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KMW

Dates of Tests: December 01 ~ December 14, 2016
Test Report S/N: LR500111612I
Test Site : LTA CO., LTD.

CERTIFICATION OF COMPLIANCE

FCC ID. **ORI-DONGLE-PL**

APPLICANT **KMW Inc**

Equipment Class	:	**Digital Transmission System (DTS)**
Manufacturing Description	:	**Zigbee module**
Manufacturer	:	**KMW Inc**
Model name	:	**DONGLE PL**
Test Device Serial No.:	:	**Identical prototype**
Rule Part(s)	:	**FCC Part 15.247 Subpart C ; ANSI C-63.4-2014**
Frequency Range	:	**2405 MHz ~ 2480 MHz**
Max. Output Power	:	**Max 18.57 dBm – Conducted**
Data of issue	:	**December 16, 2016**

This test report is issued under the authority of:

Yong-Cheol, Wang / Manager

The test was supervised by:

Jung-won, Seo / Test Engineer

This test result only responds to the tested sample. It is not allowed to copy this report even partly without the allowance of the test laboratory. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

NVLAP

NVLAP LAB Code.: 200723-0

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TABLE OF CONTENTS

1. GENERAL INFORMATION ---------- 3

2. INFORMATION ABOUT TEST ITEM ---------- 4

3. TEST REPORT ---------- 6

3.1 SUMMARY OF TESTS ---------- 6

3.2 TECHNICAL CHARACTERISTICS TEST ---------- 7

3.2.1 6 dB BANDWIDTH ---------- 7

3.2.2 PEAK OUTPUT POWER ---------- 10

3.2.3 POWER SPECTRAL DENSITY ---------- 13

3.2.4 BAND EDGE ---------- 16

3.2.5 CONDUCTED SPURIOUS EMISSIONS ---------- 19

3.2.6 RADIATED SPURIOUS EMISSIONS ---------- 22

3.2.7 AC CONDUCTED EMISSIONS ---------- 31

APPENDIX

APPENDIX TEST EQUIPMENT USED FOR TESTS ---------- 38

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1. General information

1-1 Test Performed

Company name : LTA Co., Ltd.
Address : 243, Jubug-ri,Yangji-Myeon,Youngin-Si, Kyunggi-Do, Korea. 449-822
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E-mail : chahn@ltalab.com
Telephone : +82-31-323-6008
Facsimile +82-31-323-6010

Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the "General requirements for the competents of calibration and testing laboratory".

1-2 Accredited agencies

LTA Co., Ltd. is approved to perform EMC testing by the following agencies:

Agency	Country	Accreditation No.	Validity	Reference
NVLAP	U.S.A	200723-0	2017-09-30	ECT accredited Lab.
RRA	KOREA	KR0049	-	EMC accredited Lab.
FCC	U.S.A	610755	2017-04-21	FCC filing
FCC	U.S.A	649054	2017-04-13	FCC CAB
VCCI	JAPAN	R2133(10 m), C2307	2017-06-21	VCCI registration
VCCI	JAPAN	T-2009	2016-12-23	VCCI registration
VCCI	JAPAN	G-563	2018-12-13	VCCI registration
IC	CANADA	5799A-1	2019-11-07	IC filing
KOLAS	KOREA	NO.551	2017-01-08	KOLAS accredited Lab.

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2. Information about test item

2-1 Client & Manufacturer

Company name	:	KMW Inc
Address	:	183-6, Yeongcheon-ro, Dongtan-myeon, Hwaseong-si, Gyeonggi-do, Republic of Korea
Tel / Fax	:	TEL No : +82-31-370-8600 / FAX No : +82-31-370-2898

2-2 Manufacturers

Company name	:	KMW Inc
Address 1	:	1942, Wireseong-ro, Ipjang-myeon, Seobuk-gu, Cheonan-si, Chungcheongnam-do, Republic of Korea
Address 2	:	3, Dongtansandan 6-gil Dongtan-myeon, Hwaseong-si, Gyeonggi-do, Korea
Company name	:	KMW VIETNAM CO.,LTD
Address	:	Lot C, Dong Van I Industrial Zone, Yen Bac Commune, Duy Tien District, Ha Nam Province, Viet Nam
Company name	:	SEOJIN SYSTEM VINA
Address	:	Lo23, Duong TS5, KCN Tien Son,P.Dong Nguyen, TX, Tu Son,T. VacNinhm Vietnam

2-3 Equipment Under Test (EUT)

Trade name	:	KMW Inc
Model name	:	DONGLE PL
Serial number	:	Identical prototype
Date of receipt	:	December 01, 2016
EUT condition	:	Pre-production, not damaged
Antenna type	:	IFA antenna - Max Gain 1.47 dBi
Frequency Range	:	2405 MHz ~ 2480 MHz
RF output power	:	Max 18.57 dBm – Conducted
Number of channels	:	16
Type of Modulation	:	Direct Sequence Spread Spectrum(DSSS)
Power Source	:	15 Vdc
Firmware Version	:	V1.0.0

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2-3 Tested frequency

Zigbee	LOW	MID	HIGH
Frequency (MHz)	2405	2440	2480

2-4 Ancillary Equipment

Equipment	Model No.	Serial No.	Manufacturer
Notebook	CR720	MS-1736	MSI

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3. Test Report

3.1 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status (note 1)
15.247(a)	6 dB Bandwidth	> 500 kHz	Conducted	C
15.247(b)	Transmitter Peak Output Power	< 1 Watt		C
15.247(d)	Transmitter Power Spectral Density	< 8 dBm @ 3 kHz		C
15.247(d)	Band Edge	> 20 dBc		C
15.209	Field Strength of Harmonics	Emission	Radiated	C
15.207	AC Conducted Emissions	Emissions	Conducted	C
15.203	Antenna requirement	-	-	C

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: The data in this test report are traceable to the national or international standards.

→ Antenna Requirement
The KMW Inc FCC ID: ORI-DONGLE-PL unit complies with the requirement of §15.203.
The antenna type is Chip Antenna

The sample was tested according to the following specification:

*FCC Parts 15.247; ANSI C-63.10-2013
*FCC KDB Publication No. 558074 v03r05
*FCC TCB Workshop 2012, April

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3.2 Technical Characteristics Test

3.2.1 6 dB Bandwidth

Procedure:

The bandwidth at 6 dB below the highest in-band spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate frequencies.

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 6 dB 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 point is the 6 dB bandwidth of the emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

Span = 5 MHz

VBW = 100 kHz (VBW ≥ RBW)

Sweep = auto

Trace = max hold

Detector function = peak

Measurement Data : Complies

Frequency (MHz)	Test Results	
	Measured Bandwidth (MHz)	Result
2405	**1.577**	Complies
2440	**1.570**	Complies
2480	**1.577**	Complies

- See next pages for actual measured spectrum plots.

Minimum Standard:

6 dB Bandwidth > 500 kHz

Measurement Setup

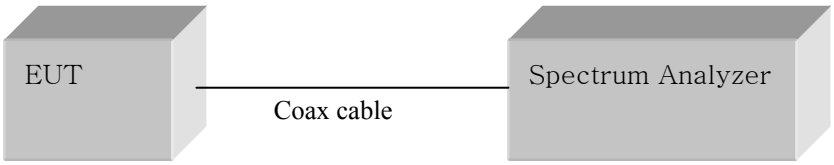
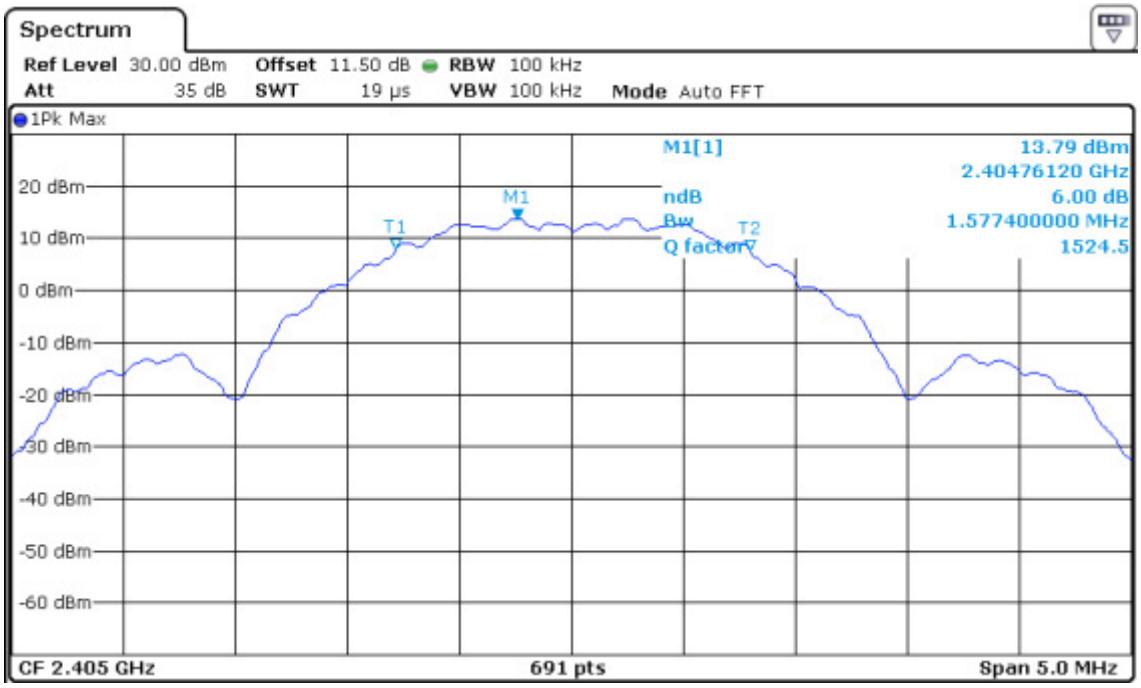
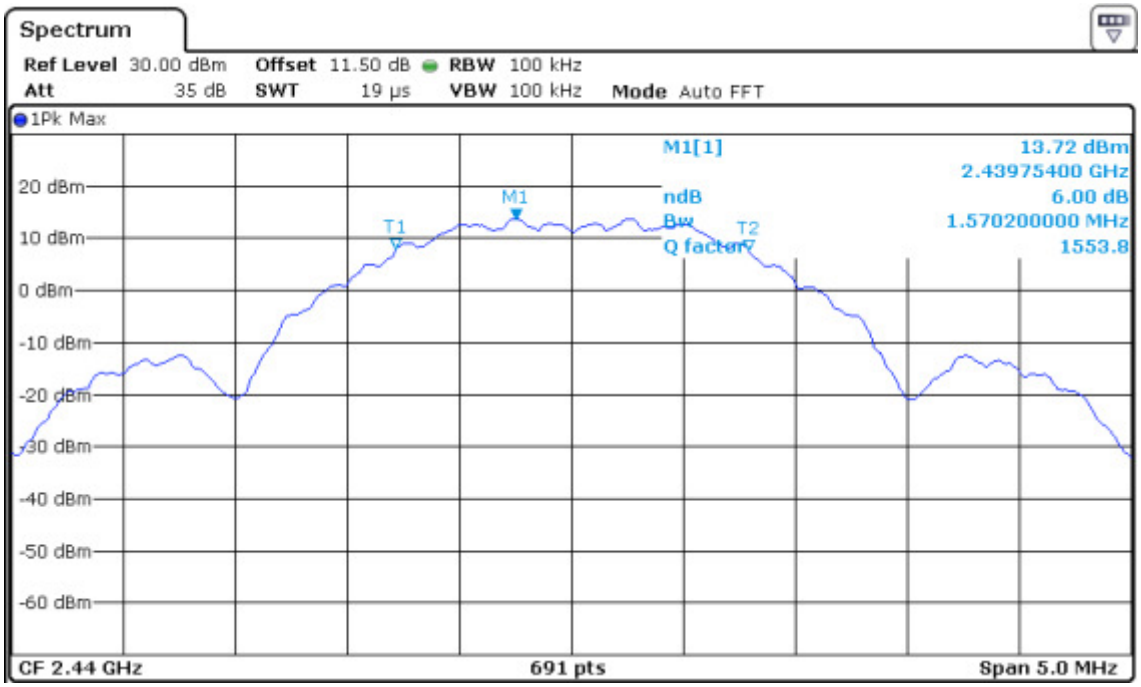


Figure 1: Measurement setup for the carrier frequency separation

Low Channel



Middle Channel



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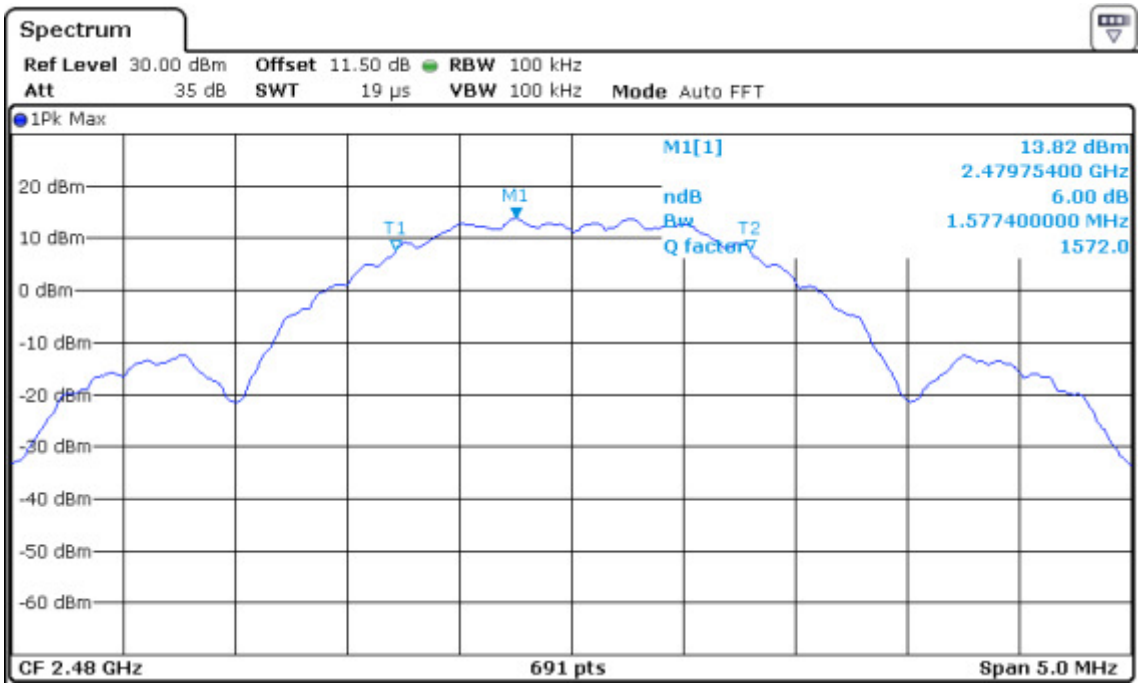
High Channel



3.2.2 Peak Output Power Measurement

Procedure:

The maximum peak output power was measured with the spectrum analyzer connected to the antenna output of the EUT. The spectrum analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth. The EUT was operating in transmit mode at the appropriate center frequency.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 1MHz Span = auto

VBW = 1MHz (VBW ≥ RBW) Sweep = auto

Detector function = peak

Measurement Data (Port 1) : Complies

Frequency (MHz)	Test Results		
	dBm	W	Result
2405	**18.59**	**0.072**	Complies
2440	**18.58**	**0.072**	Complies
2480	**18.71**	**0.074**	Complies

- See next pages for actual measured spectrum plots.

Minimum Standard:

Peak output power	< 1 W

Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

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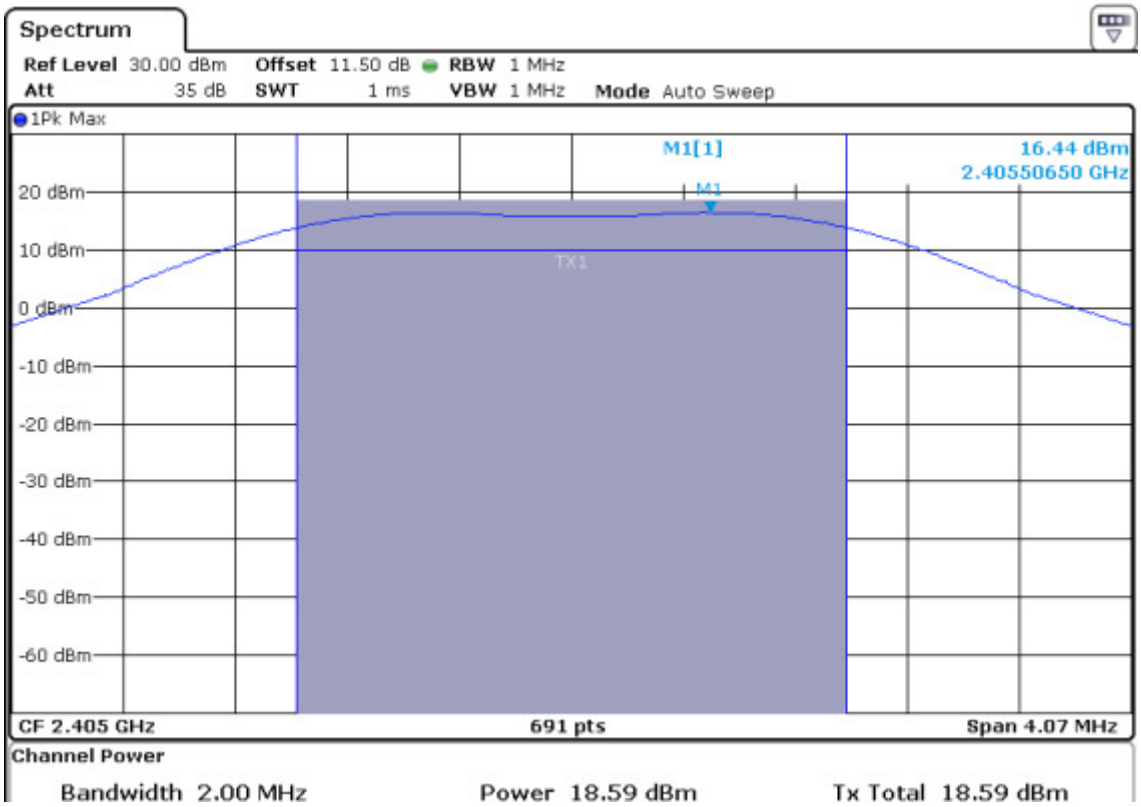
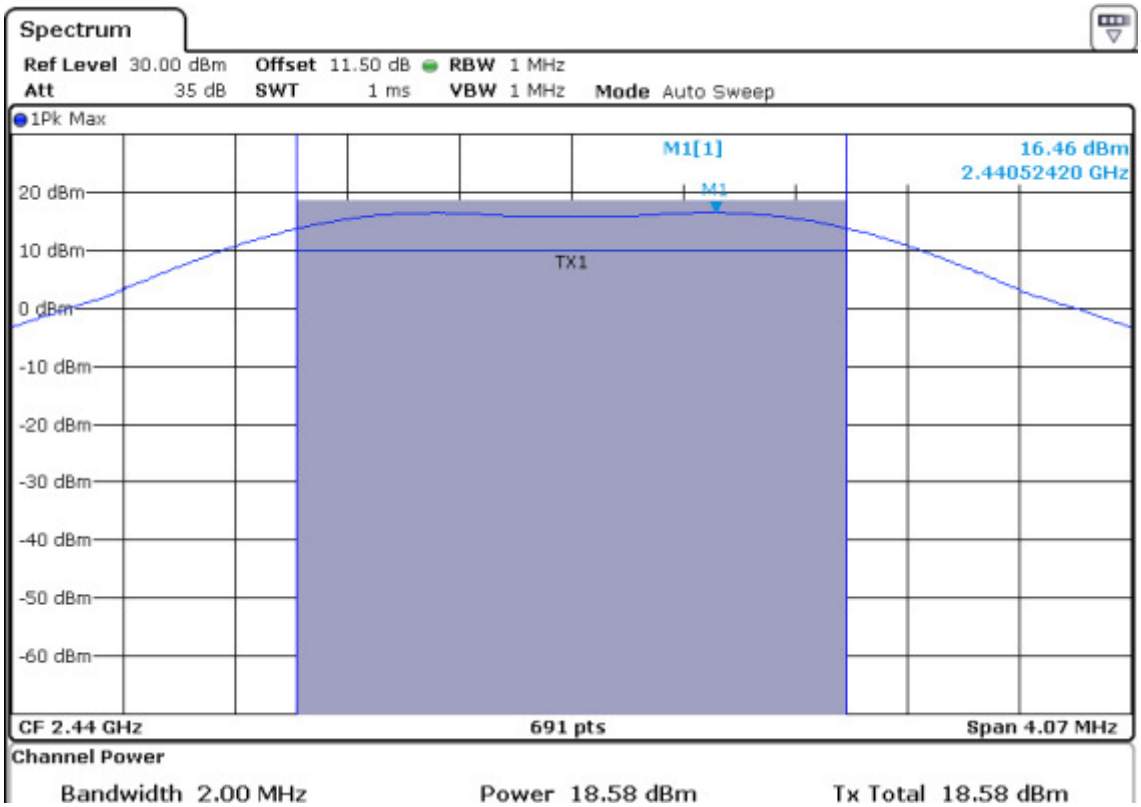
Low Channel



Middle Channel



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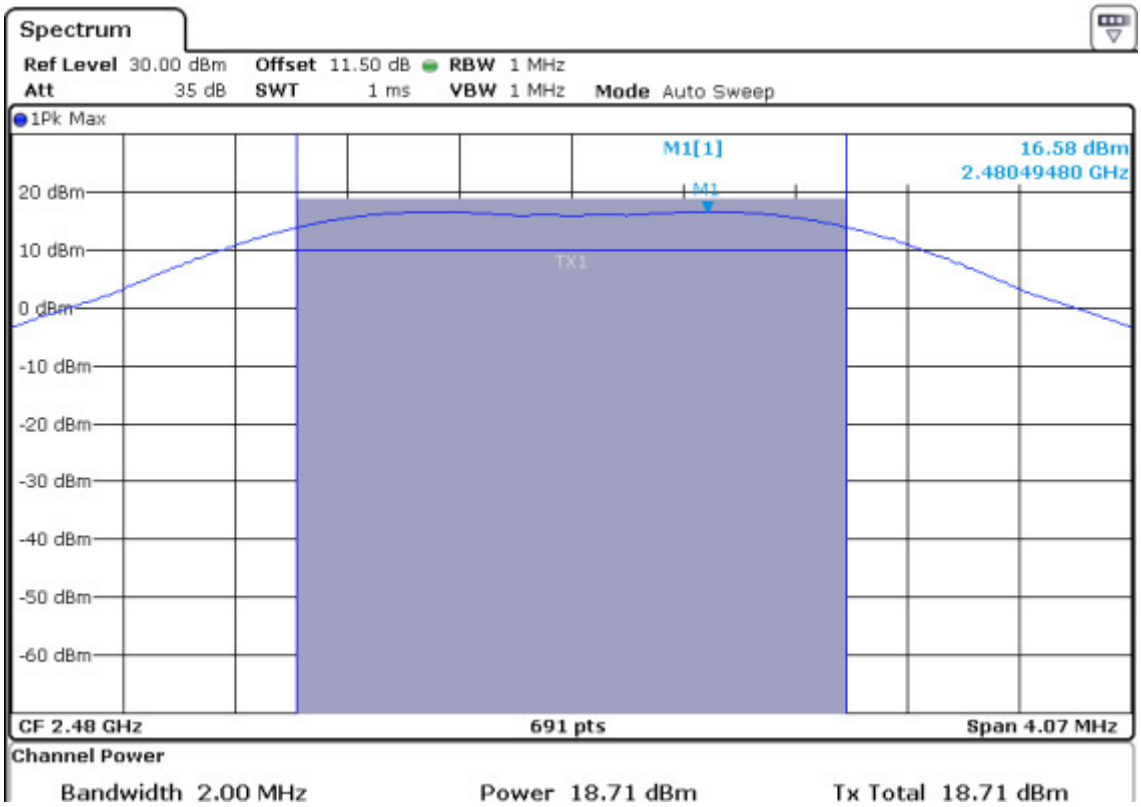
High Channel



3.2.3 Power Spectral Density

Procedure:

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

The spectrum analyzer is set to:

RBW = 3 kHz	Span = 300 kHz
VBW = 3 kHz	Sweep = auto
Detector function = peak	Trace = max hold

Measurement Data (Port 1) : Complies

Frequency (MHz)	Test Results	
	dBm	Result
2405	**5.32**	Complies
2440	**5.61**	Complies
2480	**5.75**	Complies

- See next pages for actual measured spectrum plots.

Minimum Standard:

Power Spectral Density	< 8 dBm @ 3 kHz BW

Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

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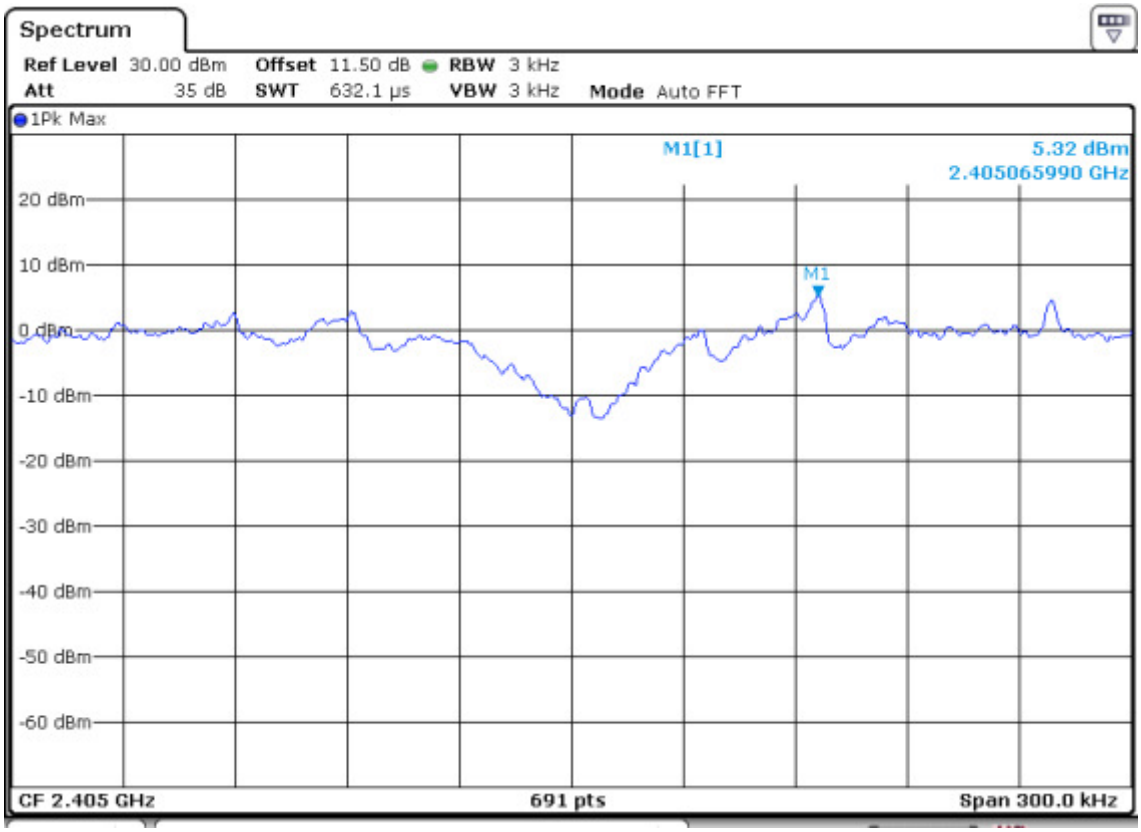
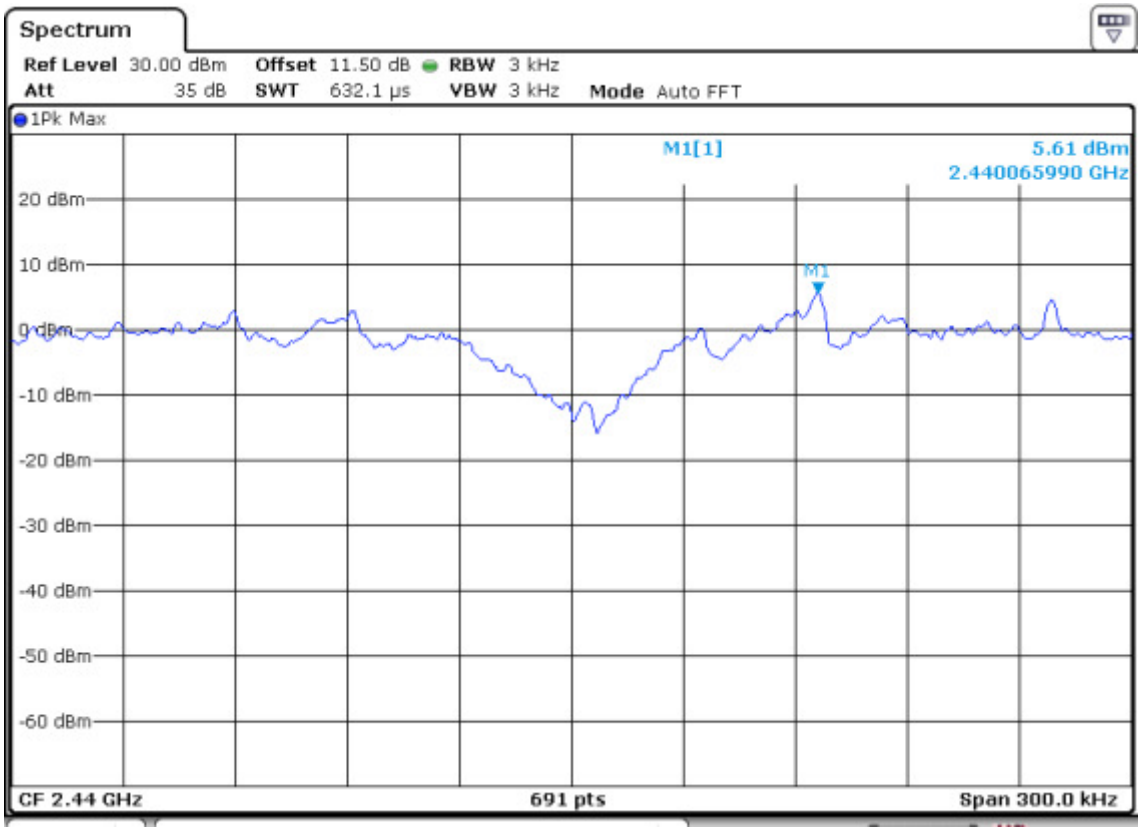
Power Density Measurement

Low Channel



Middle Channel



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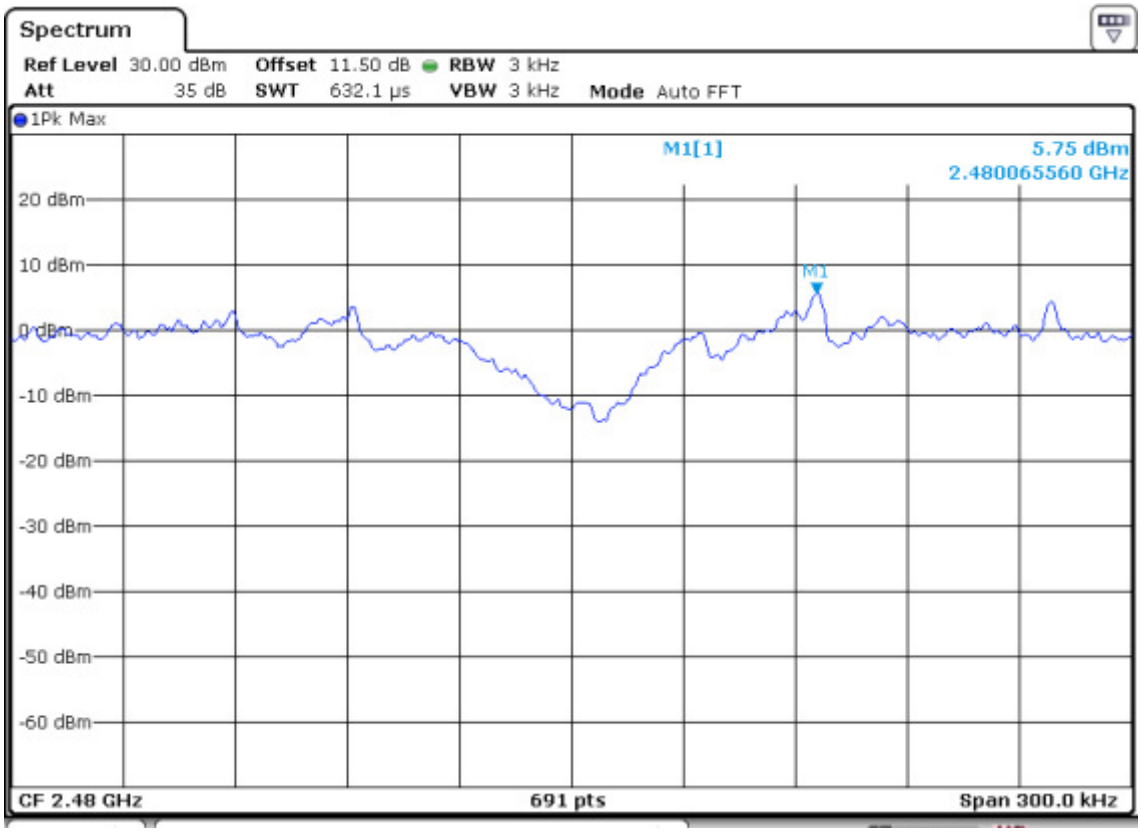
High Channel



3.2.4 Band - edge

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 is operating in transmission mode at the appropriate frequencies.

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 = 100 kHz
Span = 40 MHz	Detector function = peak
Trace = max hold	Sweep = auto

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

The spectrum analyzer is set to:

Center frequency = the highest, the lowest channels

PEAK:	RBW = VBW = 1 MHz, Sweep=Auto
Average:	RBW = 1 MHz, VBW=10 Hz, Sweep=Auto
Measurement Distance:	3 m
Polarization:	Horizontal / Vertical

Measurement Data: Complies

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

Minimum Standard:	> 20 dBc

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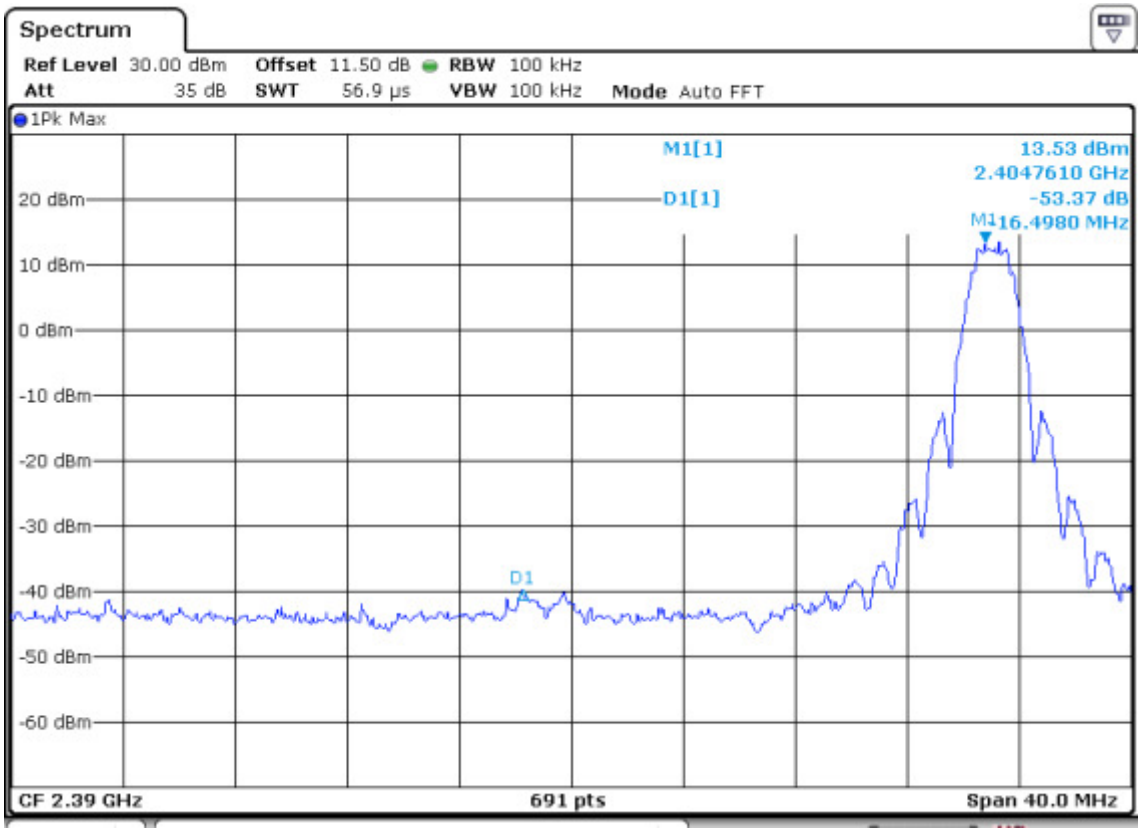
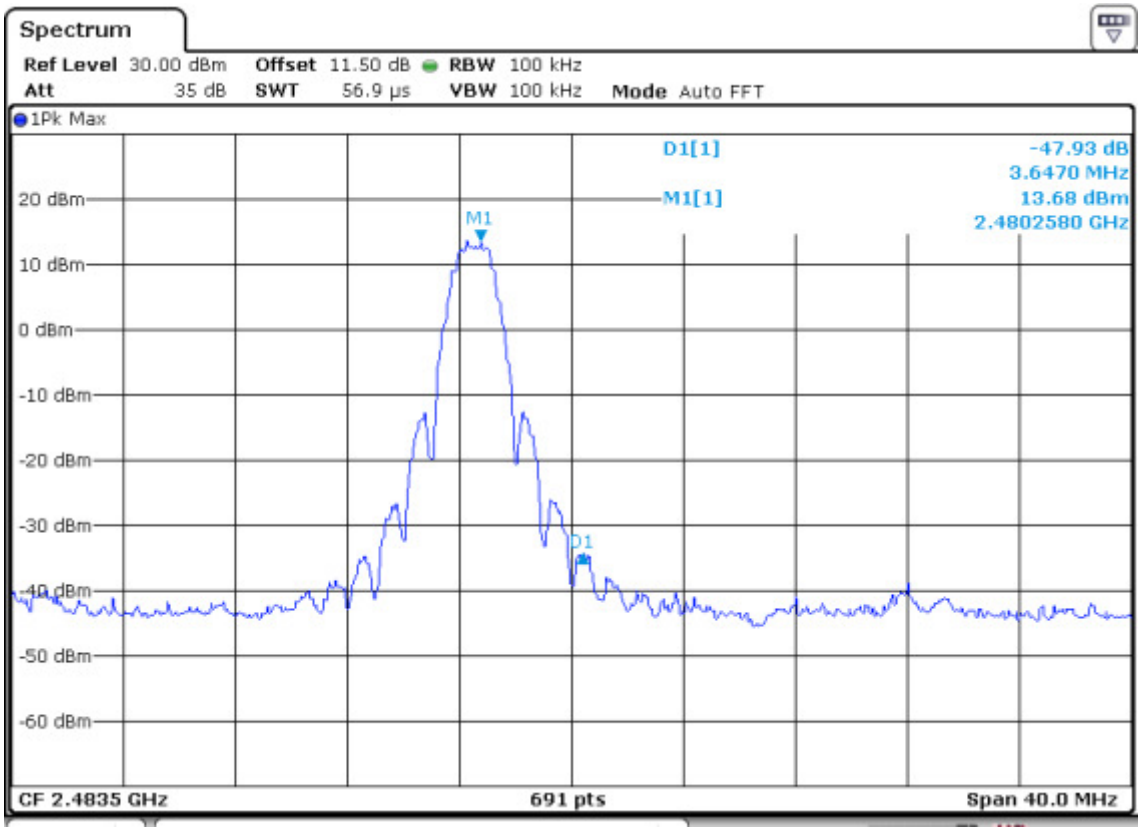
Band edge

Lower edge



Upper edge



Radiated Band-edges in the restricted band 2310-2390 MHz measurement

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor		Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] AV / Peak	
				Antenna	Amp. Gain + Cable Loss						
2373.3	31.4	46.1	V	27.86	22.92	54.0	74.0	36.34	51.04	17.66	22.96

Radiated Band-edges in the restricted band 2483.5-2500 MHz measurement

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor		Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] AV / Peak	
				Antenna	Amp. Gain + Cable Loss						
2483.5	44.3	61.0	V	27.86	22.92	54.0	74.0	49.24	65.94	4.76	8.06

Note : This EUT was tested in 3 orthogonal positions and the worst-case data was presented

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3.2.5 Conducted Spurious Emissions

Procedure:

The test follows KDB558074. The conducted spurious emissions were 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, set the marker on the peak of any spurious emission recorded.

The spectrum analyzer is set to:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions

RBW = 100 kHz Sweep = auto

VBW = 100 kHz Detector function = peak

Trace = max hold

Measurement Data: **Complies**

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

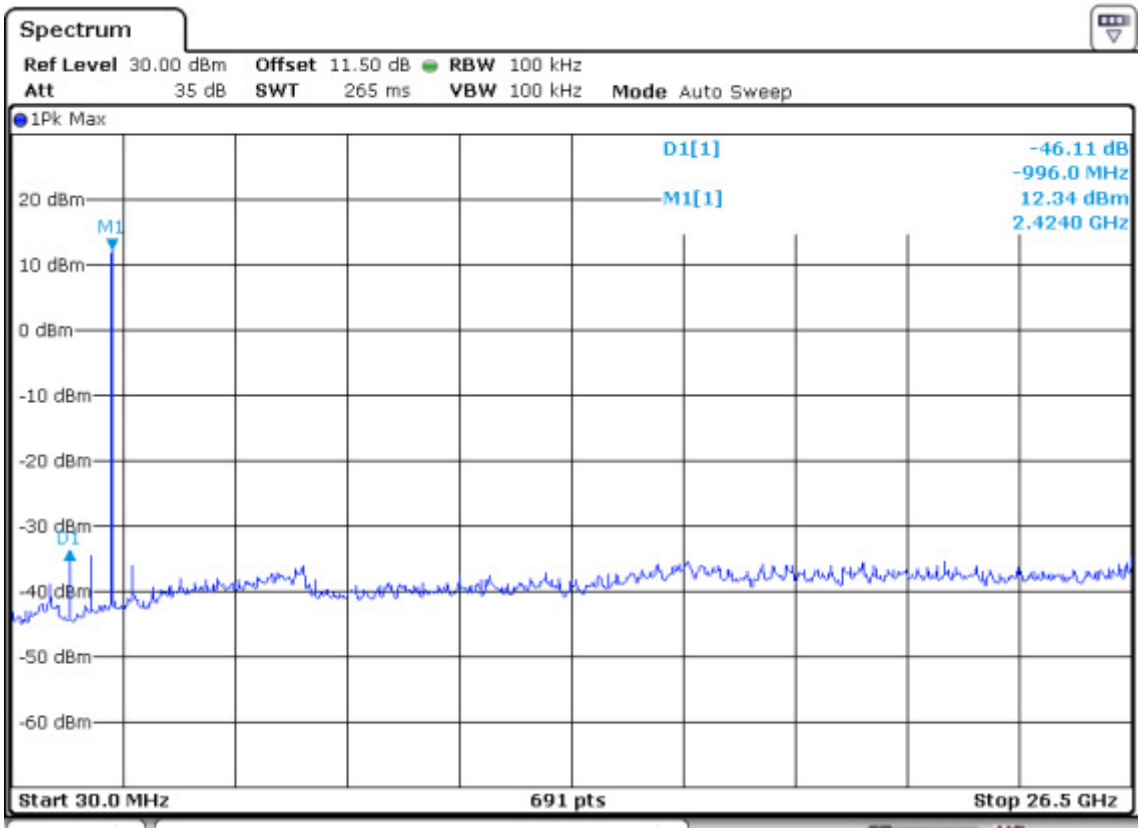
Minimum Standard:	> 20 dBc

Measurement Setup

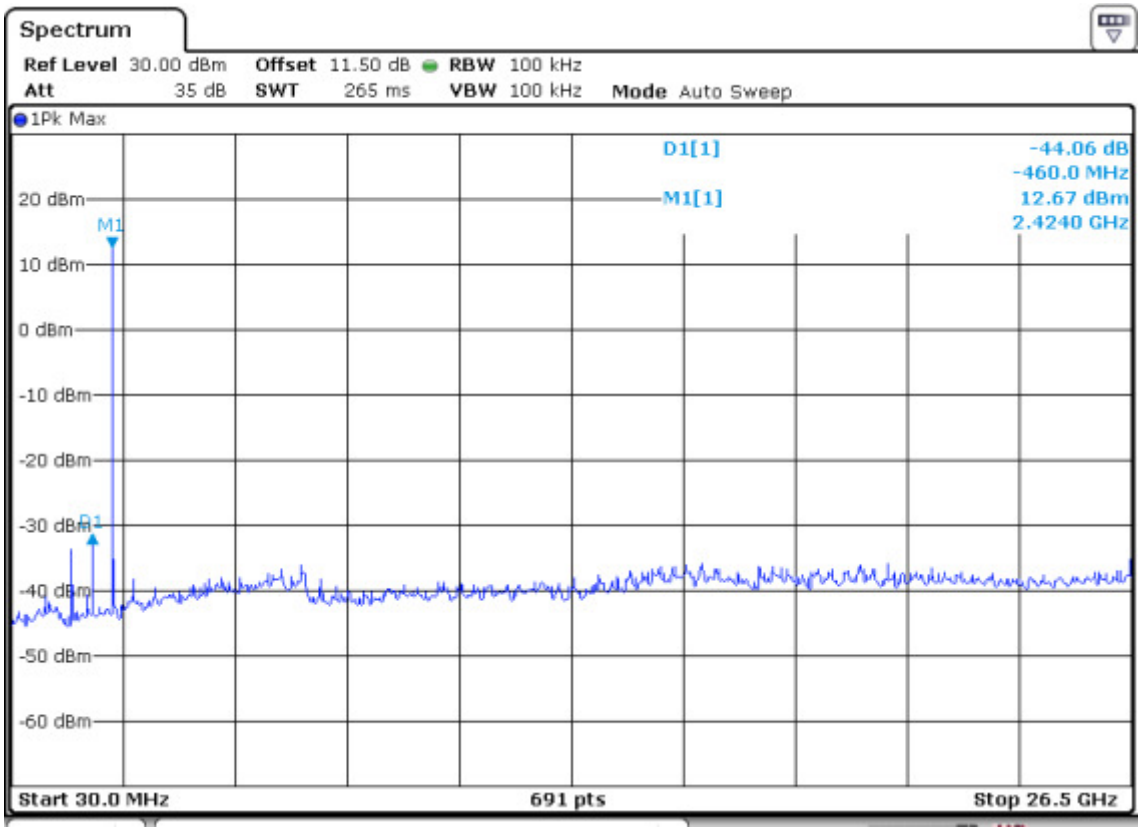
Same as the Chapter 3.2.1 (Figure 1)

Unwanted Emission – Low Channel

Frequency Range = 30 MHz ~ 26.5 GHz



Middle Channel



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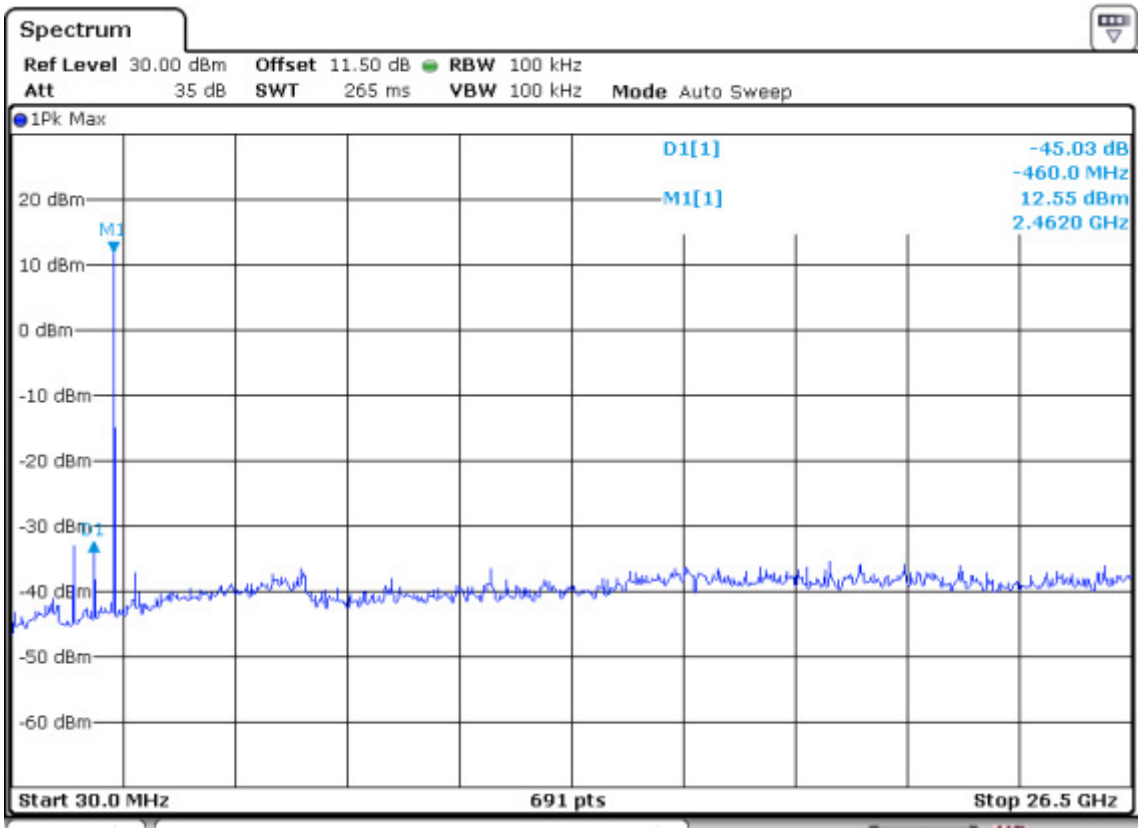
High Channel



3.2.6 Radiated Spurious Emissions

Procedure:

The EUT was placed on a 0.8m high wooden table inside a shielded enclosure. An antenna was placed near the EUT and measurements of frequencies and amplitudes of field strengths were recorded for reference during final measurements. For final radiated testing, measurements were performed in OATS. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst-case orientation for maximum emissions.

The spectrum analyzer is set to:

Center frequency = the worst channel

Frequency Range = 9 kHz ~ 10th harmonic.

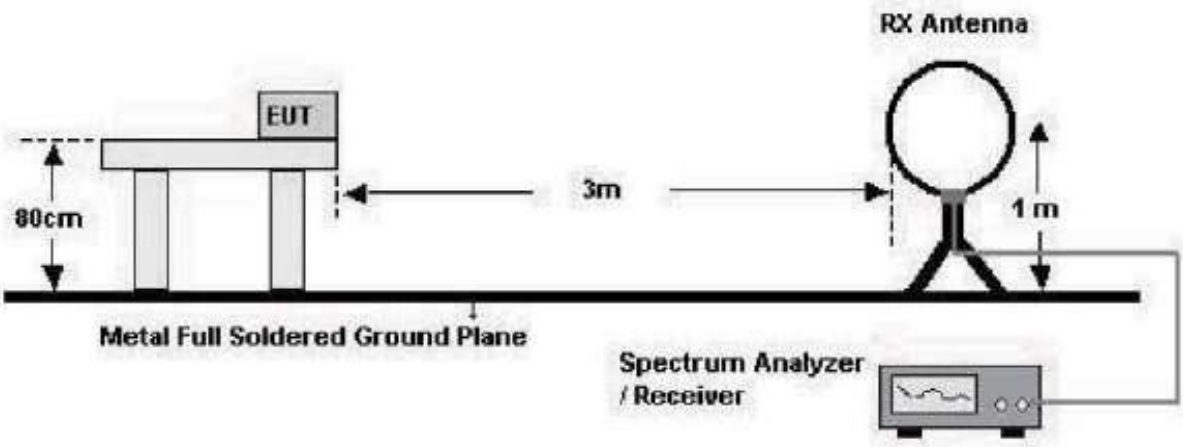
RBW = 100 kHz (30 MHz ~ 1 GHz) VBW ≥ RBW

= 1 MHz (1 GHz ~ 10th harmonic)

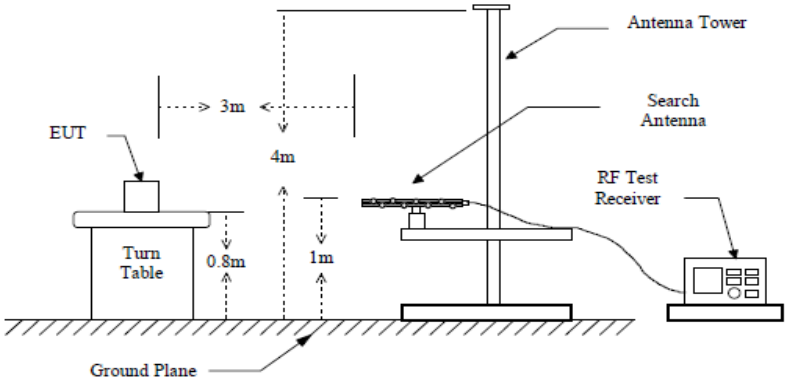
Span = 100 MHz Detector function = peak

Trace = max hold Sweep = auto

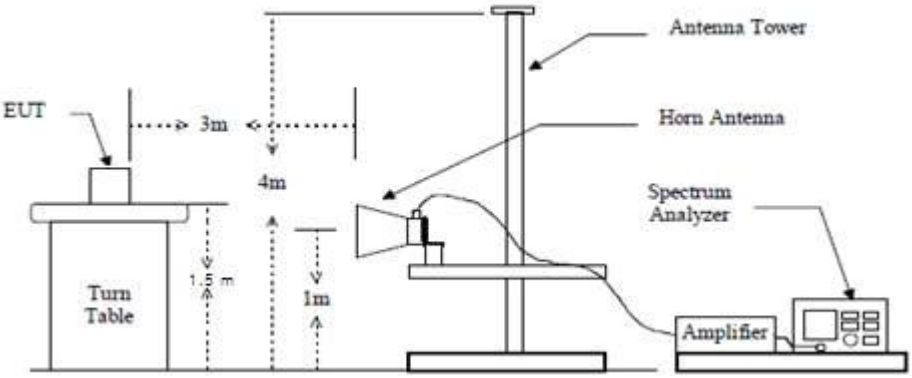
below 30 MHz



below 1 GHz (30 MHz to 1 GHz)



above 1 GHz



Measurement Data: **Complies**

- See next pages for actual measured data.
- No other emissions were detected at a level greater than 20 dB below limit include from 9 kHz to 30 MHz.

Minimum Standard: FCC Part 15.209(a)

Frequency (MHz)	Limit (uV/m) @ 3 m
0.009 ~ 0.490	2400/F(kHz) **(@ 300 m)**
0.490 ~ 1.705	24000/F(kHz) **(@ 30 m)**
1.705 ~ 30	30**(@ 30 m)**
30 ~ 88	100 **
88 ~ 216	150 **
216 ~ 960	200 **
Above 960	500

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-80 6 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

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Measurement Data : (Above 1 GHz)

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor		Limits [dBuV/m] AV/Peak		Result [dBuV/m] AV/Peak		Margin [dB] AV / Peak	
				Antenna	Amp.Gain+Cable						
5739.9	31.7	55.3	V	32.21	17.87	54.0	74.0	46.0	69.6	8.0	4.4
5752.3	30.7	57.6	V	32.21	17.87	54.0	74.0	45.0	71.9	9.0	2.1
5739.7	29.8	55.7	V	32.21	17.87	54.0	74.0	44.1	70.0	9.9	4.0

- No other emissions were detected at a level greater than 20 dB below limit.

Measurement Data: (9 kHz – 30 MHz)

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Correction Factor		Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] AV / Peak	
				Antenna	Amp.Gain+Cable						
-	-	-	-	-	-	-	-	-	-	-	-
No emissions were detected at a level greater than 20 dB below limit.											
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-

*No emissions were detected at a level greater than 20 dB below limit.

Radiated Emissions (Below 1 GHz) – 2.4 GHz Zigbee(Low) mode

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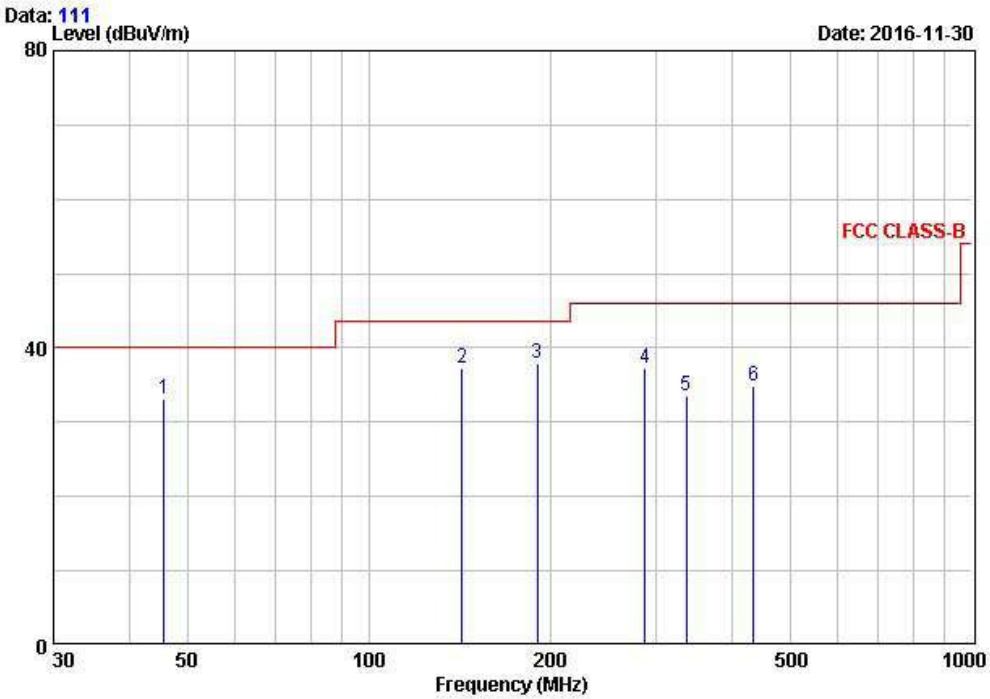
EUT/Model No.: DONGLE PL
TEST MODE: Wireless(LOW) mode
Temp Humi : 16 / 34
Tested by: SIN S U



	Freq MHz	Reading dBuV	C.F dB	Result dBuV/m	Limit QP dBuV/m	Margin dB	Height cm	Angle deg	Polarity
1	45.80	50.20	-17.08	33.12	40.00	6.88	100	112	VERTICAL
2	142.80	52.30	-14.97	37.33	43.50	6.17	400	185	HORIZONTAL
3	190.40	54.50	-16.47	38.03	43.50	5.47	355	164	HORIZONTAL
4	287.40	50.20	-13.01	37.19	46.00	8.81	392	82	HORIZONTAL
5	336.40	45.30	-11.80	33.50	46.00	12.50	266	360	HORIZONTAL
6	434.30	43.80	-8.88	34.92	46.00	11.08	243	287	HORIZONTAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

- 1 -

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Radiated Emissions (Below 1 GHz) – 2.4GHz Zigbee(Middle) mode

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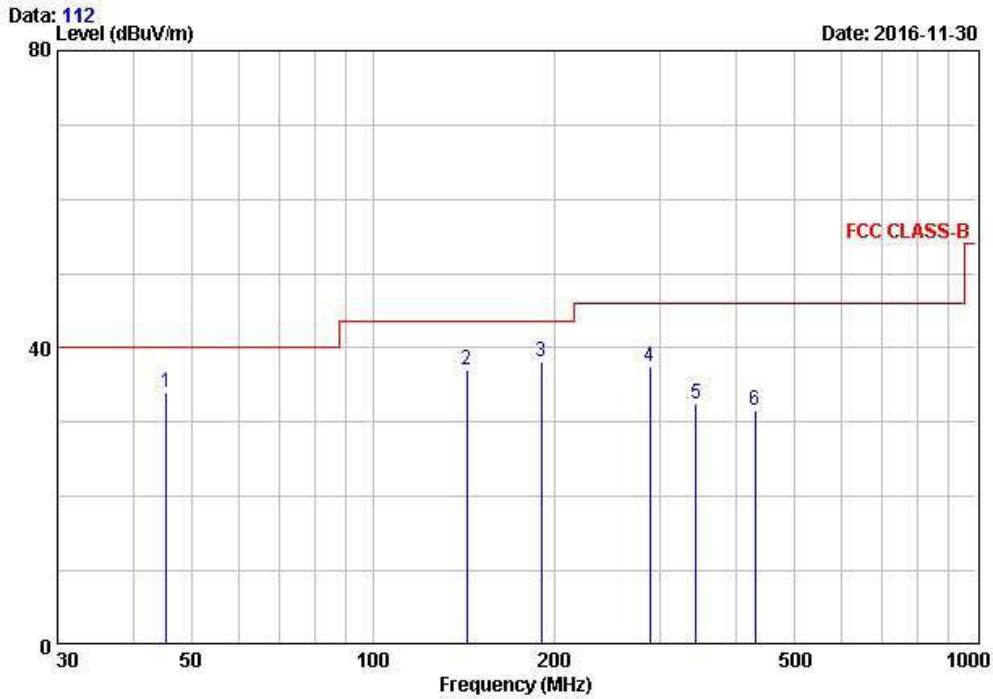
Tel :+82-31-3236008,9
Fax:+82-31-3236010

EUT/Model No.: DONGLE PL
TEST MODE: Wireless(MID) mode
Temp Humi : 16 / 34
Tested by: SIN S U



	Freq MHz	Reading dBuV	C.F dB	Result dBuV/m	Limit QP dBuV/m	Margin dB	Height cm	Angle deg	Polarity
1	45.50	51.00	-17.09	33.91	40.00	6.09	100	135	VERTICAL
2	143.00	52.10	-14.96	37.14	43.50	6.36	400	199	HORIZONTAL
3	190.40	54.60	-16.47	38.13	43.50	5.37	385	166	HORIZONTAL
4	288.10	50.50	-12.98	37.52	46.00	8.48	400	75	HORIZONTAL
5	343.90	44.20	-11.66	32.54	46.00	13.46	242	352	HORIZONTAL
6	430.90	40.50	-9.00	31.50	46.00	14.50	200	313	HORIZONTAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

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Radiated Emissions (Below 1 GHz) – 2.4GHz Zigbee(High) mode

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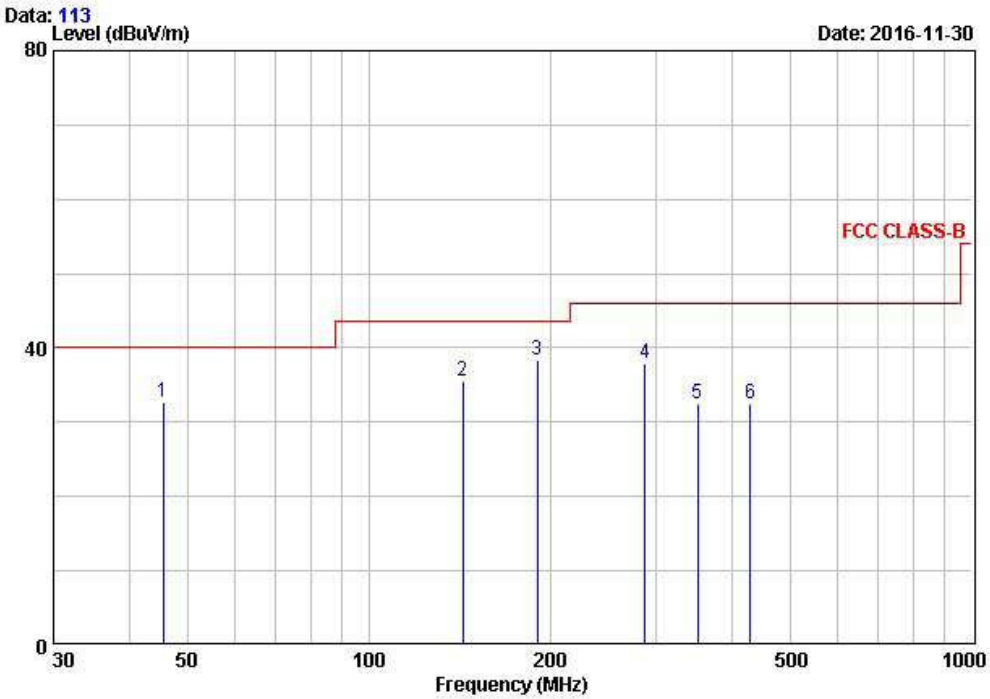
EUT/Model No.: DONGLE PL
TEST MODE: Wireless(HIGH) mode
Temp Humi : 16 / 34
Tested by: SIN S U



	Freq MHz	Reading dBuV	C.F dB	Result dBuV/m	Limit QP dBuV/m	Margin dB	Height cm	Angle deg	Polarity
1	45.60	49.80	-17.09	32.71	40.00	7.29	100	21	VERTICAL
2	143.20	50.50	-14.95	35.55	43.50	7.95	388	202	HORIZONTAL
3	190.50	54.80	-16.48	38.32	43.50	5.18	400	192	HORIZONTAL
4	287.50	51.00	-13.01	37.99	46.00	8.01	400	135	HORIZONTAL
5	350.60	43.90	-11.53	32.37	46.00	13.63	100	130	HORIZONTAL
6	428.60	41.50	-9.08	32.42	46.00	13.58	252	212	HORIZONTAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

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Radiated Emissions (Above 1 GHz) – 2.4 GHz Zigbee(Low) mode

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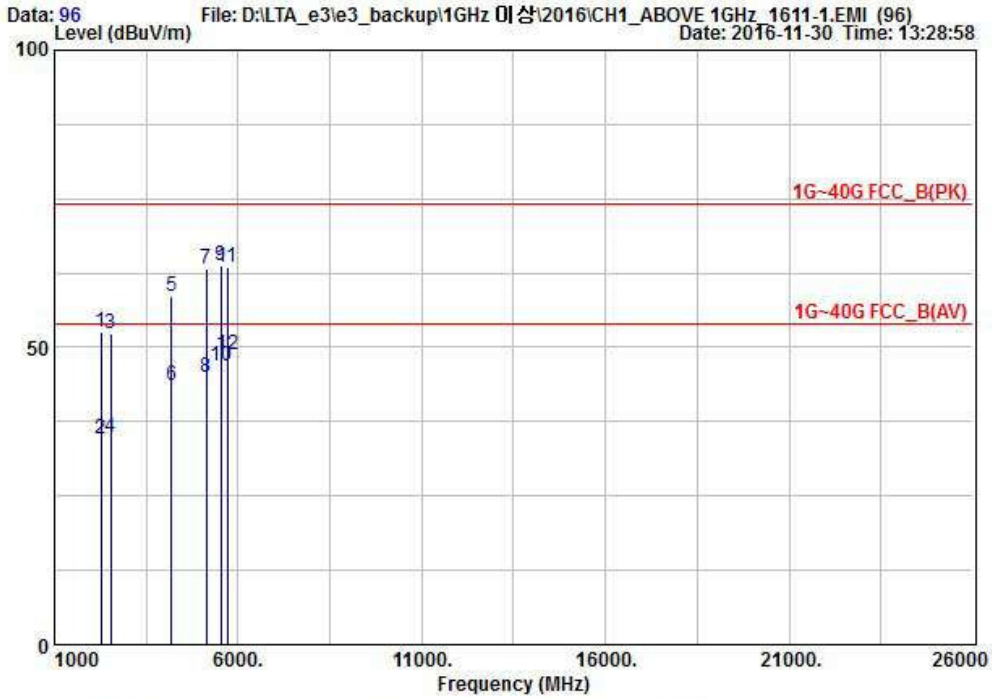
EUT/Model No.: DONGLE PL Test Mode: Wireless(LOW) mode

Tested by : SIN S U Temp/Humi: 18 / 39



	Freq MHz	Reading dBuV	C.F dB	Result PK dBuV/m	Limit dBuV/m	Margin dB	Polarity
1	2260.50	46.30	6.30	52.60	74.00	21.40	HORIZONTAL
2	2260.50	28.30	6.30	34.60	54.00	19.40	HORIZONTAL
3	2524.70	46.00	6.18	52.18	74.00	21.82	HORIZONTAL
4	2524.70	28.70	6.18	34.88	54.00	19.12	HORIZONTAL
5	4190.80	44.20	14.30	58.50	74.00	15.50	HORIZONTAL
6	4190.80	29.40	14.30	43.70	54.00	10.30	HORIZONTAL
7	5129.20	46.00	17.15	63.15	74.00	10.85	VERTICAL
8	5129.20	27.90	17.15	45.05	54.00	8.95	VERTICAL
9	5520.40	44.80	18.83	63.63	74.00	10.37	HORIZONTAL
10	5520.40	28.00	18.83	46.83	54.00	7.17	HORIZONTAL
11	5700.90	43.80	19.75	63.55	74.00	10.45	HORIZONTAL
12	5700.90	29.00	19.75	48.75	54.00	5.25	HORIZONTAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain
Blue : Vertical Black : Horizontal

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Radiated Emissions (Above 1 GHz) – 2.4 GHz Zigbee(Middle) mode

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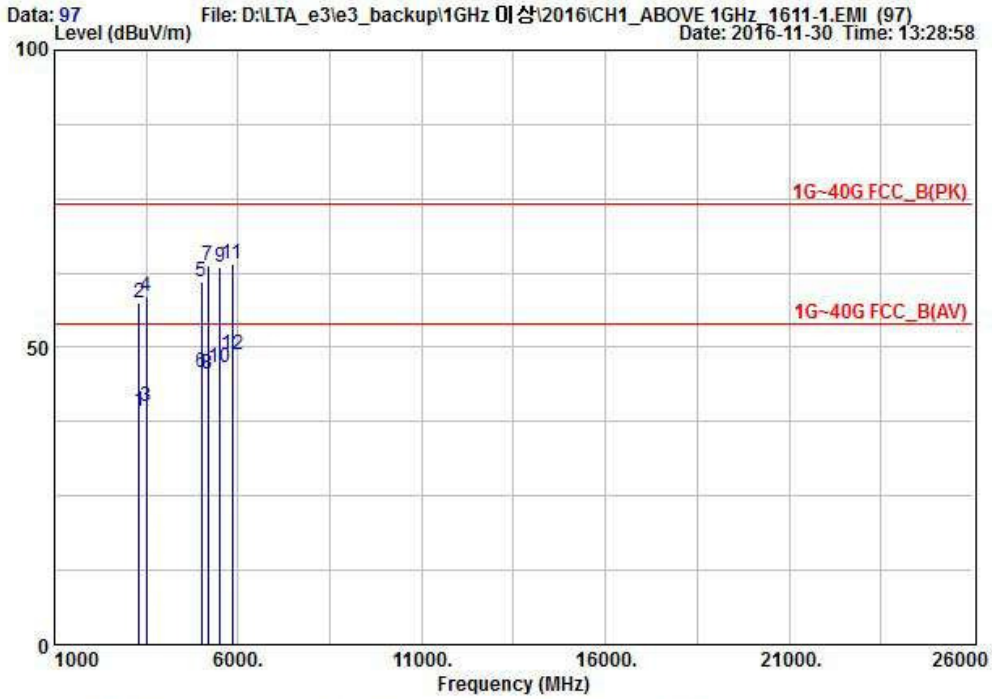
EUT/Model No.: DONGLE PL
Tested by : SIN S U
Test Mode: Wireless(MID) mode
Temp/Humi: 18 / 39



	Freq MHz	Reading dBuV	C.F dB	Result PK dBuV/m	Limit dBuV/m	Margin dB	Polarity
1	3300.50	28.50	10.73	39.23	54.00	14.77	HORIZONTAL
2	3300.50	46.80	10.73	57.53	74.00	16.47	HORIZONTAL
3	3511.80	28.50	11.61	40.11	54.00	13.89	HORIZONTAL
4	3511.80	47.00	11.61	58.61	74.00	15.39	HORIZONTAL
5	5011.50	44.50	16.66	61.16	74.00	12.84	HORIZONTAL
6	5011.50	29.00	16.66	45.66	54.00	8.34	HORIZONTAL
7	5180.00	46.50	17.37	63.87	74.00	10.13	VERTICAL
8	5180.00	28.10	17.37	45.47	54.00	8.53	VERTICAL
9	5511.90	44.60	18.78	63.38	74.00	10.62	HORIZONTAL
10	5511.90	27.90	18.78	46.68	54.00	7.32	HORIZONTAL
11	5835.90	43.50	20.44	63.94	74.00	10.06	HORIZONTAL
12	5835.90	28.20	20.44	48.64	54.00	5.36	HORIZONTAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain
Blue : Vertical Black : Horizontal

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Radiated Emissions (Above 1 GHz) – 2.4 GHz Zigbee(High) mode

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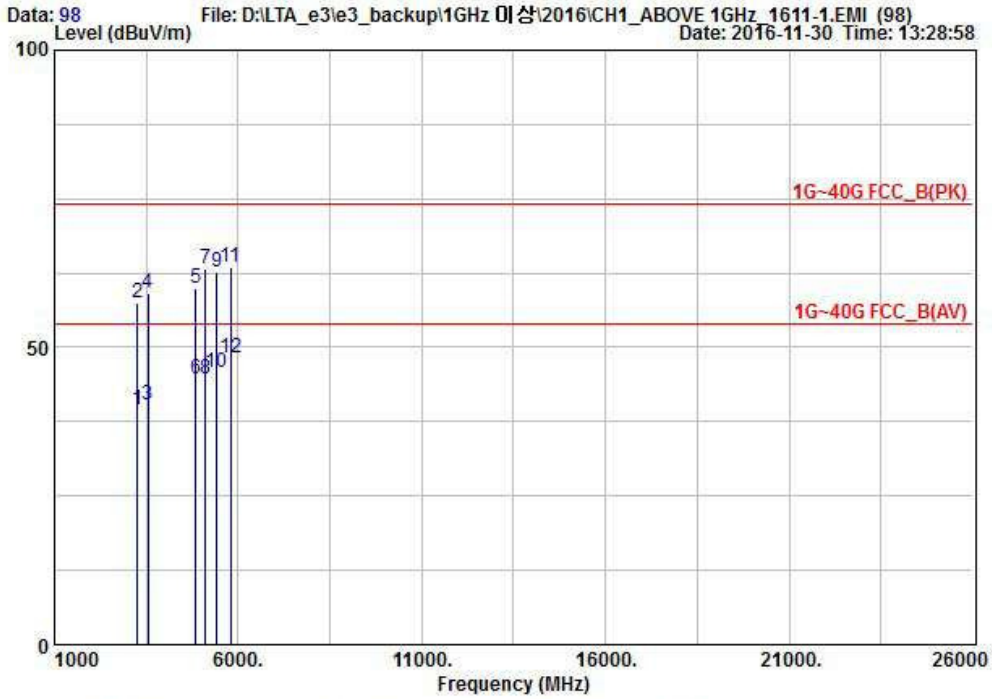
EUT/Model No.: DONGLE PL
Test Mode: Wireless(HIGH) mode
Tested by : SIN S U
Temp/Humi: 18 / 39



	Freq MHz	Reading dBuV	C.F dB	Result PK dBuV/m	Limit dBuV/m	Margin dB	Polarity
1	3254.50	28.90	10.54	39.44	54.00	14.56	HORIZONTAL
2	3254.50	47.00	10.54	57.54	74.00	16.46	HORIZONTAL
3	3554.60	28.40	11.81	40.21	54.00	13.79	HORIZONTAL
4	3554.60	47.30	11.81	59.11	74.00	14.89	HORIZONTAL
5	4850.20	43.80	16.15	59.95	74.00	14.05	HORIZONTAL
6	4850.20	28.50	16.15	44.65	54.00	9.35	HORIZONTAL
7	5112.50	46.10	17.08	63.18	74.00	10.82	VERTICAL
8	5112.50	27.70	17.08	44.78	54.00	9.22	VERTICAL
9	5418.00	44.20	18.38	62.58	74.00	11.42	HORIZONTAL
10	5418.00	27.50	18.38	45.88	54.00	8.12	HORIZONTAL
11	5799.00	43.10	20.26	63.36	74.00	10.64	HORIZONTAL
12	5799.00	27.90	20.26	48.16	54.00	5.84	HORIZONTAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain
Blue : Vertical Black : Horizontal

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3.2.6 AC Conducted Emissions

Procedure:

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). Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

Measurement Data: Complies

- See next pages for actual measured spectrum plots.
- No emissions were detected at a level greater than 20 dB below limit.

Minimum Standard: FCC Part 15.207(a)

Class B

Frequency Range	quasi-peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

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Conducted Emissions – 2.4 GHz Zigbee(LOW) mode + LINE

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EUT / Model No.	: DONGLE PL	Phase	: LINE
Test Mode	: Wireless(LOW) mode	Test Power	: 120 / 60
Temp. / Humi.	: 20 / 37	Test Engineer	: SIN S U

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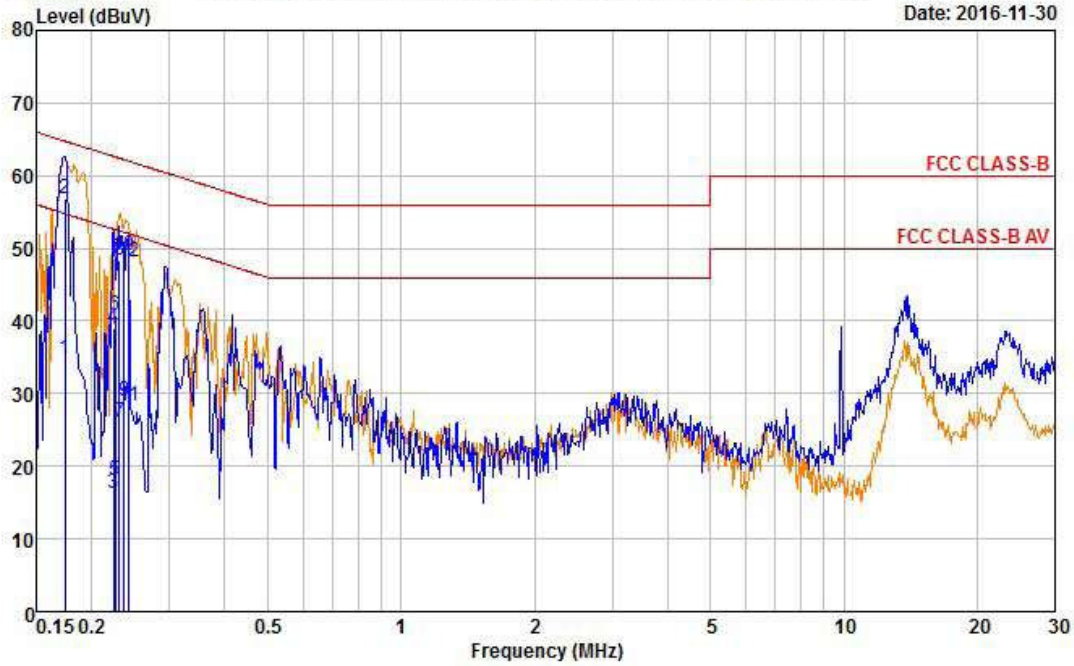

Freq MHz	RD QP dBuV	RD AV dBuV	C.F dB	Result QP dBuV	Result AV dBuV	Limit QP dBuV	Limit AV dBuV	Margin QP dB	Margin AV dB
0.174	37.35	15.35	19.48	56.83	34.83	64.77	54.77	7.94	19.94
0.224	19.47	-3.31	19.51	38.98	16.20	62.66	52.66	23.68	36.46
0.227	21.33	-1.39	19.51	40.84	18.12	62.57	52.57	21.73	34.45
0.231	28.75	6.51	19.51	48.26	26.02	62.40	52.40	14.14	26.38
0.236	29.46	9.54	19.51	48.97	29.05	62.22	52.22	13.25	23.17
0.243	28.71	8.68	19.51	48.22	28.19	61.98	51.98	13.76	23.79

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter

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Conducted Emissions – 2.4 GHz Zigbee(LOW) mode + NEUTRAL

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EUT / Model No.	: DONGLE PL	Phase	: NEUTRAL
Test Mode	: Wireless(LOW) mode	Test Power	: 120 / 60
Temp. / Humi.	: 20 / 37	Test Engineer	: SIN S U

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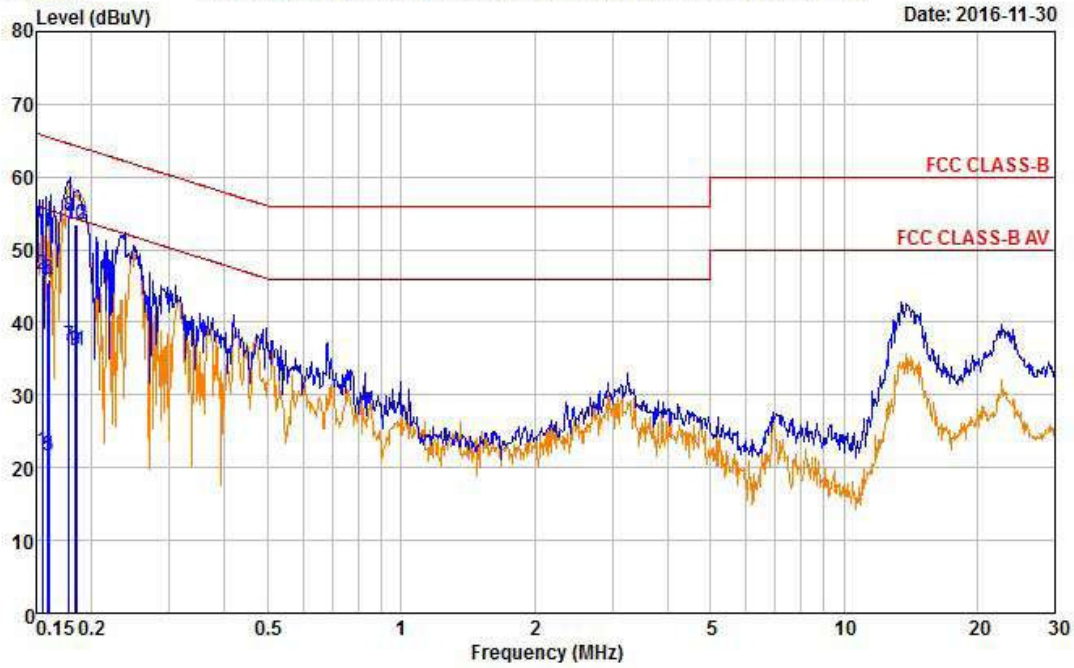

Freq MHz	RD QP dBuV	RD AV dBuV	C.F dB	Result QP dBuV	Result AV dBuV	Limit QP dBuV	Limit AV dBuV	Margin QP dB	Margin AV dB
0.155	27.01	2.91	19.46	46.47	22.37	65.75	55.75	19.28	33.38
0.160	26.04	2.05	19.47	45.51	21.52	65.48	55.48	19.97	33.96
0.160	26.35	2.13	19.47	45.82	21.60	65.47	55.47	19.65	33.87
0.178	35.11	17.24	19.48	54.59	36.72	64.57	54.57	9.98	17.85
0.184	34.08	16.71	19.48	53.56	36.19	64.29	54.29	10.73	18.10
0.185	33.95	16.63	19.49	53.44	36.12	64.28	54.28	10.84	18.16

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter

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Conducted Emissions – 2.4 GHz Zigbee(Middle) mode + LINE

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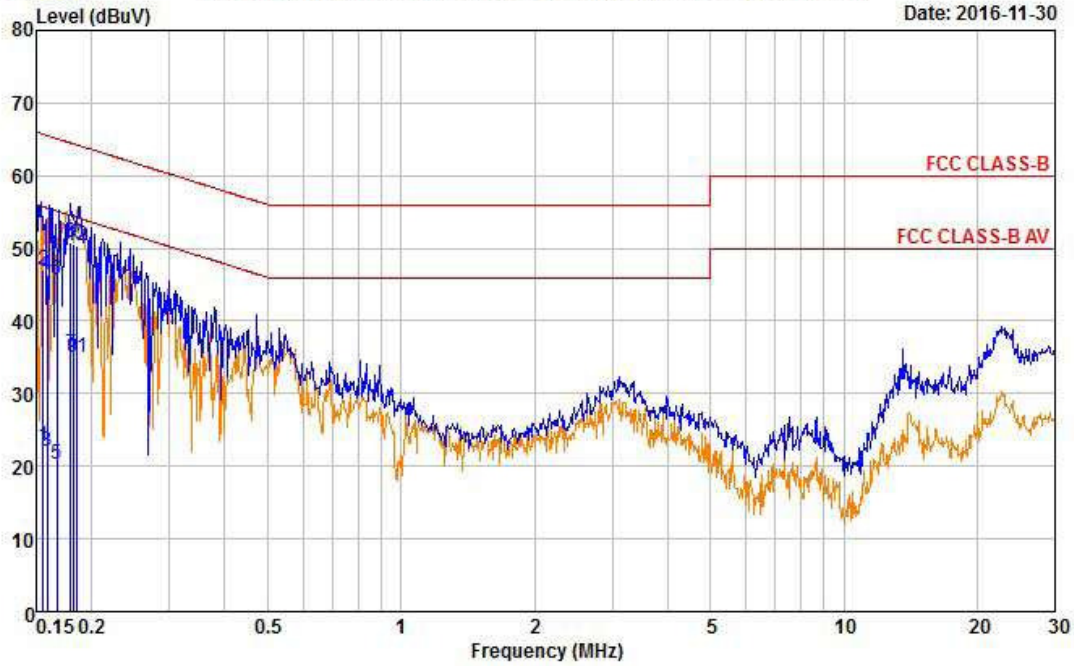
EUT / Model No.	: DONGLE PL	Phase	: LINE
Test Mode	: Wireless(MID) mode	Test Power	: 120 / 60
Temp. / Humi.	: 20 / 37	Test Engineer	: SIN S U

Data: 2149 File: D:\Conducted Data\2015\2016\LTA_Conduction_2016_11.EM6 (2149)



Freq MHz	RD QP dBuV	RD AV dBuV	C.F dB	Result QP dBuV	Result AV dBuV	Limit QP dBuV	Limit AV dBuV	Margin QP dB	Margin AV dB
0.156	27.50	3.21	19.46	46.96	22.67	65.70	55.70	18.74	33.03
0.159	26.93	2.66	19.46	46.39	22.12	65.51	55.51	19.12	33.39
0.167	26.12	0.70	19.48	45.60	20.18	65.12	55.12	19.52	34.94
0.180	31.24	16.06	19.48	50.72	35.54	64.50	54.50	13.78	18.96
0.181	31.11	15.51	19.48	50.59	34.99	64.42	54.42	13.83	19.43
0.186	30.83	15.49	19.49	50.32	34.98	64.24	54.24	13.92	19.26

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter

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Conducted Emissions – 2.4 GHz Zigbee(Middle) mode + NEUTRAL

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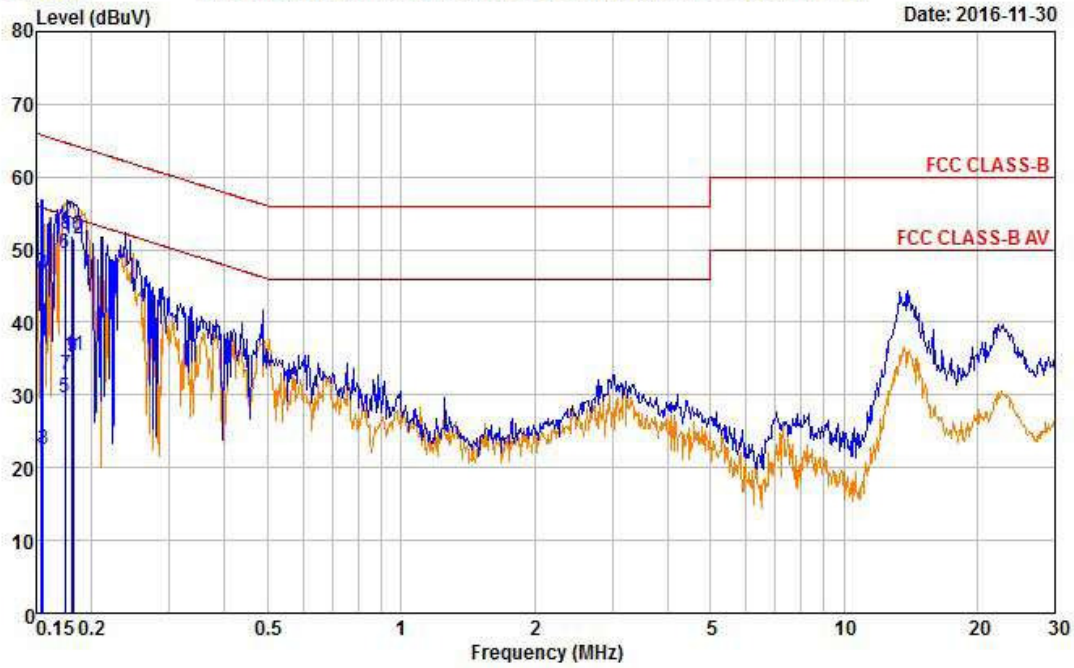
EUT / Model No.	: DONGLE PL	Phase	: NEUTRAL
Test Mode	: Wireless(MID) mode	Test Power	: 120 / 60
Temp. / Humi.	: 20 / 37	Test Engineer	: SIN S U

Data: 2145 File: D:\Conducted Data\2015\2016\LTA_Conduction_2016_11.EM6 (2145)



Freq MHz	RD QP dBuV	RD AV dBuV	C.F dB	Result QP dBuV	Result AV dBuV	Limit QP dBuV	Limit AV dBuV	Margin QP dB	Margin AV dB
0.153	27.44	2.05	19.46	46.90	21.51	65.82	55.82	18.92	34.31
0.156	27.03	3.12	19.46	46.49	22.58	65.70	55.70	19.21	33.12
0.174	30.03	10.18	19.48	49.51	29.66	64.77	54.77	15.26	25.11
0.175	32.74	13.28	19.48	52.22	32.76	64.72	54.72	12.50	21.96
0.181	32.47	15.83	19.48	51.95	35.31	64.44	54.44	12.49	19.13
0.183	32.02	16.00	19.48	51.50	35.48	64.37	54.37	12.87	18.89

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter

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Conducted Emissions – 2.4 GHz Zigbee(High) mode + LINE

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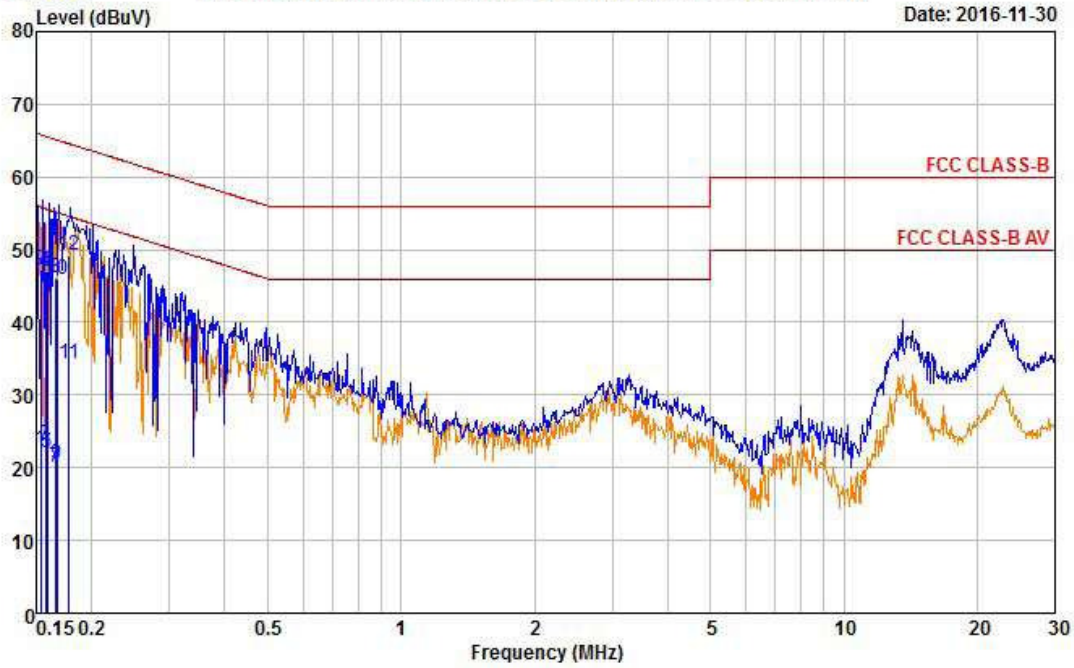
EUT / Model No.	: DONGLE PL	Phase	: LINE
Test Mode	: Wireless(HIGH) mode	Test Power	: 120 / 60
Temp. / Humi.	: 20 / 37	Test Engineer	: SIN S U

Data: 2155 File: D:\Conducted Data\2015\2016\LTA_Conduction_2016_11.EM6 (2155)



Freq MHz	RD QP dBuV	RD AV dBuV	C.F dB	Result QP dBuV	Result AV dBuV	Limit QP dBuV	Limit AV dBuV	Margin QP dB	Margin AV dB
0.154	27.89	3.02	19.46	47.35	22.48	65.81	55.81	18.46	33.33
0.157	27.62	3.61	19.46	47.08	23.07	65.61	55.61	18.53	32.54
0.159	27.58	2.61	19.46	47.04	22.07	65.51	55.51	18.47	33.44
0.166	26.70	0.59	19.48	46.18	20.07	65.17	55.17	18.99	35.10
0.167	26.34	0.98	19.48	45.82	20.46	65.12	55.12	19.30	34.66
0.178	29.86	14.86	19.48	49.34	34.34	64.59	54.59	15.25	20.25

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter

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Conducted Emissions – 2.4 GHz Zigbee(High) mode + NEUTRAL

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EUT / Model No.	: DONGLE PL	Phase	: NEUTRAL
Test Mode	: Wireless(HIGH) mode	Test Power	: 120 / 60
Temp. / Humi.	: 20 / 37	Test Engineer	: SIN S U

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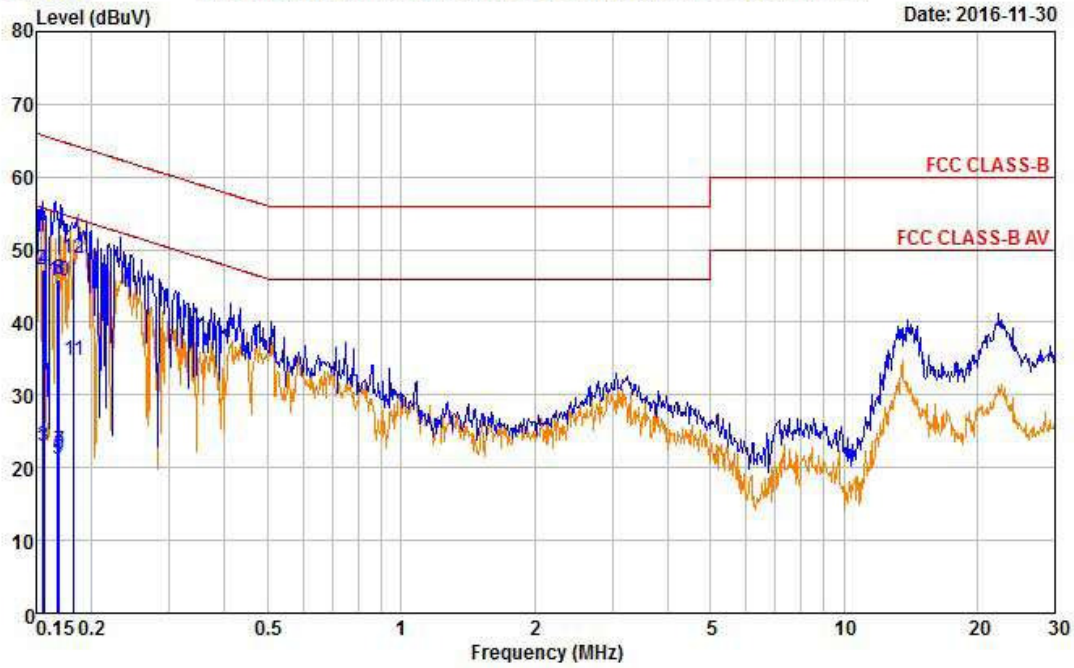

Freq MHz	RD QP dBuV	RD AV dBuV	C.F dB	Result QP dBuV	Result AV dBuV	Limit QP dBuV	Limit AV dBuV	Margin QP dB	Margin AV dB
0.155	27.88	3.22	19.46	47.34	22.68	65.74	55.74	18.40	33.06
0.156	27.80	3.60	19.46	47.26	23.06	65.66	55.66	18.40	32.60
0.168	26.40	1.59	19.48	45.88	21.07	65.08	55.08	19.20	34.01
0.169	26.42	2.78	19.48	45.90	22.26	65.01	55.01	19.11	32.75
0.169	26.18	2.44	19.48	45.66	21.92	64.99	54.99	19.33	33.07
0.183	29.35	15.38	19.48	48.83	34.86	64.37	54.37	15.54	19.51

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter

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APPENDIX

TEST EQUIPMENT USED FOR TESTS

	Description	Model No.	Serial No.	Manufacturer	Interval	Last Cal. Date
1	Signal Analyzer (9 kHz ~ 30 GHz)	FSV30	100757	R&S	1 year	2016-10-11
2	Signal Generator (~ 3.2 GHz)	8648C	3623A02597	HP	1 year	2016-03-21
3	SYNTHESIZED CW GENERATOR	83711B	US34490456	HP	1 year	2016-03-21
4	Attenuator (3 dB)	8491A	37822	HP	1 year	2016-09-12
5	Attenuator (10 dB)	8491A	63196	HP	1 year	2016-09-12
6	Test Receiver (~ 30 MHz)	ESHS10	828404/009	R&S	1 year	2016-03-21
7	EMI Test Receiver (~ 7 GHz)	ESCI7	100722	R&S	1 year	2016-09-12
8	RF Amplifier (~ 1.3 GHz)	8447D OPT 010	2944A07684	HP	-	-
9	RF Amplifier (1 ~ 26.5 GHz)	8449B	3008A02126	HP	1 year	2016-03-22
10	Horn Antenna (1 ~ 18 GHz)	3115	00114105	ETS	1 year	2016-04-21
11	DRG Horn (Small)	3116B	81109	ETS-Lindgren	1 year	2016-02-26
12	DRG Horn (Small)	3116B	133350	ETS-Lindgren	1 year	2016-02-26
13	TRILOG Antenna	VULB 9160	9160-3237	SCHWARZBECK	2 year	2015-04-21
14	Temp.Humidity Data Logger	SK-L200TH II A	00801	SATO	1 year	2016-03-22
15	Splitter (SMA)	ZFSC-2-2500	SF617800326	Mini-Circuits	-	-
16	Power Divider	11636A	06243	HP	1 year	2016-09-12
17	DC Power Supply	6674A	3637A01657	Agilent	-	-
18	Frequency Counter	5342A	2826A12411	HP	1 year	2016-03-21
19	Power Meter	EPM-441A	GB32481702	HP	1 year	2016-03-22
20	Power Sensor	8481A	3318A94972	HP	1 year	2016-01-05
21	Audio Analyzer	8903B	3729A18901	HP	1 year	2016-09-12
22	Modulation Analyzer	8901B	3749A05878	HP	1 year	2016-09-12
23	TEMP & HUMIDITY Chamber	YJ-500	LTAS06041	JinYoung Tech	1 year	2016-09-12
24	Stop Watch	HS-3	812Q08R	CASIO	2 year	2016-03-22
25	LISN	KNW-407	8-1430-1	Kyoritsu	1 year	2016-09-12
26	Two-Lime V-Network	ESH3-Z5	893045/017	R&S	1 year	2016-03-21
27	UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	106243	R&S	1 year	2016-03-21
28	Highpass Filter	WHKX1.5/15G-10SS	74	Wainwright Instruments	1 year	2016-03-21
29	Highpass Filter	WHKX3.0/18G-10SS	118	Wainwright Instruments	1 year	2016-03-21
30	Active Loop Antenna	FMZB1519	1519-031	SCHWARZBECK	2 year	2016-01-12
31	OSP120 BASE UNIT	OSP120	101230	R&S	1 year	2016-03-22
32	Signal Generator(100 kHz ~ 40 GHz)	SMB100A	177621	R&S	1 year	2016-03-22
33	Signal Analyzer (10 Hz ~ 40 GHz)	FSV40	101367	R&S	1 year	2016-03-22

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