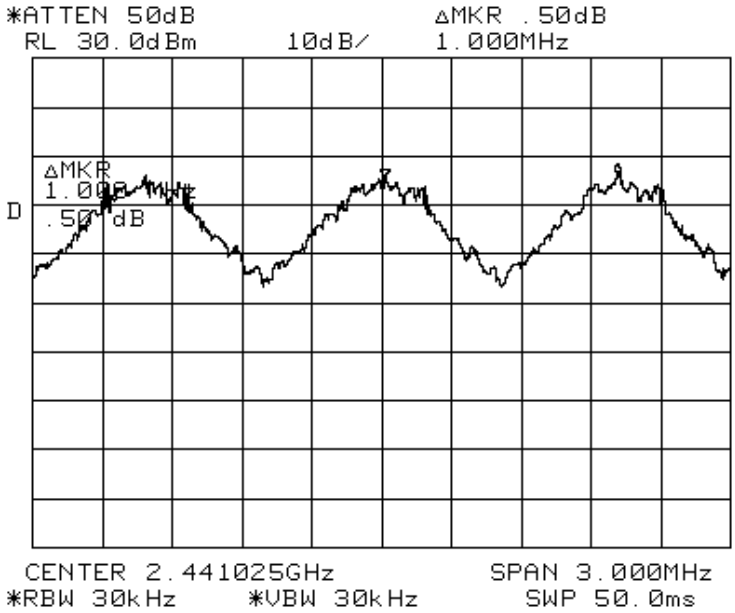
Minimum Standard:

The EUT shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

BDR Mode



EDR Mode



7.2 Number of Hopping Frequencies

Temperature : 22℃

Relative Humidity : (40 - 42) % R.H.

Procedure

The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled. To get higher resolution, four frequency ranges within the 2 400 ~ 2 482 MHz band were examined.

The spectrum analyzer is set to:

Frequency range 1: Start = 2 400 MHz, Stop = 2 450 MHz

2: Start = 2 450 MHz, Stop = 2 482 MHz

RBW = 100 kHz (1% of the span or more) Sweep = auto

VBW = 100 kHz (VBW ≥ RBW) Detector function = peak

Trace = max hold Span = 60 MHz, 24 MHz

Test equipment used

Model NO.	Mannufacturer	Description	S/N	Due to Cal. Date
ESCI	R&S	EMI RECEIVER	100025	2013.09.19

Measurement Data:

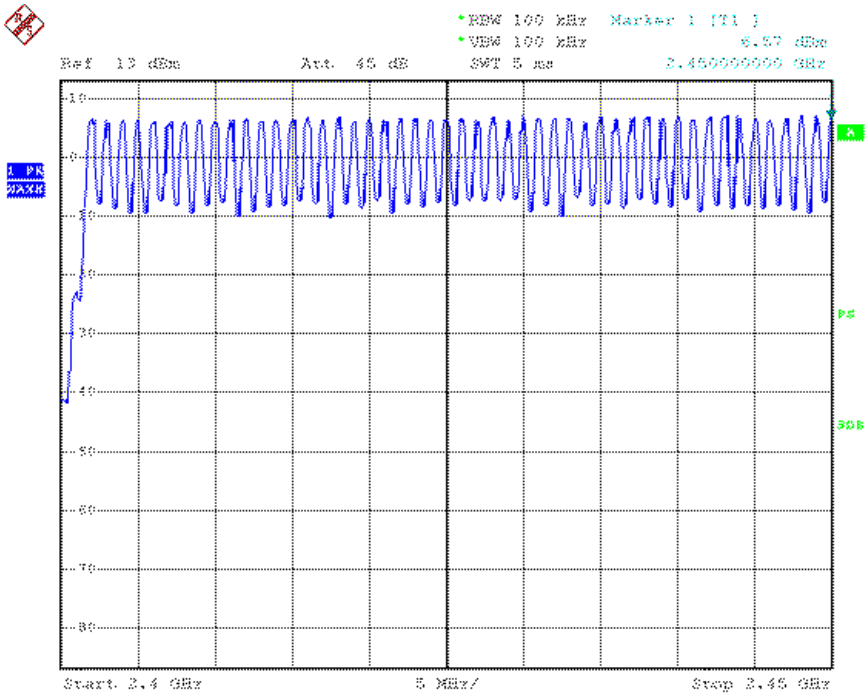
Mode	**Total number of Hopping Channels**	Result
BDR	**79**	Compliance
EDR	**79**	Compliance

-See next pages of actual measured spectrum plots.

Minimum Standard:

At least 15 hopes

BDR Mode



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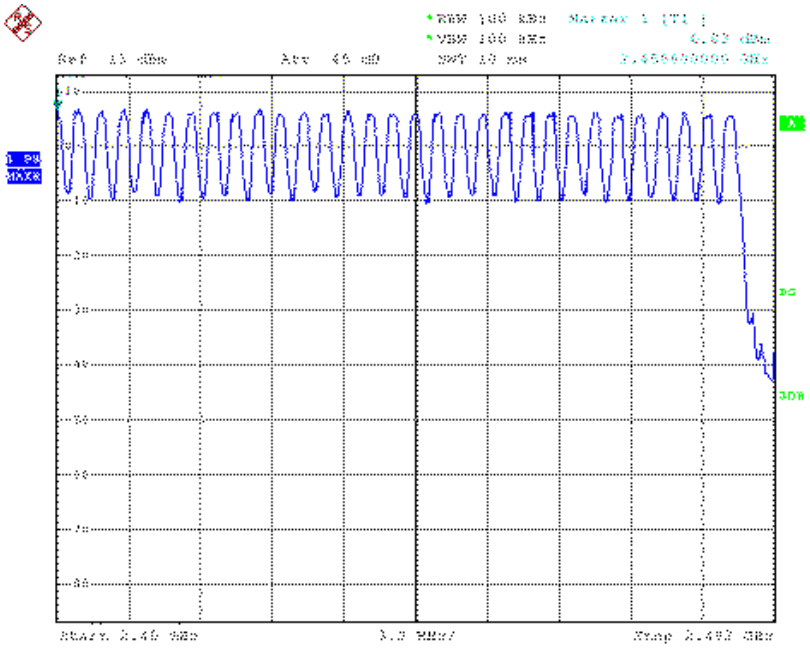

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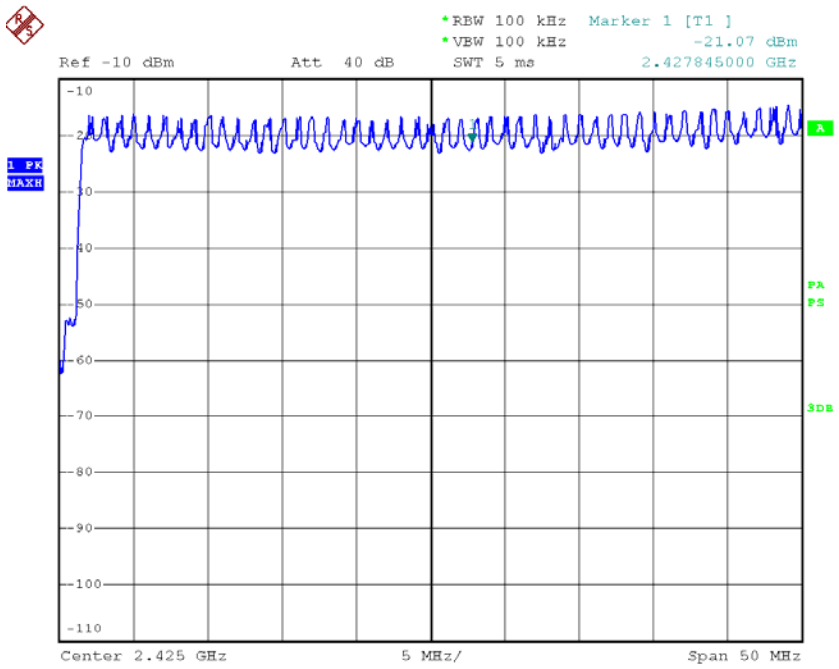
EDR Mode



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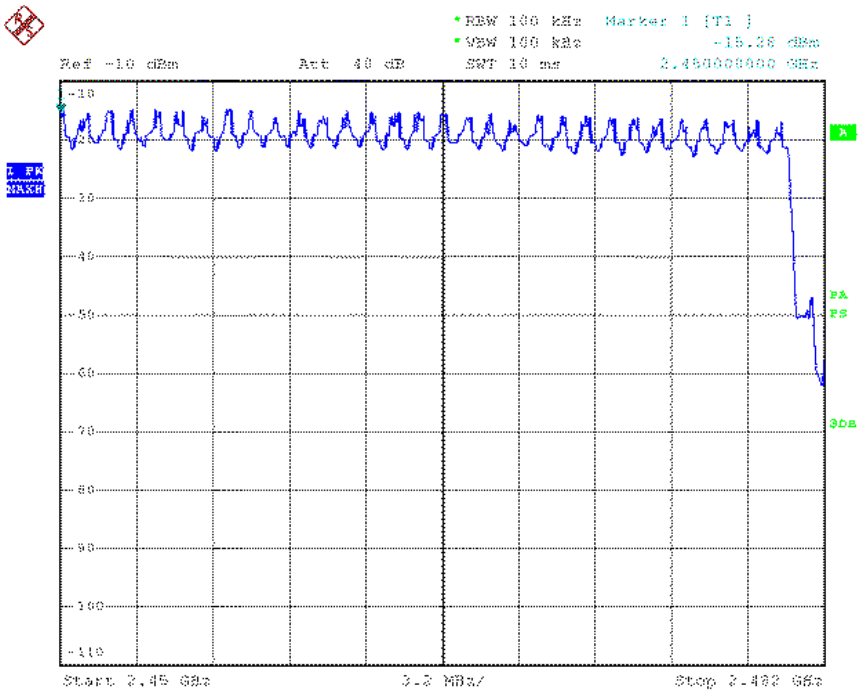


Date: 21.APR.2013 07:31:16

7.3 20 dB Bandwidth

Temperature : 23℃

Relative Humidity : (40 - 41) % R.H.

Procedure

The bandwidth at 20 dB below the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels. After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is) as close as possible to) even with the reference marker level. The marker-delta reading at this is the 20 dB bandwidth of the emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

Span = 2 MHz (approximately 2 or 3 times of the 20 dB bandwidth)

RBW = 10 kHz (1% of the 20dB bandwidth or more) Sweep = auto

VBW = 30 kHz (VBW ≥ RBW) Detector function = peak

Trace = max hold

Test equipment used

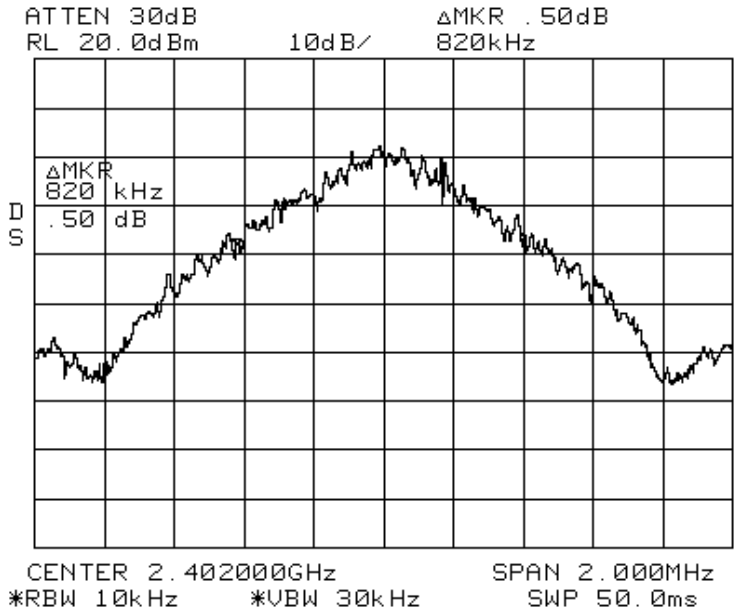
Model NO.	Mannufacturer	Description	S/N	Due to Cal. Date
8564E	H.P	Spectrum Analyzer	3745A01024	2014.04.03

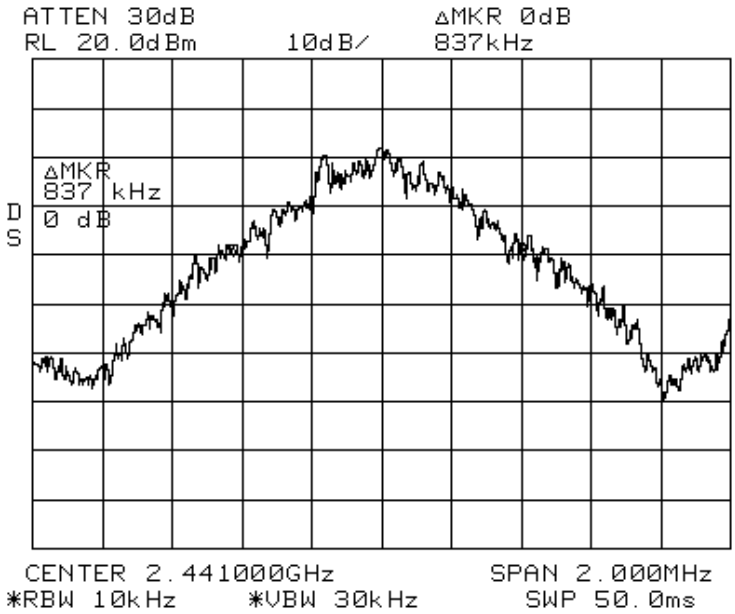
Measurement Data:

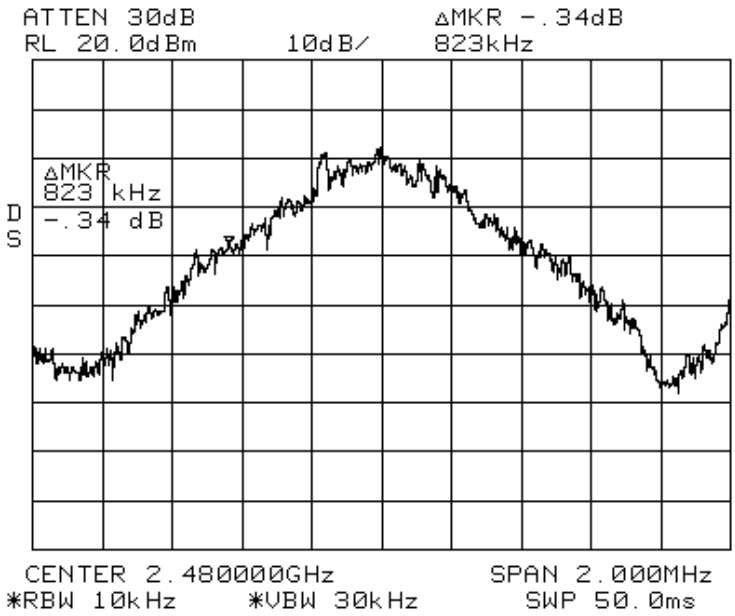
Mode	Frequency(MHz)	Channel No.	Test Results Measured Bandwidth (MHz)
BDR	**2402**	**1**	**0.82**
BDR	**2441**	**40**	**0.83**
BDR	**2480**	**79**	**0.82**
EDR	**2402**	**1**	**1.26**
EDR	**2441**	**40**	**1.26**
EDR	**2480**	**79**	**1.30**

- See next pages for actual measured spectrum plots.

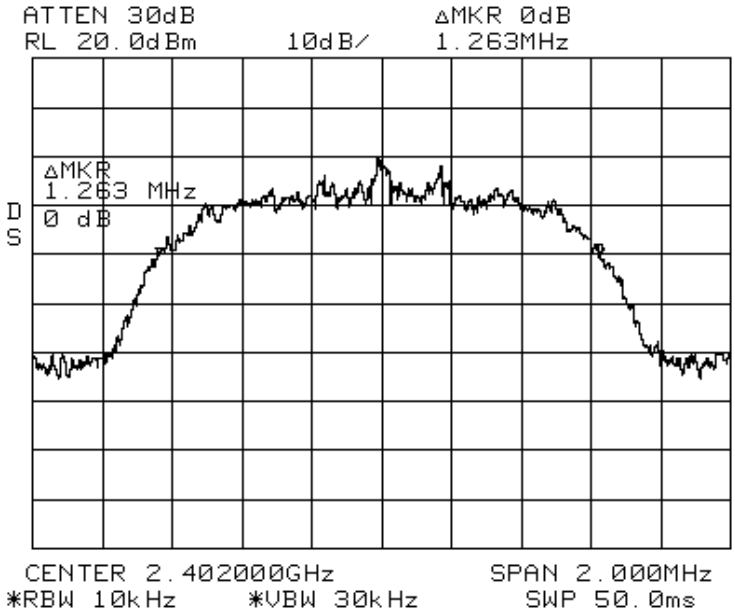
BDR Mode

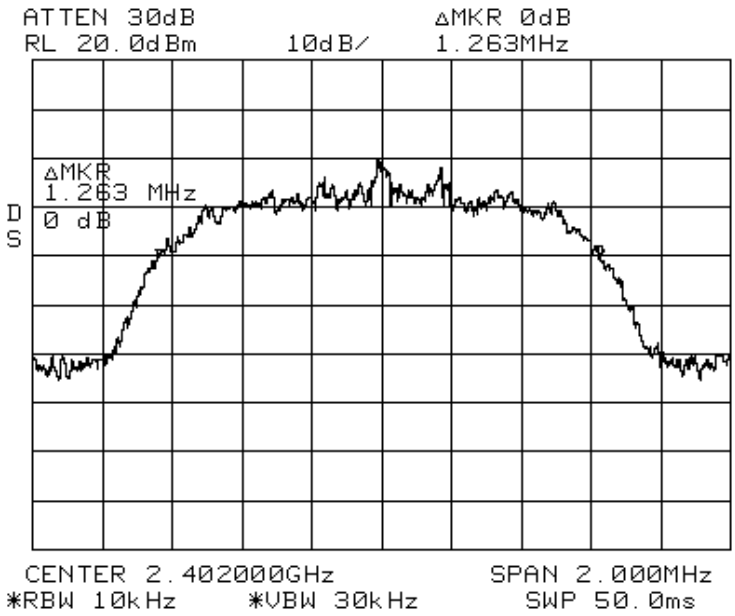

ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR .50dB
820kHz
ΔMKR
820 kHz
.50 dB
D
S
CENTER 2.402000GHz
SPAN 2.000MHz
*RBW 10kHz
*VBW 30kHz
SWP 50.0ms

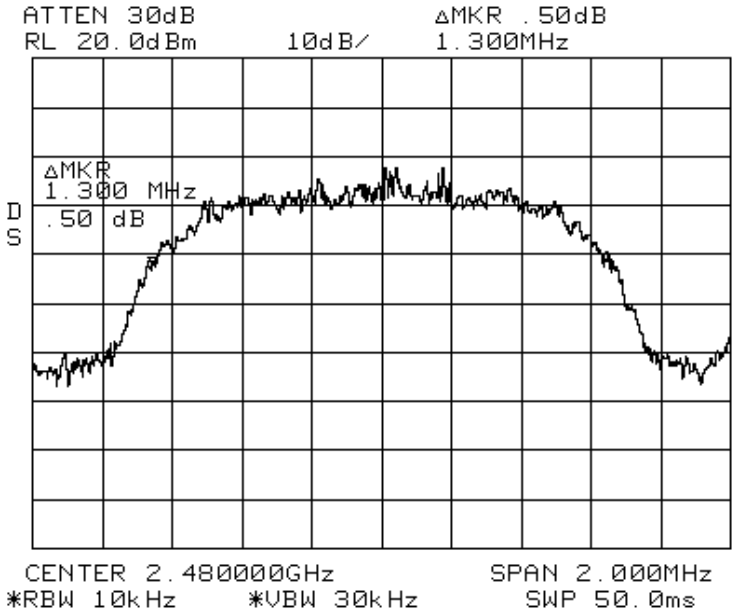

ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR 0dB
837kHz
ΔMKR
837 kHz
0 dB
D
S
CENTER 2.441000GHz
SPAN 2.000MHz
*RBW 10kHz
*VBW 30kHz
SWP 50.0ms


ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR -.34dB
823kHz
ΔMKR
823 kHz
-.34 dB
D
S
CENTER 2.480000GHz
SPAN 2.000MHz
*RBW 10kHz
*VBW 30kHz
SWP 50.0ms

EDR Mode


ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR 0dB
1.263MHz
ΔMKR
1.263 MHz
0 dB
D
S
CENTER 2.402000GHz
SPAN 2.000MHz
*RBW 10kHz
*VBW 30kHz
SWP 50.0ms


ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR 0dB
1.263MHz
ΔMKR
1.263 MHz
0 dB
D
S
CENTER 2.402000GHz
SPAN 2.000MHz
*RBW 10kHz
*VBW 30kHz
SWP 50.0ms


ATTEN 30dB
RL 20.0dBm
10dB/
ΔMKR .50dB
1.300MHz
ΔMKR
1.300 MHz
.50 dB
D
S
CENTER 2.480000GHz
SPAN 2.000MHz
*RBW 10kHz
*VBW 30kHz
SWP 50.0ms

7.4 Time of Occupancy (Dwell Time)

Temperature : 22℃

Relative Humidity : (40 - 42) % R.H

Procedure

The dwell time was measured with a spectrum analyzer connected to the terminal, while EUT had its hopping function enabled.

The spectrum analyzer is set to:

Center frequency = 2441 MHz Span = zero

RBW = 1 MHz VBW = 1 MHz (VBW ≥ RBW)

Trace = max hold Detector function = peak

Test equipment used

Model NO.	Mannufacturer	Description	S/N	Due to Cal. Date
ESCI	R&S	EMI RECEIVER	100025	2013.09.19

Measurement Data

Mode	Burst duration in one hop (ms)	Test Results	
		Dwell Time (ms)	Result
BDR	**2.912**	**931.52**	Compliance
EDR	**2.912**	**931.52**	Compliance

The system makes worst case 1 600 hops per second or 1 time slot has a length of 625μs with 79 channels. a one Packet need 1 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case 1600/2 = 800 hops per second with 79 channels. so have a each channel 800/79 = 10.13 times.

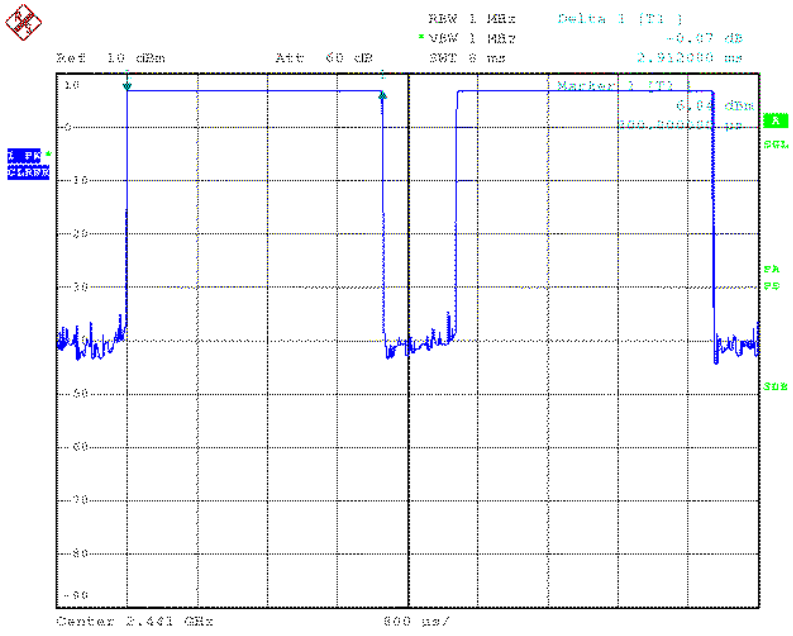
and a period of 0.4 seconds multiplies by the number of hopping channels employed.

- See next pages of actual measured spectrum plots.

Minimum Standard:

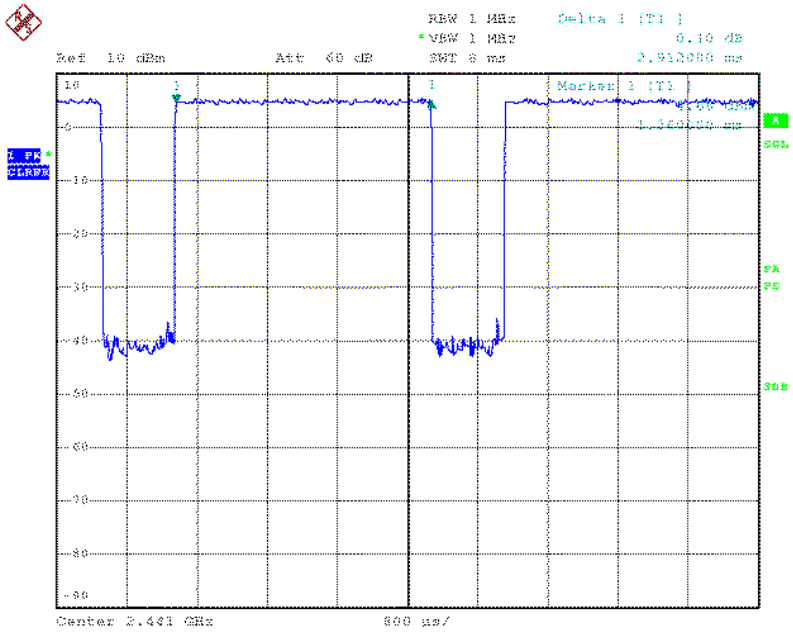
0.4 seconds within a 30 second period per any frequency

BDR Mode



Date: 8.APR.2013 07:09:08

EDR Mode



Date: 8.APR.2013 07:15:00

7.5 Peak Output Power

Temperature : 22℃

Relative Humidity : (40 - 42) % R.H

Procedure:

The peak output power was measured with a spectrum analyzer connected to the terminal, while EUT had its hopping function disable at the highest, middle and the lowest available channels.

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission.

The indicated level is the peak output power.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

Span = 5 MHz (approximately 5 times of the 20 dB bandwidth)

RBW = 1 MHz (greater than the 20dB bandwidth of the emission being measured)

VBW = 1 MHz (VBW ≥ RBW) Detector function = peak

Trace = max hold Sweep = auto

Test equipment used

Model NO.	Mannufacturer	Description	S/N	Due to Cal. Date
8564E	H.P	Spectrum Analyzer	3745A01024	2014.04.03

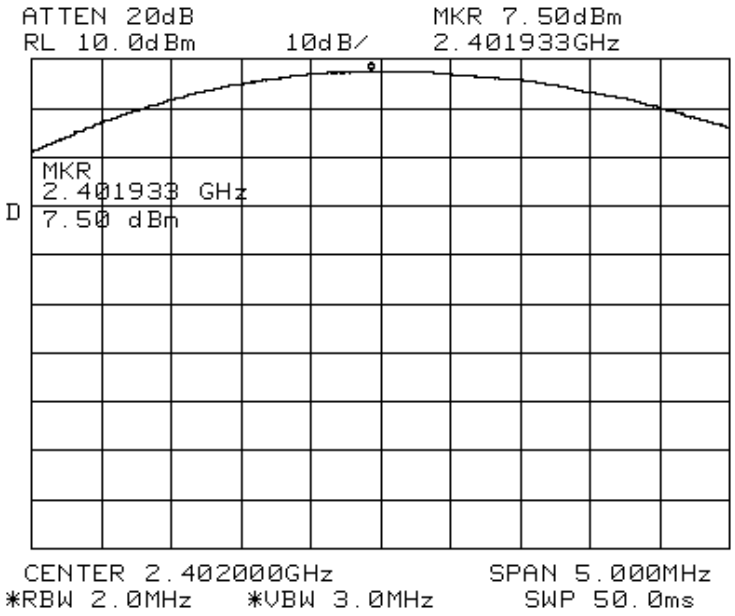
Measurement Data:

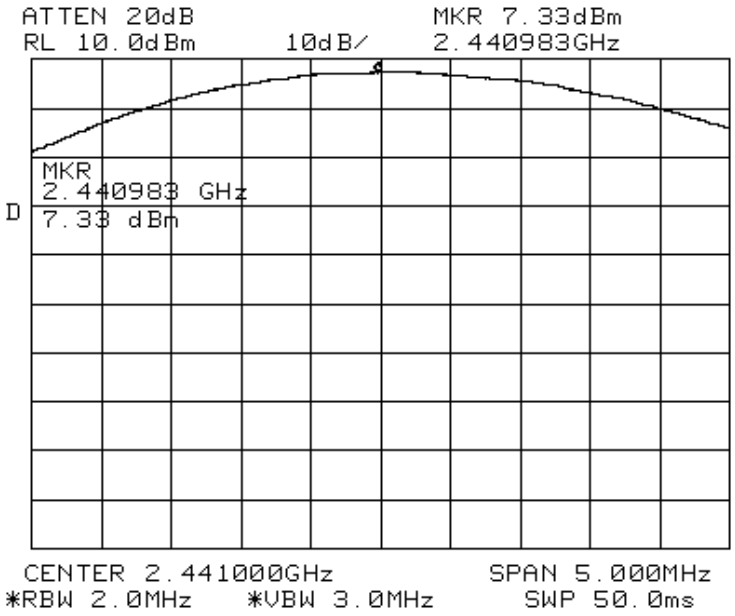
Mode	Frequency (MHz)	Ch.	Test Results		
			dBm	W	Result
BDR	2402	1	**7.50**	**0.0056**	Compliance
BDR	2441	40	**7.33**	**0.0054**	Compliance
BDR	2480	79	**8.00**	**0.0063**	Compliance
EDR	2402	1	**7.50**	**0.0056**	Compliance
EDR	2441	40	**7.33**	**0.0054**	Compliance
EDR	2480	79	**8.00**	**0.0063**	Compliance

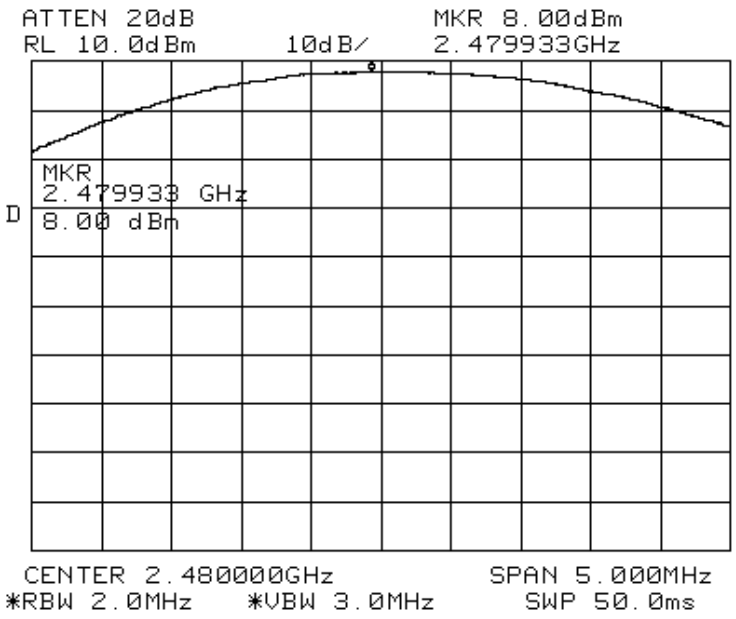
- See next pages of actual measured spectrum plots.

Minimum Standard:	< 1W

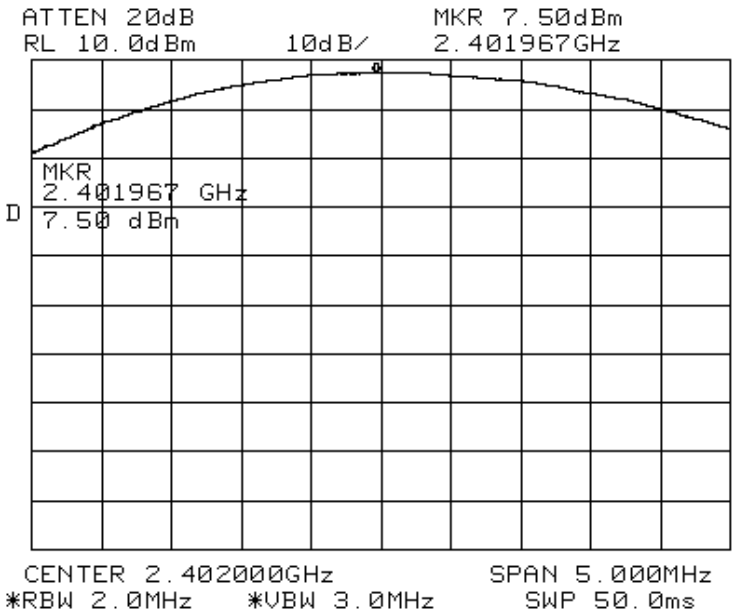
BDR Mode

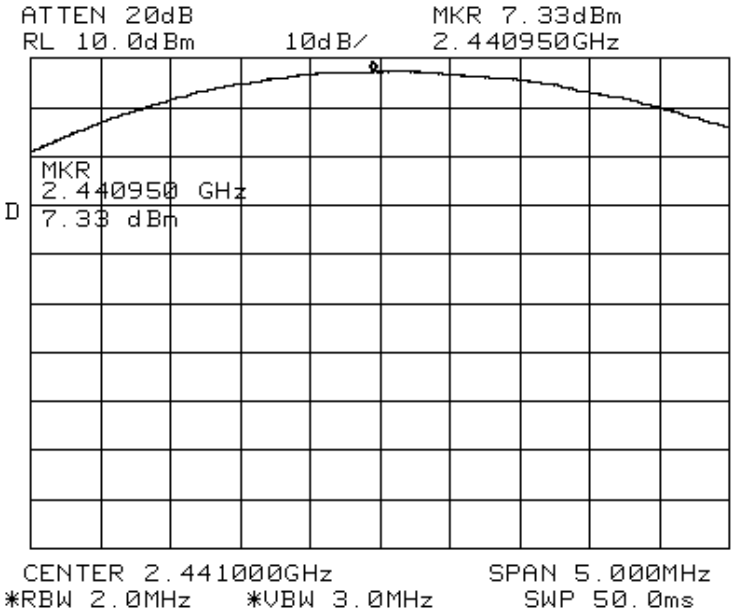

ATTEN 20dB
RL 10.0dBm
10dB/
MKR 7.50dBm
2.401933GHz
MKR
2.401933 GHz
D
7.50 dBm
CENTER 2.402000GHz
SPAN 5.000MHz
*RBW 2.0MHz
*VBW 3.0MHz
SWP 50.0ms

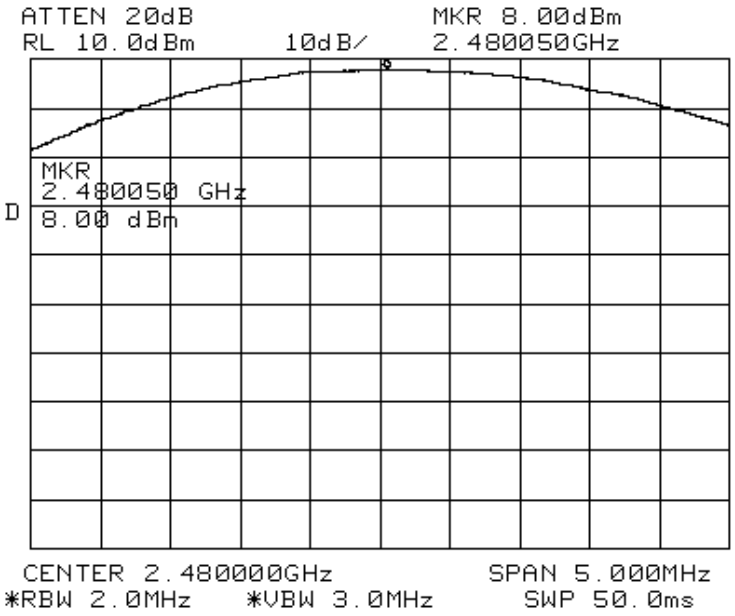

ATTEN 20dB
RL 10.0dBm
10dB/
MKR 7.33dBm
2.440983GHz
MKR
2.440983 GHz
D
7.33 dBm
CENTER 2.441000GHz
SPAN 5.000MHz
*RBW 2.0MHz
*VBW 3.0MHz
SWP 50.0ms


ATTEN 20dB
RL 10.0dBm
10dB/
MKR 8.00dBm
2.479933GHz
MKR
2.479933 GHz
8.00 dBm
D
CENTER 2.480000GHz
SPAN 5.000MHz
*RBW 2.0MHz
*VBW 3.0MHz
SWP 50.0ms

EDR Mode


ATTEN 20dB
RL 10.0dBm
10dB/
MKR 7.50dBm
2.401967GHz
MKR
2.401967 GHz
7.50 dBm
D
CENTER 2.402000GHz
SPAN 5.000MHz
*RBW 2.0MHz
*VBW 3.0MHz
SWP 50.0ms


ATTEN 20dB
RL 10.0dBm
10dB/
MKR 7.33dBm
2.440950GHz
MKR
2.440950 GHz
7.33 dBm
D
CENTER 2.441000GHz
SPAN 5.000MHz
*RBW 2.0MHz
*VBW 3.0MHz
SWP 50.0ms


ATTEN 20dB
RL 10.0dBm
10dB/
MKR 8.00dBm
2.480050GHz
MKR
2.480050 GHz
8.00 dBm
D
CENTER 2.480000GHz
SPAN 5.000MHz
*RBW 2.0MHz
*VBW 3.0MHz
SWP 50.0ms

7.6 Band – edge (at 20 dB below)

Temperature : 21℃

Relative Humidity : (40 - 42) % R.H

Procedure:

The bandwidth at 20 dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal,, while EUT had its hopping function disabled at the highest, middle and the lowest available channels.

After the trace being stable, Use the marker-to-peak function to measure 20 dB down both sides of the intentional emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz VBW ≥ RBW

Span = 100 MHz Detector function = peak

Trace = max hold Sweep = auto

Test equipment used

Model NO.	Mannufacturer	Description	S/N	Due to Cal. Date
8564E	H.P	Spectrum Analyzer	3745A01024	2014.04.03

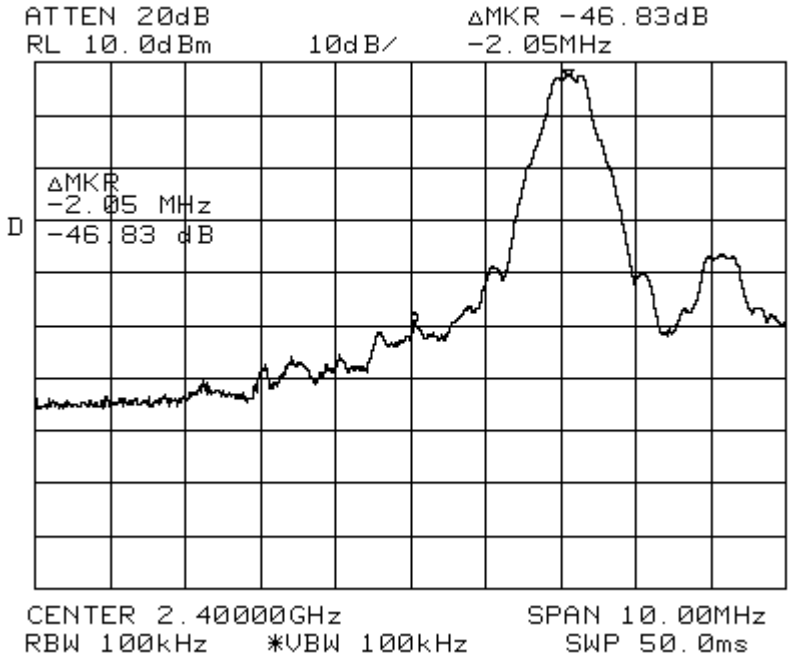
Measurement Data:

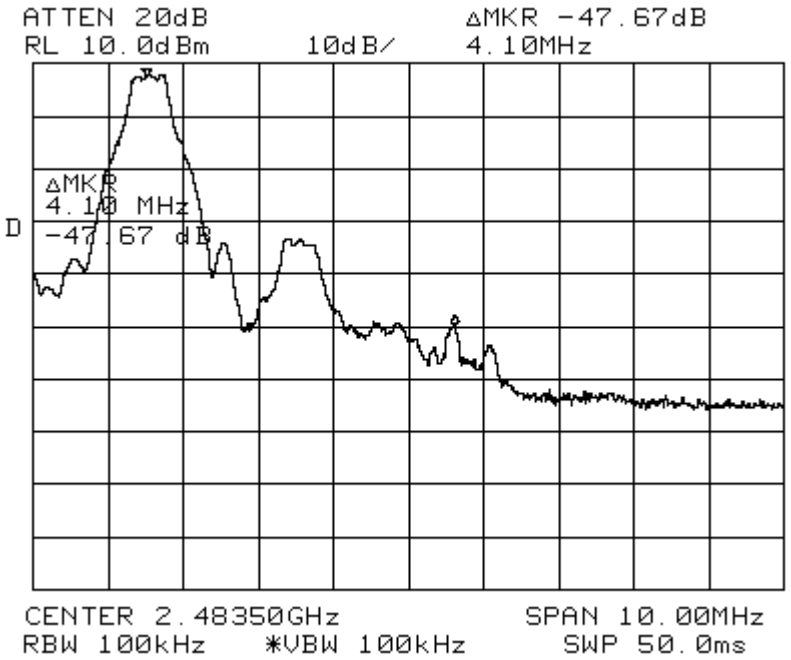
- All conducted emission in any 100kHz bandwidth outside of the spread spectrum band was at least 20dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.
- See next pages of actual measured spectrum plots.

Mode	Frequency (MHz)	Setting Channel (MHz)	Test Results	
			Measured value (dBc)	Result
BDR	2402	~ 2400	**46.83**	Compliance
BDR	2480	2483.5 ~	**47.67**	Compliance
BDR	2402	~ 2400	**48.84**	Compliance
EDR	2480	2483.5 ~	**46.00**	Compliance

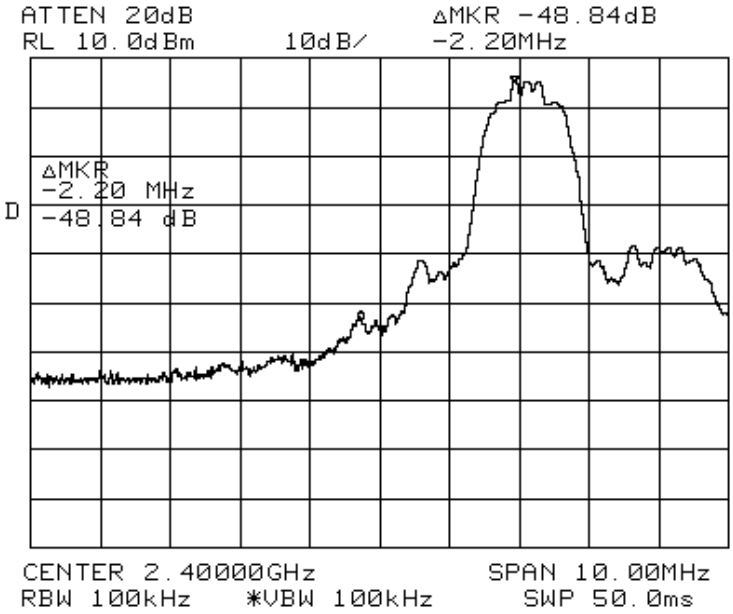
Minimum Standard:	> 20 dBc

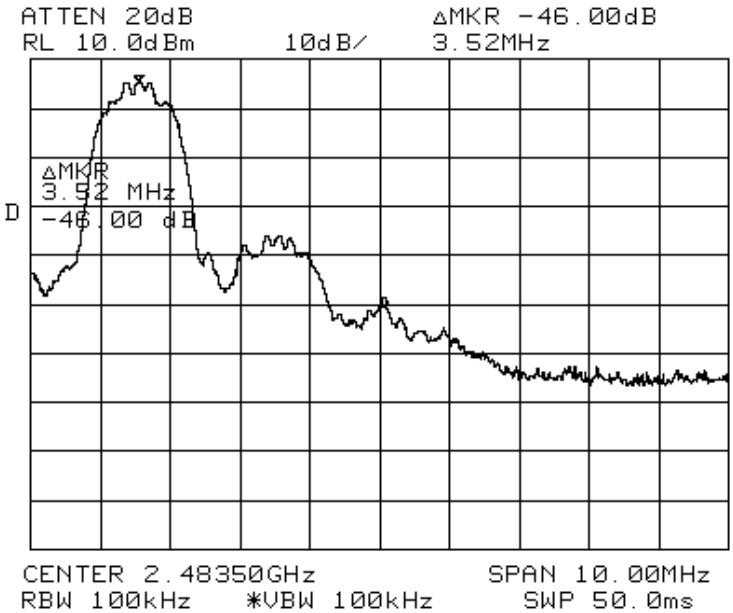
BDR Mode


ATTEN 20dB
RL 10.0dBm
10dB/
ΔMKR -46.83dB
-2.05MHz
ΔMKR
-2.05 MHz
D
-46.83 dB
CENTER 2.40000GHz
SPAN 10.00MHz
RBW 100kHz
*VBW 100kHz
SWP 50.0ms


ATTEN 20dB
RL 10.0dBm
10dB/
ΔMKR -47.67dB
4.10MHz
ΔMKR
4.10 MHz
D
-47.67 dB
CENTER 2.48350GHz
SPAN 10.00MHz
RBW 100kHz
*VBW 100kHz
SWP 50.0ms

EDR Mode


ATTEN 20dB
RL 10.0dBm
10dB/
ΔMKR -48.84dB
-2.20MHz
ΔMKR
-2.20 MHz
-48.84 dB
D
CENTER 2.40000GHz
SPAN 10.00MHz
RBW 100kHz
*VBW 100kHz
SWP 50.0ms


ATTEN 20dB
RL 10.0dBm
10dB/
ΔMKR -46.00dB
3.52MHz
ΔMKR
3.52 MHz
-46.00 dB
D
CENTER 2.48350GHz
SPAN 10.00MHz
RBW 100kHz
*VBW 100kHz
SWP 50.0ms

7.7 Test data for radiated emission

Above 1 GHz Electric Field strength was measured in accordance with ANSI C 63.4 (2003). The test setup was made according to ANSI C 63.4 (2003) on an Anechoic chamber, which allows a 3m distance measurement. The EUT was placed in the center of wooden turntable. The height of this table was 0.8m. The measurement was conducted with both horizontal and vertical antenna polarization. The turntable has fully rotated.

7.7.1 Radiated Emission which fall in the Restricted Band

Temperature : 17 ℃

Relative Humidity : (46 - 48) % R.H

Center frequency = the highest and the lowest channels

RBW = 1 MHz for Peak and Average Mode

VBW = 1 MHz for Peak Mode, 10 Hz for Average Mode

Sweep = auto

Result : PASSED

Test equipment used

Model NO.	Mannufacturer	Description	S/N	Due to Cal. Date
3115	ETS	HORN ANTENNA	6443	2014.10.21
KTI-HD-1080	KTI	HORN ANTENNA	130001	2015.04.10
6502	EMCO	LOOP ANTENNA	3434	2014.03.15
VULB9163	S/B	BI-LOG ANTENNA	281	2014.10.29
VHA9103	S/B	BICONICAL ANTENNA	1111	2014.03.27
UHALP9107	S/B	LOG PERIODIC ANTENNA	1568	2014.03.27

Measuremnet Data

Frequency (MHz)	Reading. (dBμV)	Detector Mode	Ant. Pol.	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2389.73	37.33	Peak	H	27.05	3.13	28.98	38.53	74.00	35.47
	26.83	Average	H				28.03	54.00	25.97
	36.50	Peak	V				37.70	74.00	36.30
	26.33	Average	V				27.53	54.00	26.47
Test Data for High Channel									
2483.53	36.67	Peak	H	27.31	3.17	28.82	38.33	74.00	35.67
	26.33	Average	H				27.99	54.00	26.01
	37.00	Peak	V				38.66	74.00	35.34
	26.50	Average	V				28.16	54.00	25.84

Notes : “H” : Horizontal, “V” : Vertical

Each data transfer rate, BDR Mode and EDR Mode was tested, but the worst data was recorded.

7.7.2 Spurious Radiated Emission above 1 GHz

Temperature : 17 ℃

Relative Humidity : (46 - 48) % R.H

Center frequency = the highest, middle and the lowest channels

RBW = 1 MHz for Peak and Average Mode for the emissions fall in restricted band,

100 kHz for Peak Mode for the emissions outside restricted band

VBW = 1 MHz

z for Peak Mode, 10 Hz for Average Mode

Measurement distance : 3m

Frequency Range : 1 GHz ~ 25 GHz

Result : PASSED

Frequency (MHz)	Reading. (dBµV)	Detector Mode	Ant. Pol.	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel									
2402.00	58.72	Peak	H	27.09	3.16	-	90.79	-	90.79
	52.61	Peak	V				85.00	-	85.00
4804.00*	34.28	Peak	H	31.07	4.10	28.80	40.65	74.00	33.35
	23.11	Average	H				29.48	54.00	24.52
	36.15	Peak	V				42.52	74.00	31.48
	24.51	Average	V				30.88	54.00	23.12
Test Data for Middle Channel									
2441.00	59.46	Peak	H	27.19	3.16	-	90.53	-	90.53
	51.46	Peak	V				84.23	-	84.23
4882.00*	33.58	Peak	H	31.19	4.12	28.73	40.16	74.00	33.84
	23.41	Average	H				29.99	54.00	24.01
	34.67	Peak	V				41.25	74.00	32.75
	23.81	Average	V				30.39	54.00	23.61

Frequency (MHz)	Reading. (dBμV)	Detector Mode	Ant. Pol.	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for high Channel									
2 480.00	60.11	Peak	H	27.10	3.16	-	90.57	-	90.57
	52.74	Peak	V				83.20	-	83.20
4 960.00*	34.15	Peak	H	31.32	4.15	28.67	40.95	74.00	33.05
	22.17	Average	H				28.97	54.00	25.03
	35.64	Peak	V				42.44	74.00	31.56
	23.74	Average	V				30.54	54.00	23.46

Notes: 1.All modes of operation were investigated.
And the worst-case emission are reported.

2.All other emission is non-significant.

3.All readings are calibrated by self-mode in receiver.

4.Measurements using CISPR peak mode.

5. Correction Factor(dB)= Cable Factor(dB) + Amp. Factor (dB)

6. H = Horizontal, V = Vertical Polarization

7."*" Frequency fall in restricted band

7.7.3 Spurious Radiated Emission below 1 GHz

Temperature : 15 ℃

Relative Humidity : (48 - 50) % R.H

RBW = 120 kHz

Measurement distance : 3m

Frequency Range : 30 MHz ~ 1 GHz

Result : PASSED

Frequency (MHz)	Reading. (dBμV)	Ant. Pol.	Ant. Height (m)	Angle (˚)	Ant. Factor (dB/m)	Cable Loss (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)
44.68	**8.9**	**V**	**1.04**	**120**	**14.86**	**1.4**	**25.11**	**30.00**	**4.89**
144.04	**14.7**	**V**	**1.28**	**340**	**9.35**	**2.5**	**26.56**	**30.00**	**3.42**
215.92	**11.9**	**H**	**3.44**	**300**	**12.07**	**3.0**	**26.99**	**30.00**	**3.01**
288.04	**12.9**	**H**	**3.05**	**110**	**14.66**	**3.8**	**31.40**	**37.00**	**5.60**
431.96	**10.4**	**H**	**2.84**	**110**	**16.90**	**4.8**	**32.13**	**37.00**	**4.87**
720.00	**6.0**	**V**	**1.80**	**120**	**20.27**	**6.2**	**32.46**	**37.00**	**4.54**

Notes : “H” : Horizontal, “V” : Vertical,

Each data transfre rate, BDR Mode, EDR Mode was tested, but the worst data was recorded.

7.7.4 Spurious Radiated Emission below 30 MHz

Temperature : 16 ℃

Relative Humidity : (48 - 50) % R.H

RBW = 200 Hz(from 9 kHz to 0.15 MHz), 9 kHz(from 0.15 MHz to 30 MHz)

Measurement distance : 3m

Frequency Range : 9 kHz ~ 30 MHz

Result : PASSED

Frequency (MHz)	Reading. (dBμV)	Ant. Pol.	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

7.8 AC Conducted Emissions

Temperature : 18 ℃

Relative Humidity : (44 - 45) % R.H

Procedure

AC power line conducted emissions from the EUT were measured according to the dictates ANSI C64.4:2003.

The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold.

While the measurement, EUT had its hopping function disabled at the middle channels in line with Section 15.31(m).

Test equipment used

Equipment	Mannufacturer	S/N	Due to Cal. Date
Field Strength Meter	ESIB40	100093	05.2013
LISN	KNW407	8-1157-2	03.2014
LISN	Em-7823	115019	03.2014
Conducted Cable	N/A	N/A	11.2013

Measurement Data

Frequency (MHz)	(1) Reading (dBμV)		Line	(2) Limit (dBμV)		(3) Margin (dB)	
	QP	AV		QP	AV	QP	AV
0.23	40.9	35.8	L2	62.3	52.3	21.4	25.4
0.28	37.1	34.3	L1	60.8	50.8	23.6	16.5
2.77	29.4	26.5	L1	56.0	46.0	26.6	19.5
3.81	29.0	24.9	L1	56.0	46.0	27.0	21.1
14.07	35.7	33.5	L2	60.0	50.0	24.3	16.5
19.18	44.4	32.5	L2	60.0	50.0	15.6	17.5

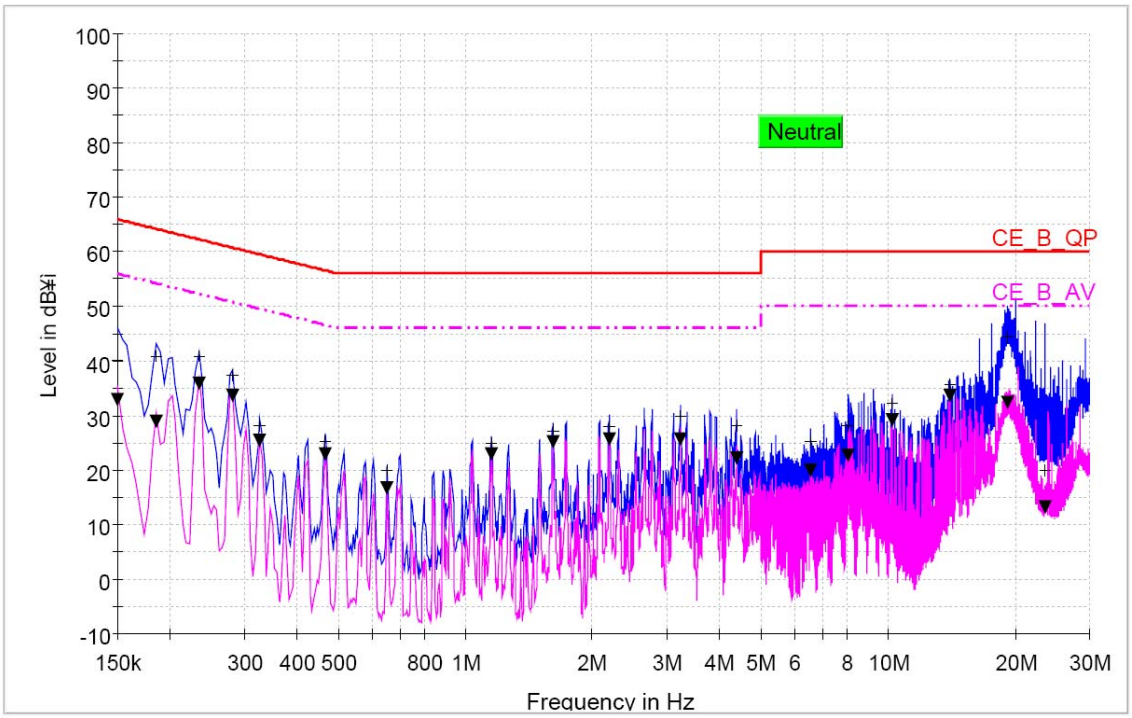
NOTES:

1. **All modes of operation were investigated and the worst-case emissions are reported.**
2. **All other emissions are non-significant.**
3. **All readings are calibrated by self-mode in receiver.**
4. **Measurements using CISPR quasi-peak mode.**
5. **L1 = LINE-PE, L2 = NEUTRAL-PE**
6. **The limit for Class B digital device is 66dBuV to 56dBuV from 150KHz to 500KHz, 56dBuV from 500KHz to 5MHz, 60dBuV Above 5MHz.**

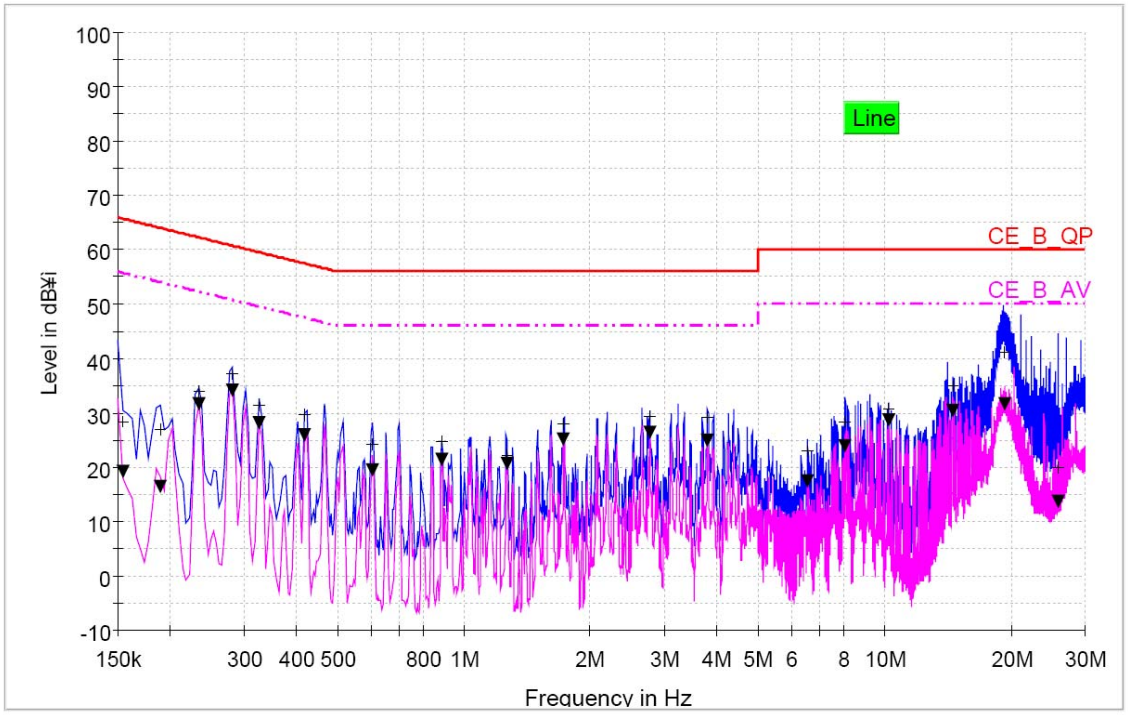
♠ Margin Calculation

(3) Margin = (2) Limit – (1) Reading

Spectral Diagram_LINE-PE



Spectral Diagram_NEUTRAL-PE



7.9 Antenna Requirement

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by responsible party shall be used with the device.

The use of a permanently attached antenna or of an antenna that user 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 broken antenna can be replaced by the user, but the Use of a standard antenna jack or electrical connector is prohibited.

And according to §15.247(4)(1), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi

According to above requirement standard's This product's antenna type is an PCB type and it's gain is -1.0 dBi, So radiated emission field strength from EUT is below requirement standard limit

Frequency Band	Gain (dBi)	Limit (dBi)	Results
2400 ~ 2484 MHz	2.69	≤ 6	Compliance