Testing Laboratory 1190

FCC Test Report

FCC ID	:	2AGBW9290019758X
Equipment	:	Hue outdoor sensor
Brand Name	:	PHILIPS
Model Name	:	9290019758
Applicant	:	Philips Lighting (China) Investment Co., Ltd. Building 9, Lane 888, Tianlin Road, Minhang District, Shanghai 200233 China
Manufacturer	:	Philips Lighting (China) Investment Co., Ltd. Building 9, Lane 888, Tianlin Road, Minhang District, Shanghai 200233 China
Standard	:	47 CFR FCC Part 15.247

The product was received on Aug. 01, 2018, and testing was started from Aug. 02, 2018 and completed on Aug. 27, 2018. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Approved by: Phoenix Chen

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)

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PHOTOGRAPHS OF EUT V01

History of this test report

Report No.	Version	Description	Issued Date
FR873106AZ	01	Initial issue of report	Sep. 18, 2018

Summary of Test Result

Report Clause	Ref. Std. Clause	Test Items	Result (PASS/FAIL)	Remark
1.1.2	15.203	Antenna Requirement	PASS	FCC 15.203
3.1	15.207	AC Power-line Conducted Emissions	Not Required	FCC 15.207
3.2	15.247(a)	DTS Bandwidth	PASS	≥500kHz
3.3	15.247(b)	Maximum Conducted Output Power	PASS	Power [dBm]:30
3.4	15.247(e)	Power Spectral Density	PASS	PSD [dBm/3kHz]:8
3.5	15.247(d)	Emissions in Non-restricted Frequency Bands	PASS	Non-Restricted Bands: > 30 dBc
3.6	15.247(d)	Emissions in Restricted Frequency Bands	PASS	Restricted Bands: FCC 15.209

Reviewed by: Sam Tsai

Report Producer: Jenny Yang

1 General Description

1.1 Information

1.1.1 RF General Information

Frequency Range (MHz)	IEEE Std.	Ch. Frequency (MHz)	Channel Number
2400-2483.5	802.15.4	2405-2480	11-26 [16]

Band	Mode	BWch (MHz)	Nant
2.4-2.4835GHz	Zigbee	5	1TX

Note:.
- Zigbee uses a O-QPSK (250kbps) modulation for DSSS.
- BWch is the nominal channel bandwidth.

1.1.2 Antenna Information

Ant.	Port	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	1	LITEON	SZ3507AT-00	PCB	fixed on board	2.85

1.1.3 EUT Information

Operational Condition				
EUT Power Type	From Battery			
EUT Function	☒	Point-to-multipoint	☐	Point-to-point

Type of EUT		
☒	Stand-alone	
☐	Combined (EUT where the radio part is fully integrated within another device)	
	Combined Equipment - Brand Name / Model No.:	…
☐	Plug-in radio (EUT intended for a variety of host systems)	
	Host System - Brand Name / Model No.:	…
☐	Other:	

1.1.4 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)	VBW(Hz) ≥ 1/T
Zigbee	1	0	n/a (DC>=0.98)	n/a (DC>=0.98)

1.2 Testing Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR FCC Part 15
- ANSI C63.10-2013
- KDB 558074 D01 v05

1.3 Testing Location Information

Testing Location						
☒	HWA YA	ADD	:	No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)		
		TEL	:	886-3-327-3456	FAX :	886-3-327-0973
Test site Designation No. TW1190 with FCC.						
☐	JHUBEI	ADD	:	No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County, Taiwan (R.O.C.)		
		TEL	:	886-3-656-9065	FAX :	886-3-656-9085
Test site Designation No. TW0006 with FCC.						

Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
RF Conducted	TH01-HY	Andy	24.5°C / 65%	27/Aug/2018
Radiated	03CH03-HY	Jeff	24.2°C / 56%	27/Aug/2018

1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	3.6 dB	Confidence levels of 95%
Radiated Emission (9kHz ~ 30MHz)	3.0 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	4.3 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.9 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Conducted Emission	1.3 dB	Confidence levels of 95%
Temperature	0.7 °C	Confidence levels of 95%
Humidity	4 %	Confidence levels of 95%

2 Test Configuration of EUT

2.1 Test Condition

RF Conducted	Abbreviation	Remark
TnomVnom	Tnom	20°C
-	Vnom	3V

2.2 Test Channel Mode

Test Software	Dos

Mode	Power Setting
Zigbee	-
2405MHz	0
2440MHz	0
2480MHz	1

2.3 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests	
Tests Item	DTS Bandwidth Maximum Conducted Output Power Power Spectral Density Emissions in Non-restricted Frequency Bands
Test Condition	Conducted measurement at transmit chains

The Worst Case Mode for Following Conformance Tests			
Tests Item	Emissions in Restricted Frequency Bands		
Test Condition	Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type.		
Operating Mode < 1GHz	CTX		
1	Battery Mode		
Operating Mode > 1GHz	CTX		
Orthogonal Planes of EUT	**X Plane**	**Y Plane**	**Z Plane**
Worst Planes of EUT			V

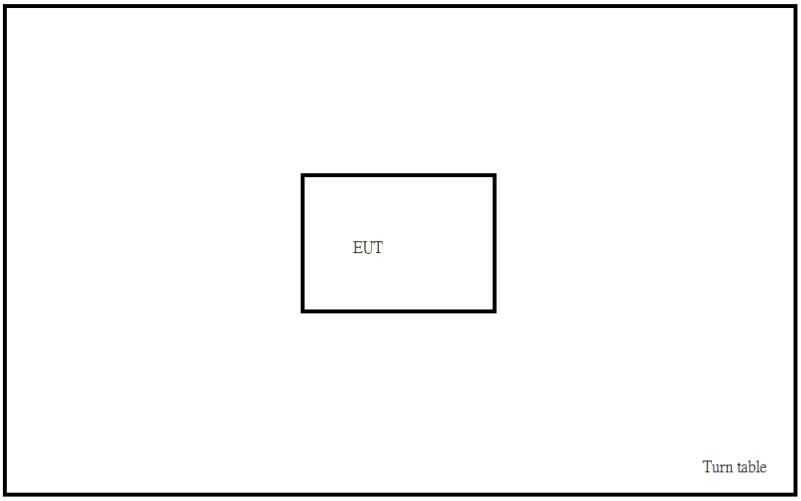
2.4 Support Equipment

Support Equipment – RF Conducted				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
1	Notebook	DELL	E5410	DoC
2	Adapter for NB	DELL	HA65NM130	DoC
3	DC Power supply	GW	GPS-3030DD	-
4	Fixture	-	FT232 USB UART Board (type A)	-

Support Equipment – Radiated				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
1	Battery	-	-	-

2.5 Test Setup Diagram

Test Setup Diagram - Radiated Test



3 Transmitter Test Result

3.1 AC Power-line Conducted Emissions

3.1.1 AC Power-line Conducted Emissions Limit

AC Power-line Conducted Emissions Limit		
Frequency Emission (MHz)	**Quasi-Peak**	**Average**
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50
Note 1: * Decreases with the logarithm of the frequency.		

3.1.2 Measuring Instruments

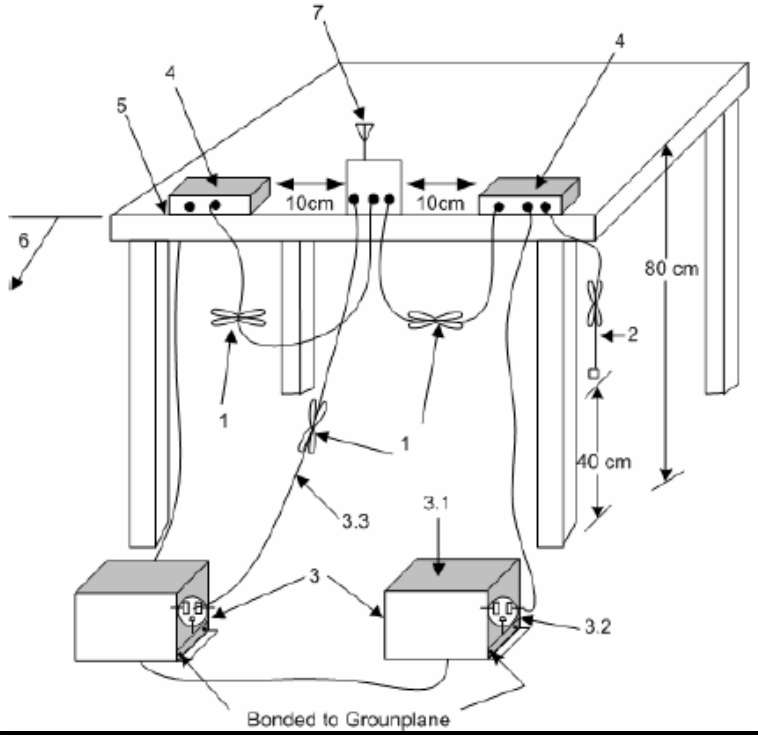
Refer a test equipment and calibration data table in this test report.

3.1.3 Test Procedures

Test Method
☒ Refer as ANSI C63.10-2013, clause 6.2 for AC power-line conducted emissions.

3.1.4 Test Setup

AC Power-line Conducted Emissions



3.1.5 Test Result of AC Power-line Conducted Emissions

Please refer to FCC 15.207 which states, “Measurements to demonstrate compliance with the conducted limits are not required for devices employ Battery for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines”.
Therefore, for this device, AC Power Line Conducted Emissions investigation is not required.

3.2 DTS Bandwidth

3.2.1 6dB Bandwidth Limit

6dB Bandwidth Limit
Systems using digital modulation techniques:
▪ 6 dB bandwidth ≥ 500 kHz.

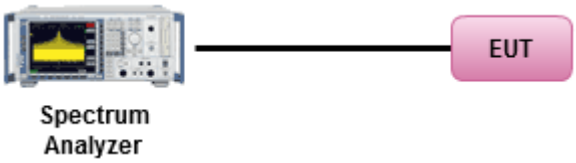
3.2.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.2.3 Test Procedures

Test Method	
▪ For the emission bandwidth shall be measured using one of the options below:	
	☒ Refer as KDB 558074, clause 8.2 (11.9.2.2 of ANSI C63.10) DTS bandwidth measurement.
	☐ Refer as RSS-Gen, clause 6.7 for occupied bandwidth testing.
	☐ Refer as ANSI C63.10, clause 6.9.3 for occupied bandwidth testing.

3.2.4 Test Setup

Emission Bandwidth


3.2.5 Test Result of Emission Bandwidth

Refer as Appendix A

3.3 Maximum Conducted Output Power

3.3.1 Maximum Conducted Output Power Limit

Maximum Conducted Output Power Limit			
	▪ If $G_{TX} \leq 6$ dBi, then $P_{Out} \leq 30$ dBm (1 W)		
	▪ Point-to-multipoint systems (P2M): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 – (G_{TX} – 6)$ dBm		
	▪ Point-to-point systems (P2P): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 – (G_{TX} – 6)/3$ dBm		
	▪ Smart antenna system (SAS):		
		- Single beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 – (G_{TX} – 6)/3$ dBm	
		- Overlap beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 – (G_{TX} – 6)/3$ dBm	
		- Aggregate power on all beams: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 – (G_{TX} – 6)/3 + 8$dB dBm	
e.i.r.p. Power Limit:			
▪ 2400-2483.5 MHz Band			
	▪ Point-to-multipoint systems (P2M): $P_{eirp} \leq 36$ dBm (4 W)		
	▪ Point-to-point systems (P2P): $P_{eirp} \leq MAX(36, [P_{Out} + G_{TX}])$ dBm		
	▪ Smart antenna system (SAS)		
		- Single beam: $P_{eirp} \leq MAX(36, P_{Out} + G_{TX})$ dBm	
		- Overlap beam: $P_{eirp} \leq MAX(36, P_{Out} + G_{TX})$ dBm	
		- Aggregate power on all beams: $P_{eirp} \leq MAX(36, [P_{Out} + G_{TX} + 8])$ dBm	
P_{Out} = maximum peak conducted output power or maximum conducted output power in dBm, **G_{TX}** = the maximum transmitting antenna directional gain in dBi.			

3.3.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.3.3 Test Procedures

Test Method	
▪ Maximum Peak Conducted Output Power	
	☐ Refer as KDB 558074, clause 8.3.1.1 (11.9.1.1 of ANSI C63.10) RBW ≥ EBW method.
	☐ Refer as KDB 558074, clause 8.3.1.2 (11.9.1.2 of ANSI C63.10) integrated band power method.
	☐ Refer as KDB 558074, clause 8.3.1.3 (11.9.1.3 of ANSI C63.10) peak power meter.
▪ Maximum Average Conducted Output Power	
	☐ Refer as KDB 558074, clause 8.3.2.2 (11.9.2.2 of ANSI C63.10) using a spectrum analyzer.
	☒ Refer as KDB 558074, clause 8.3.2.3 (11.9.2.3 of ANSI C63.10) using a power meter.
▪ For conducted measurement.	
	▪ If the EUT supports multiple transmit chains using options given below: Refer as KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them.
	▪ If multiple transmit chains, EIRP calculation could be following as methods: $P_{total} = P_1 + P_2 + \ldots + P_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $EIRP_{total} = P_{total} + DG$

3.3.4 Test Setup

Maximum Conducted Output Power (Power Meter)

3.3.5 Test Result of Maximum Conducted Output Power

Refer as Appendix B

3.4 Power Spectral Density

3.4.1 Power Spectral Density Limit

Power Spectral Density Limit
▪ Power Spectral Density (PSD) ≤ 8 dBm/3kHz

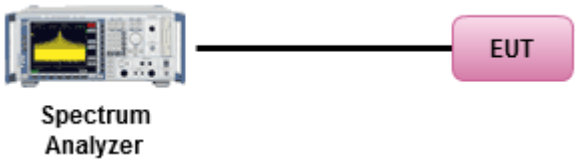
3.4.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.4.3 Test Procedures

Test Method		
▪ Peak power spectral density procedures that the same method as used to determine the conducted output power. If maximum peak conducted output power was measured to demonstrate compliance to the output power limit, then the peak PSD procedure below (Method PKPSD) shall be used. If maximum conducted output power was measured to demonstrate compliance to the output power limit, then one of the average PSD procedures shall be used, as applicable based on the following criteria (the peak PSD procedure is also an acceptable option).		
	☒ Refer as KDB 558074, clause 8.4 (11.10 of ANSI C63.10) Method PKPSD.	
▪ For conducted measurement.		
	▪ If The EUT supports multiple transmit chains using options given below:	
		▪ Measure and sum the spectra across the outputs. Refer as KDB 662911, In-band power spectral density (PSD). Sample all transmit ports simultaneously using a spectrum analyzer for each transmit port. Where the trace bin-by-bin of each transmit port summing can be performed. (i.e., in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the NTX output to obtain the value for the first frequency bin of the summed spectrum.). Add up the amplitude (power) values for the different transmit chains and use this as the new data trace.

3.4.4 Test Setup

Power Spectral Density


3.4.5 Test Result of Power Spectral Density

Refer as Appendix C

3.5 Emissions in Non-restricted Frequency Bands

3.5.1 Emissions in Non-restricted Frequency Bands Limit

Un-restricted Band Emissions Limit	
RF output power procedure	**Limit (dB)**
Peak output power procedure	20
Average output power procedure	30
Note 1: If the peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level. Note 2: If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in-band average PSD level.	

3.5.2 Measuring Instruments

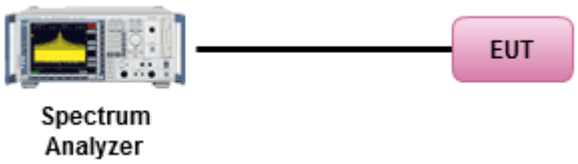
Refer a test equipment and calibration data table in this test report.

3.5.3 Test Procedures

Test Method
▪ Refer as KDB 558074, clause 8.5 (11.11 of ANSI C63.10) for non-restricted frequency bands.

3.5.4 Test Setup

Emissions in Non-restricted Frequency Bands



3.5.5 Test Result of Emissions in Non-restricted Frequency Bands

Refer as Appendix D

3.6 Emissions in Restricted Frequency Bands

3.6.1 Emissions in Restricted Frequency Bands Limit

Restricted Band Emissions Limit			
Frequency Range (MHz)	**Field Strength (uV/m)**	**Field Strength (dBuV/m)**	**Measure Distance (m)**
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

Note 3: Using the distance of 1m during the test for above 18 GHz, and the test value to correct for the distance factor at 3m.

3.6.2 Measuring Instruments

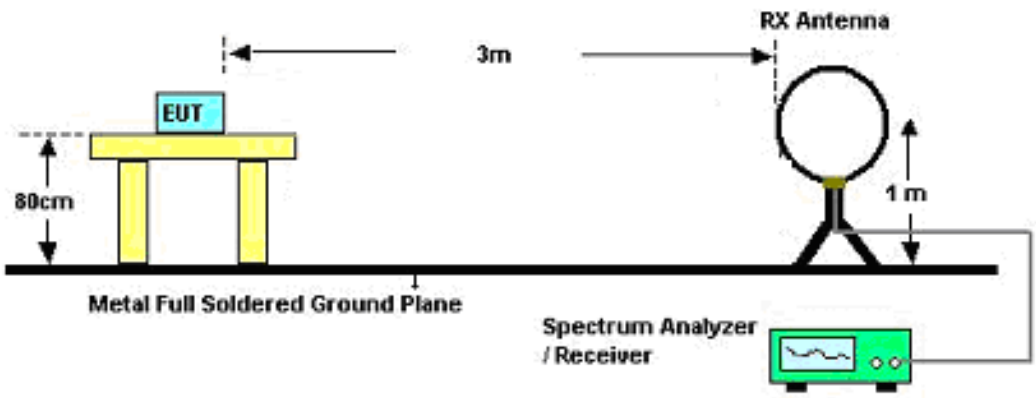
Refer a test equipment and calibration data table in this test report.

3.6.3 Test Procedures

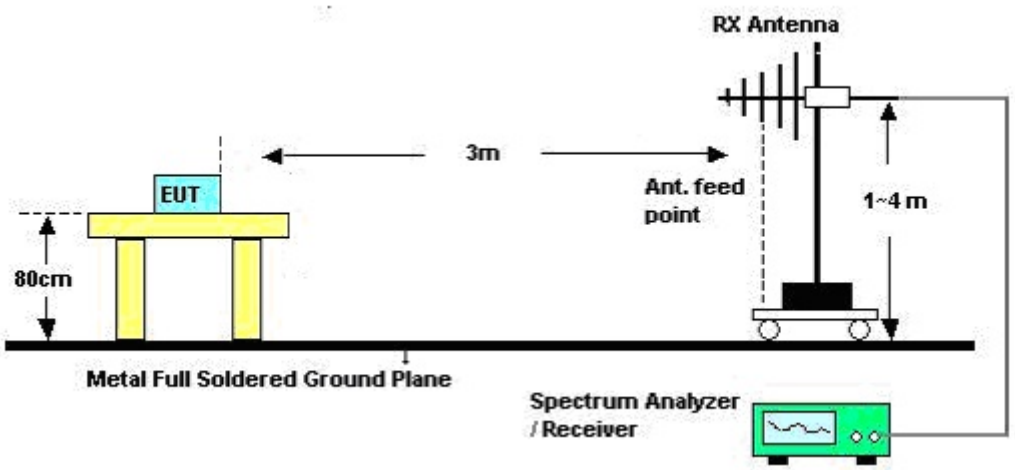
Test Method	
▪ The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].	
▪ Refer as ANSI C63.10, clause 6.10.3 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.	
▪ For the transmitter unwanted emissions shall be measured using following options below:	
	▪ Refer as KDB 558074, clause 8.6 (11.12 of ANSI C63.10) for restricted frequency bands.
▪ For the transmitter band-edge emissions shall be measured using following options below:	
	▪ Refer as KDB 558074 clause 8.7.1, When the performing peak or average radiated measurements, emissions within 2 MHz of the authorized band edge may be measured using the marker-delta method described below.
	▪ Refer as KDB 558074, clause 8.7.2 (6.10.6 of ANSI C63.10) for marker-delta method for band-edge measurements.
	▪ Refer as KDB 558074, clause 8.7.3 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz).

3.6.4 Test Setup

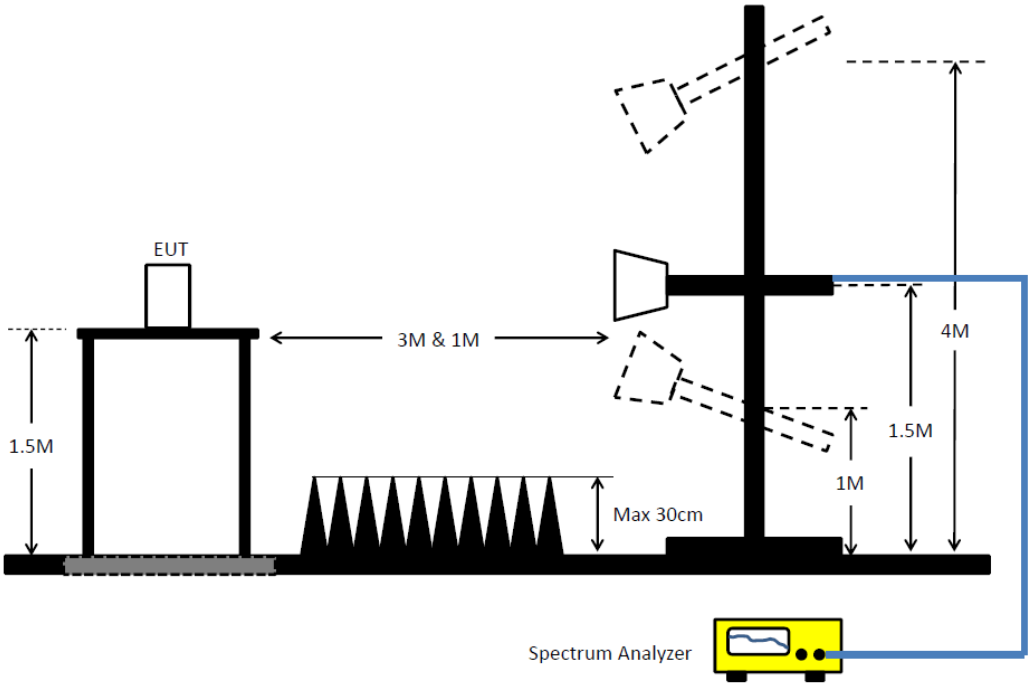
Emissions in Restricted Frequency Bands
9kHz ~30MHz



30MHz~1GHz



Above 1GHz



3.6.5 Test Result of Emissions in Restricted Frequency Bands (Below 30MHz)

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

3.6.6 Test Result of Emissions in Restricted Frequency Bands

Refer as Appendix E

4 Test Equipment and Calibration Data

Instrument for Conducted Test

Instrument	Manufacturer	Model No.	Serial No.	Spec.	Calibration Date	Calibration Due Date
Spectrum Analyzer	R&S	FSV 40	101013	9kHz~40GHz	29/Dec/2017	28/Dec/2018
Signal Generator	R&S	SMR 40	100116	10MHz ~ 40GHz	23/Jul/2018	22/Jul/2019
Pulse Power Sensor	Anritsu	MA2411B	1027452	300MHz ~ 40GHz	27/Feb/2018	26/Feb/2019
Power Meter	Anritsu	ML2495A	1124009	300MHz ~ 40GHz	27/Feb/2018	26/Feb/2019
CABLE 0.2m	HUBER	MY37960/4	RF Cable - 17	1 to 18GHz	17/Jan/2018	16/Jan/2019
CABLE 0.2m	HUBER	MY37960/4	RF Cable - 17	30 to 1000MHz	17/Jan/2018	16/Jan/2019
CABLE 0.5m	HUBER	MY37963/4	RF Cable - 22	1 to 18GHz	17/Jan/2018	16/Jan/2019

Instrument for Radiated Test

Instrument	Manufacturer	Model No.	Serial No.	Spec.	Calibration Date	Calibration Due Date
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz ~ 1GHz 3m	31/Oct/2017	30/Oct/2018
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	1GHz ~ 18GHz 3m	01/Nov/2017	31/Oct/2018
Amplifier	HP	8447D	2944A08033	10kHz ~ 1.3GHz	23/Apr/2018	19/Apr/2019
Microwave System Preamplifier	KEYSIGHT	83017A	MY53270196	1GHz ~ 26.5GHz	31/Aug/2017	30/Aug/2018
Signal Analyzer	R&S	FSP40	100305	10Hz ~ 40GHz	04/Jan/2018	03/Jan/2019
RF Cable-R03m	Jye Bao	RG142	CB021	9kHz ~ 1GHz	29/Jan/2018	28/Jan/2019
RF Cable-high	SUHNER	SUCOFLEX 106	CB222	1GHz ~ 40GHz	29/Jan/2018	28/Jan/2019
Bilog Antenna	SCHAFFNER	CBL 6112B	2723	30MHz ~ 1GHz	09/Sep/2017	08/Sep/2018
Receiver	R&S	ESCS 30	100354	9kHz ~ 2.75GHz	08/Dec/2017	07/Dec/2018
Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA 9170154	18GHz ~ 40GHz	06/Feb/ 2018	05/Feb/2019
Double Ridged Guide Horn Antenna	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1531	1GHz ~ 18GHz	18/Apr/ 2018	17/Apr/2019
Loop Antenna	TESEQ	HLA 6120	31244	9kHz ~ 30MHz	28/Mar/2018	27/Mar/2019

Summary

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
2.4-2.4835GHz	-	-	-	-	-
Zigbee	1.625M	2.411M	2M41G1D	1.625M	2.411M

Max-N dB = Maximum 6dB down bandwidth; **Max-OBW** = Maximum 99% occupied bandwidth;
Min-N dB = Minimum 6dB down bandwidth; **Min-OBW** = Minimum 99% occupied bandwidth;

Result

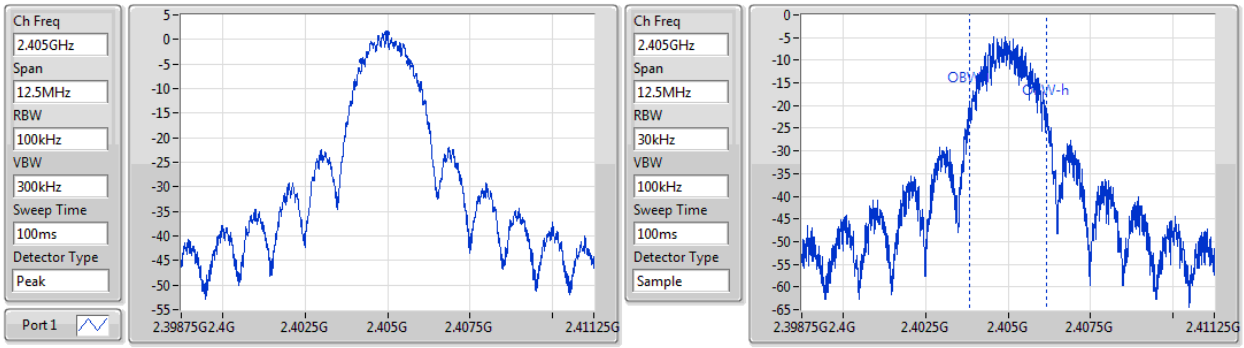
Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
Zigbee	-	-	-	-
2405MHz_TnomVnom	Pass	500k	1.419M	2.355M
2440MHz_TnomVnom	Pass	500k	1.538M	2.386M
2480MHz_TnomVnom	Pass	500k	1.625M	2.411M

Port X-N dB = Port **X** 6dB down bandwidth; **Port X-OBW** = Port **X** 99% occupied bandwidth;

Zigbee **EBW**

2405MHz

07/08/2018

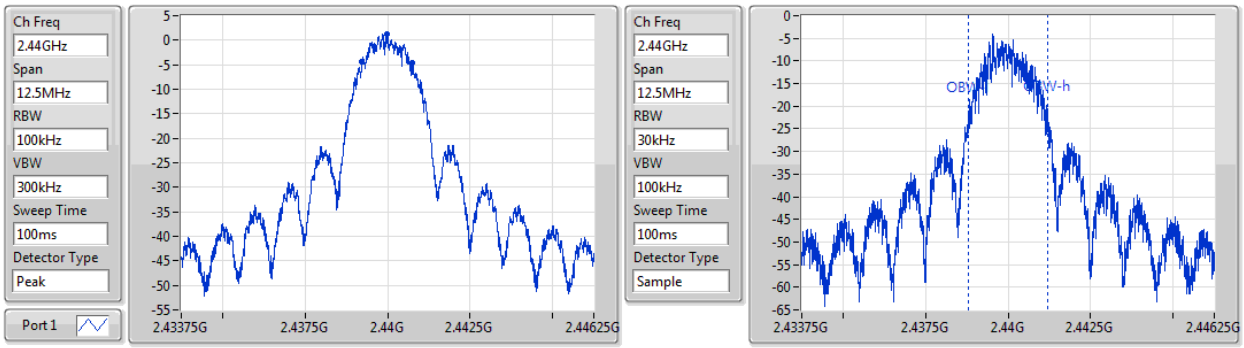


6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
1.419M	2.404231G	2.40565G	2.355M	2.403826G	2.406181G	500k	1

Zigbee **EBW**

2440MHz

07/08/2018

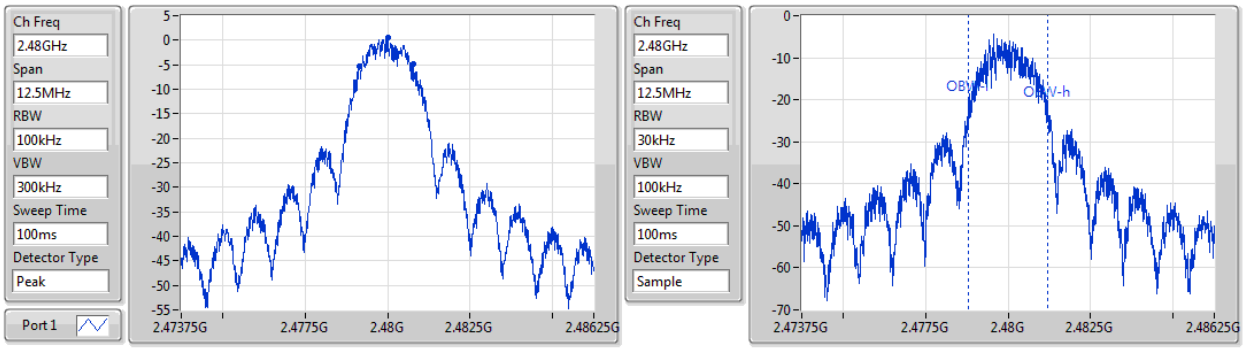


6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
1.538M	2.439225G	2.440763G	2.386M	2.438807G	2.441193G	500k	1

Zigbee **EBW**

2480MHz

27/08/2018



6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
1.625M	2.47915G	2.480775G	2.411M	2.478807G	2.481218G	500k	1

Summary

Mode	Total Power (dBm)	Total Power (W)
2.4-2.4835GHz	-	-
Zigbee	3.37	0.00217

Result

Mode	Result	DG (dBi)	Port 1 (dBm)	Total Power (dBm)	Power Limit (dBm)
Zigbee	-	-	-	-	-
2405MHz_TnomVnom	Pass	2.85	3.37	3.37	30.00
2440MHz_TnomVnom	Pass	2.85	3.22	3.22	30.00
2480MHz_TnomVnom	Pass	2.85	3.03	3.03	30.00

DG = Directional Gain; **Port X** = Port X output power
Note : Conducted average output power is for reference only

Summary

Mode	PD (dBm/RBW)
2.4-2.4835GHz	-
Zigbee	-8.66

RBW=3kHz.

Result

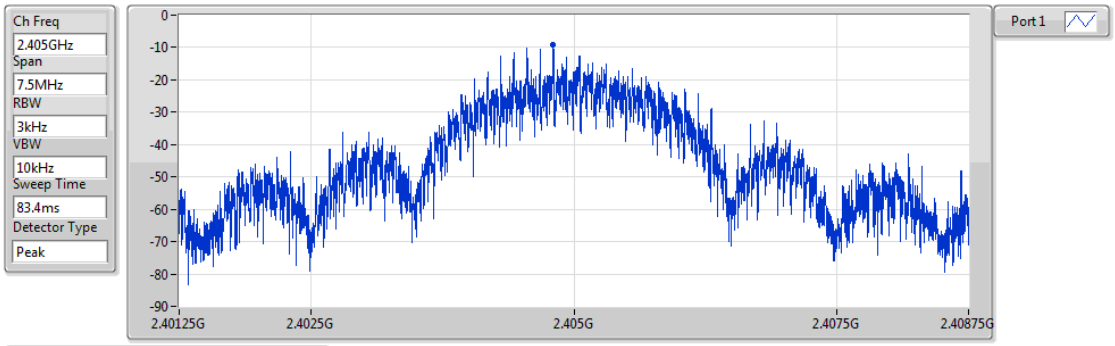
Mode	Result	DG (dBi)	Port 1 (dBm/RBW)	PD (dBm/RBW)	PD Limit (dBm/RBW)
Zigbee	-	-	-	-	-
2405MHz_TnomVnom	Pass	2.85	-9.20	-9.20	8.00
2440MHz_TnomVnom	Pass	2.85	-8.66	-8.66	8.00
2480MHz_TnomVnom	Pass	2.85	-9.32	-9.32	8.00

DG = Directional Gain; RBW=3kHz;
PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; **Port X** = Port Xpower density;

Zigbee **PSD**

2405MHz

07/08/2018

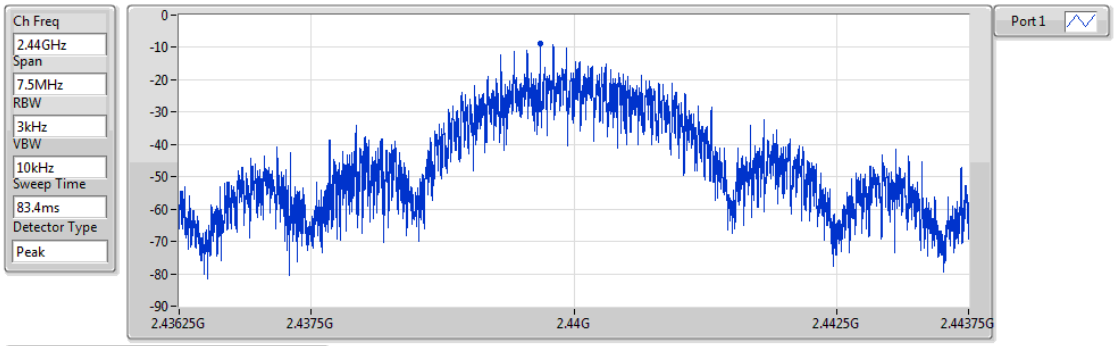


Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-9.20	-9.20	-9.20

Zigbee **PSD**

2440MHz

07/08/2018

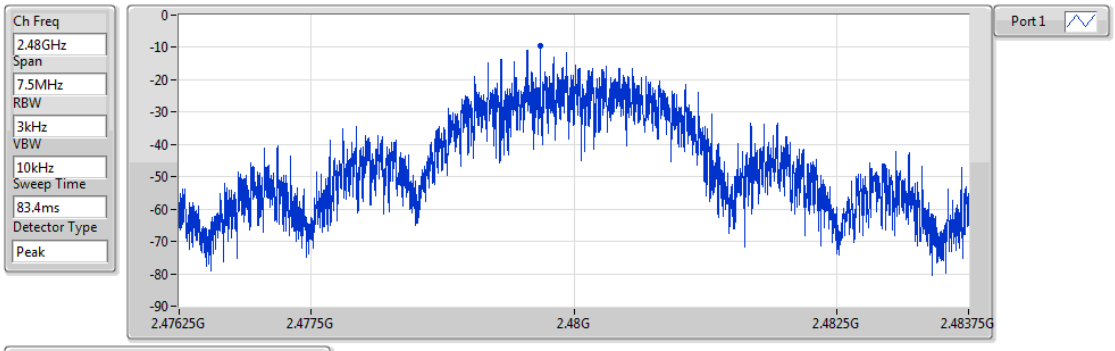


Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-8.66	-8.66	-8.66

Zigbee **PSD**

2480MHz

27/08/2018



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-9.32	-9.32	-9.32

Summary

Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-	-
Zigbee	Pass	2.404676G	0.10	-29.90	2.14338G	-59.45	2.39748G	-58.10	2.48398G	-33.76	5.759756G	-52.74	1

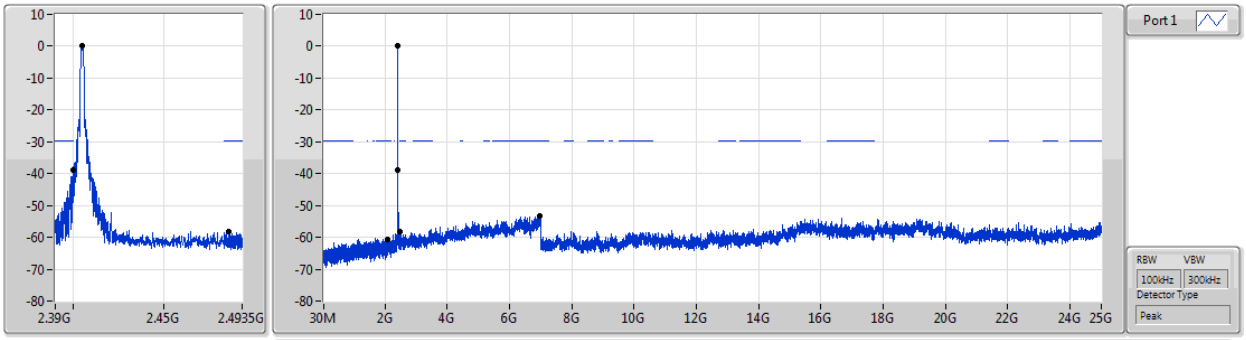
Result

Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
Zigbee	-	-	-	-	-	-	-	-	-	-	-	-	-
2405MHz_TnomVnom	Pass	2.404676G	0.10	-29.90	2.07966G	-60.49	2.39998G	-38.88	2.48582G	-58.19	6.949787G	-53.12	1
2440MHz_TnomVnom	Pass	2.404676G	0.10	-29.90	2.30976G	-59.93	2.39458G	-58.36	2.48636G	-57.98	6.989173G	-51.61	1
2480MHz_TnomVnom	Pass	2.404676G	0.10	-29.90	2.14338G	-59.45	2.39748G	-58.10	2.48398G	-33.76	5.759756G	-52.74	1

Zigbee **CSE NdB**

2405MHz

27/08/2018

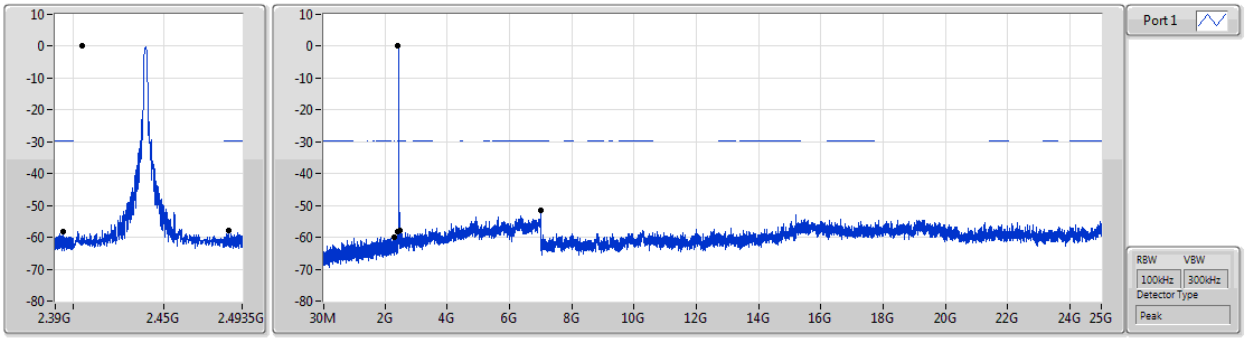


Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.404676G	0.10	-29.90	2.07966G	-60.49	2.39998G	-38.88	2.48582G	-58.19	6.949787G	-53.12	1

Zigbee **CSE NdB**

2440MHz

27/08/2018

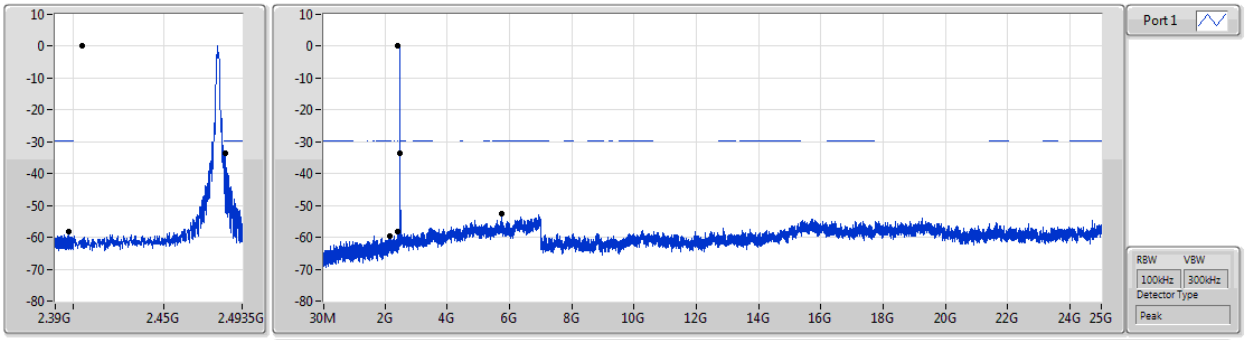


Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.404676G	0.10	-29.90	2.30976G	-59.93	2.39458G	-58.36	2.48636G	-57.98	6.989173G	-51.61	1

Zigbee **CSE NdB**

2480MHz

27/08/2018



Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.404676G	0.10	-29.90	2.14338G	-59.45	2.39748G	-58.10	2.48398G	-33.76	5.759756G	-52.74	1

Summary

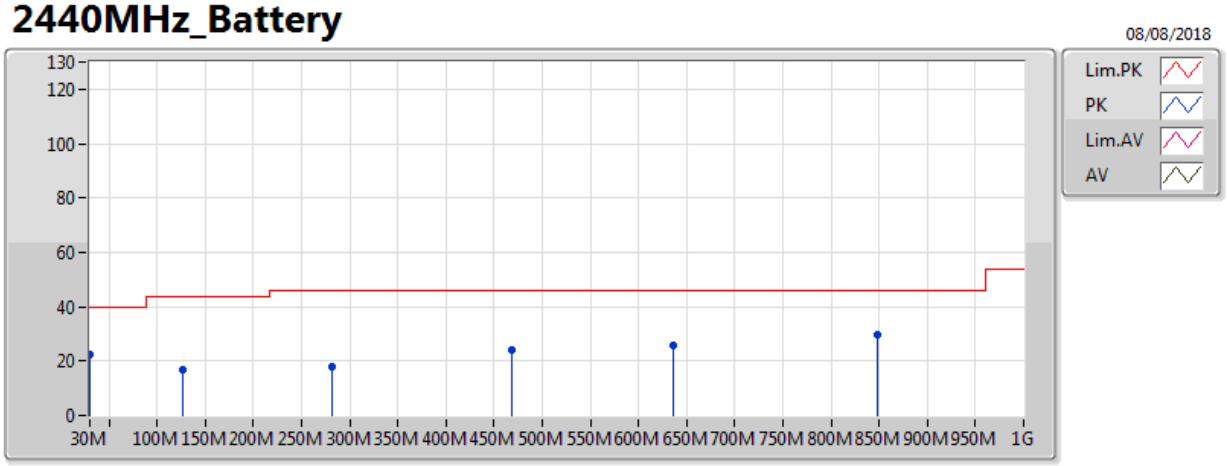
Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-
Zigbee_Nss1_1TX	Pass	PK	848.68M	29.88	46.00	-16.12	2.38	3	Vertical	0	1.00	-

Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
Zigbee_Nss1_1TX	-	-	-	-	-	-	-	-	-	-	-	-
2440MHz	Pass	PK	30M	22.28	40.00	-17.72	-2.38	3	Vertical	0	1.00	-
2440MHz	Pass	PK	127M	16.77	43.50	-26.73	-7.76	3	Vertical	0	1.00	-
2440MHz	Pass	PK	282.2M	18.12	46.00	-27.88	-6.01	3	Vertical	0	1.00	-
2440MHz	Pass	PK	468.44M	24.20	46.00	-21.80	-1.85	3	Vertical	0	1.00	-
2440MHz	Pass	PK	635.28M	26.02	46.00	-19.98	0.13	3	Vertical	0	1.00	-
2440MHz	Pass	PK	848.68M	29.88	46.00	-16.12	2.38	3	Vertical	0	1.00	-
2440MHz	Pass	PK	30M	22.57	40.00	-17.43	-2.38	3	Horizontal	360	1.00	-
2440MHz	Pass	PK	132.82M	17.62	43.50	-25.88	-7.99	3	Horizontal	360	1.00	-
2440MHz	Pass	PK	272.5M	18.65	46.00	-27.35	-6.14	3	Horizontal	360	1.00	-
2440MHz	Pass	PK	361.74M	20.81	46.00	-25.19	-4.28	3	Horizontal	360	1.00	-
2440MHz	Pass	PK	462.62M	24.44	46.00	-21.56	-2.04	3	Horizontal	360	1.00	-
2440MHz	Pass	PK	567.38M	27.43	46.00	-18.57	-0.56	3	Horizontal	360	1.00	-

Zigbee_Nss1_1TX

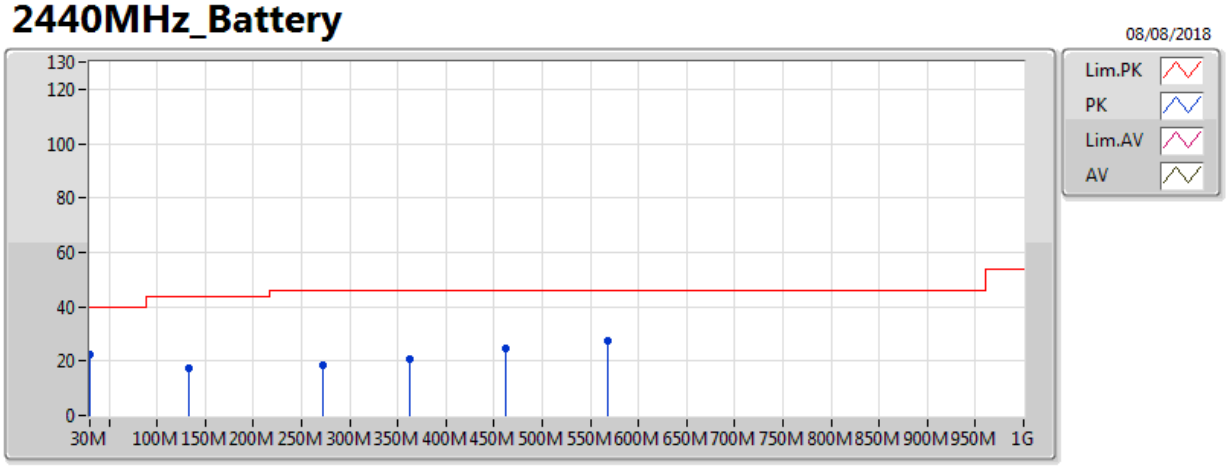
2440MHz_Battery



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
PK	30M	22.28	40.00	-17.72	-2.38	3	Vertical	0	1.00	-
PK	127M	16.77	43.50	-26.73	-7.76	3	Vertical	0	1.00	-
PK	282.2M	18.12	46.00	-27.88	-6.01	3	Vertical	0	1.00	-
PK	468.44M	24.20	46.00	-21.80	-1.85	3	Vertical	0	1.00	-
PK	635.28M	26.02	46.00	-19.98	0.13	3	Vertical	0	1.00	-
PK	848.68M	29.88	46.00	-16.12	2.38	3	Vertical	0	1.00	-

Zigbee_Nss1_1TX

2440MHz_Battery



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
PK	30M	22.57	40.00	-17.43	-2.38	3	Horizontal	360	1.00	-
PK	132.82M	17.62	43.50	-25.88	-7.99	3	Horizontal	360	1.00	-
PK	272.5M	18.65	46.00	-27.35	-6.14	3	Horizontal	360	1.00	-
PK	361.74M	20.81	46.00	-25.19	-4.28	3	Horizontal	360	1.00	-
PK	462.62M	24.44	46.00	-21.56	-2.04	3	Horizontal	360	1.00	-
PK	567.38M	27.43	46.00	-18.57	-0.56	3	Horizontal	360	1.00	-

Summary

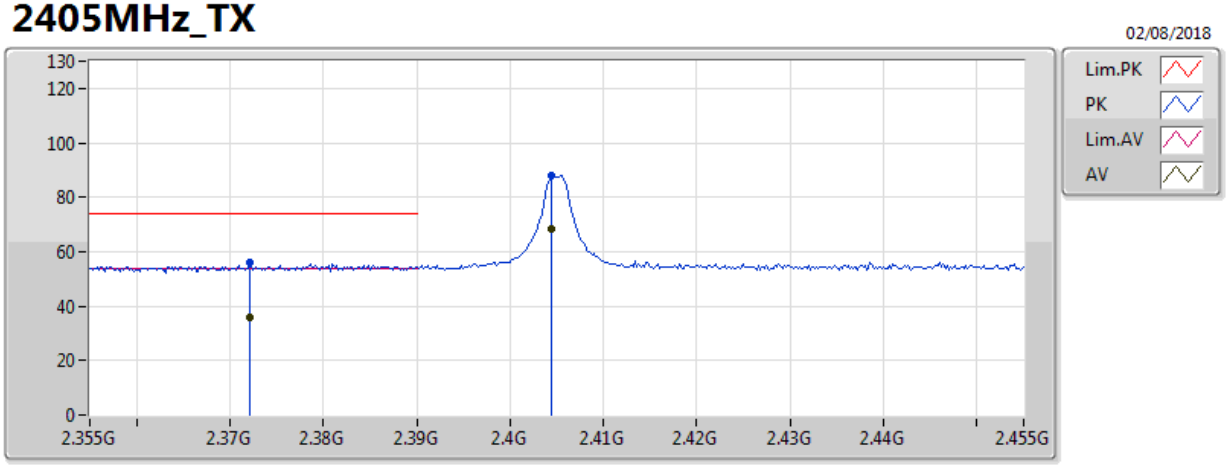
Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-
Zigbee_Nss1_1TX	Pass	AV	2.483502G	49.09	54.00	-4.91	30.69	3	Horizontal	0	1.08	-

Result

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
Zigbee_Nss1_1TX	-	-	-	-	-	-	-	-	-	-	-	-
2405MHz	Pass	AV	2.3722G	35.85	54.00	-18.15	32.21	3	Vertical	256	2.34	-
2405MHz	Pass	AV	2.4044G	68.23	Inf	-Inf	32.33	3	Vertical	256	2.34	-
2405MHz	Pass	PK	2.3722G	55.85	74.00	-18.15	32.21	3	Vertical	256	2.34	-
2405MHz	Pass	PK	2.4044G	88.23	Inf	-Inf	32.33	3	Vertical	256	2.34	-
2405MHz	Pass	AV	2.3898G	36.25	54.00	-17.75	32.28	3	Horizontal	17	2.52	-
2405MHz	Pass	AV	2.4046G	82.04	Inf	-Inf	32.33	3	Horizontal	17	2.52	-
2405MHz	Pass	PK	2.3898G	56.25	74.00	-17.75	32.28	3	Horizontal	17	2.52	-
2405MHz	Pass	PK	2.4046G	102.04	Inf	-Inf	32.33	3	Horizontal	17	2.52	-
2405MHz	Pass	AV	4.80892G	25.03	54.00	-28.97	3.00	3	Vertical	172	1.08	-
2405MHz	Pass	PK	4.80892G	45.03	74.00	-28.97	3.00	3	Vertical	172	1.08	-
2405MHz	Pass	AV	4.80898G	28.59	54.00	-25.41	13.04	3	Horizontal	86	3.19	-
2405MHz	Pass	PK	4.80898G	48.59	74.00	-25.41	13.04	3	Horizontal	86	3.19	-
2440MHz	Pass	AV	2.3764G	34.95	54.00	-19.05	32.22	3	Vertical	146	3.06	-
2440MHz	Pass	AV	2.4396G	74.81	Inf	-Inf	32.46	3	Vertical	146	3.06	-
2440MHz	Pass	AV	2.4904G	35.40	54.00	-18.60	32.64	3	Vertical	146	3.06	-
2440MHz	Pass	PK	2.3764G	54.95	74.00	-19.05	32.22	3	Vertical	146	3.06	-
2440MHz	Pass	PK	2.4396G	94.81	Inf	-Inf	32.46	3	Vertical	146	3.06	-
2440MHz	Pass	PK	2.4904G	55.40	74.00	-18.60	32.64	3	Vertical	146	3.06	-
2440MHz	Pass	AV	2.3612G	35.52	54.00	-18.48	32.17	3	Horizontal	12	2.74	-
2440MHz	Pass	AV	2.4396G	81.63	Inf	-Inf	32.46	3	Horizontal	12	2.74	-
2440MHz	Pass	AV	2.4888G	36.22	54.00	-17.78	32.63	3	Horizontal	12	2.74	-
2440MHz	Pass	PK	2.3612G	55.52	74.00	-18.48	32.17	3	Horizontal	12	2.74	-
2440MHz	Pass	PK	2.4396G	101.63	Inf	-Inf	32.46	3	Horizontal	12	2.74	-
2440MHz	Pass	PK	2.4888G	56.22	74.00	-17.78	32.63	3	Horizontal	12	2.74	-
2440MHz	Pass	AV	4.87886G	24.96	54.00	-29.04	3.16	3	Vertical	169	1.04	-
2440MHz	Pass	PK	4.87886G	44.96	74.00	-29.04	3.16	3	Vertical	169	1.04	-
2440MHz	Pass	AV	4.87898G	28.72	54.00	-25.28	3.16	3	Horizontal	75	2.96	-
2440MHz	Pass	PK	4.87898G	48.72	74.00	-25.28	3.16	3	Horizontal	75	2.96	-
2480MHz	Pass	AV	2.4804G	70.58	Inf	-Inf	30.68	3	Vertical	61	3.12	-
2480MHz	Pass	AV	2.483502G	41.71	54.00	-12.29	30.69	3	Vertical	61	3.12	-
2480MHz	Pass	PK	2.4804G	90.58	Inf	-Inf	30.68	3	Vertical	61	3.12	-
2480MHz	Pass	PK	2.483502G	61.71	74.00	-12.29	30.69	3	Vertical	61	3.12	-
2480MHz	Pass	AV	2.4796G	79.46	Inf	-Inf	30.68	3	Horizontal	0	1.08	-
2480MHz	Pass	AV	2.483502G	49.09	54.00	-4.91	30.69	3	Horizontal	0	1.08	-
2480MHz	Pass	PK	2.4796G	99.46	Inf	-Inf	30.68	3	Horizontal	0	1.08	-
2480MHz	Pass	PK	2.483502G	69.09	74.00	-4.91	30.69	3	Horizontal	0	1.08	-
2480MHz	Pass	AV	4.96066G	25.67	54.00	-28.33	6.11	3	Vertical	62	1.12	-
2480MHz	Pass	PK	4.96066G	45.67	74.00	-28.33	6.11	3	Vertical	62	1.12	-
2480MHz	Pass	AV	4.96096G	28.60	54.00	-25.40	6.12	3	Horizontal	186	1.07	-
2480MHz	Pass	PK	4.96096G	48.60	74.00	-25.40	6.12	3	Horizontal	186	1.07	-

Zigbee_Nss1_1TX

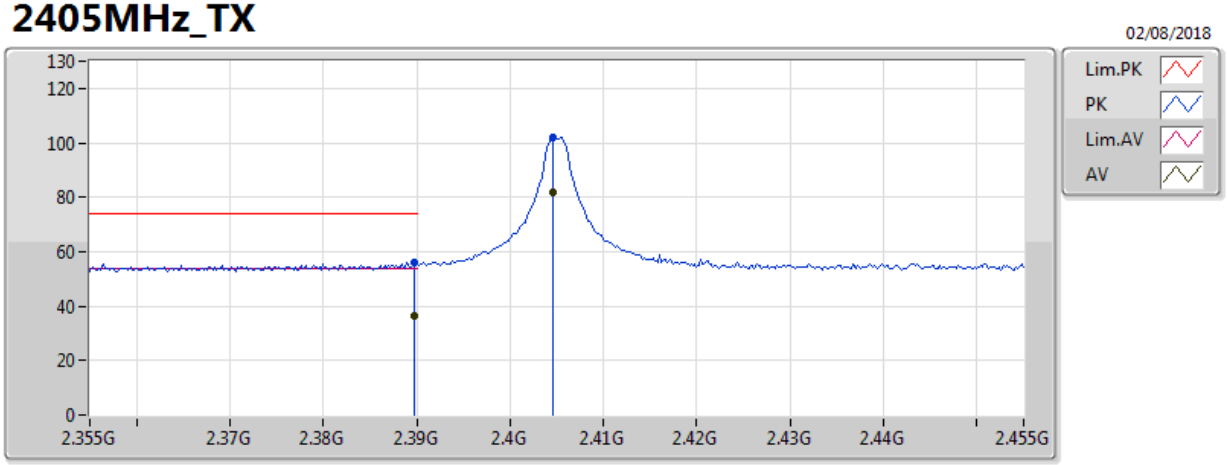
2405MHz_TX



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	2.3722G	35.85	54.00	-18.15	32.21	3	Vertical	256	2.34	-
AV	2.4044G	68.23	Inf	-Inf	32.33	3	Vertical	256	2.34	-
PK	2.3722G	55.85	74.00	-18.15	32.21	3	Vertical	256	2.34	-
PK	2.4044G	88.23	Inf	-Inf	32.33	3	Vertical	256	2.34	-

Zigbee_Nss1_1TX

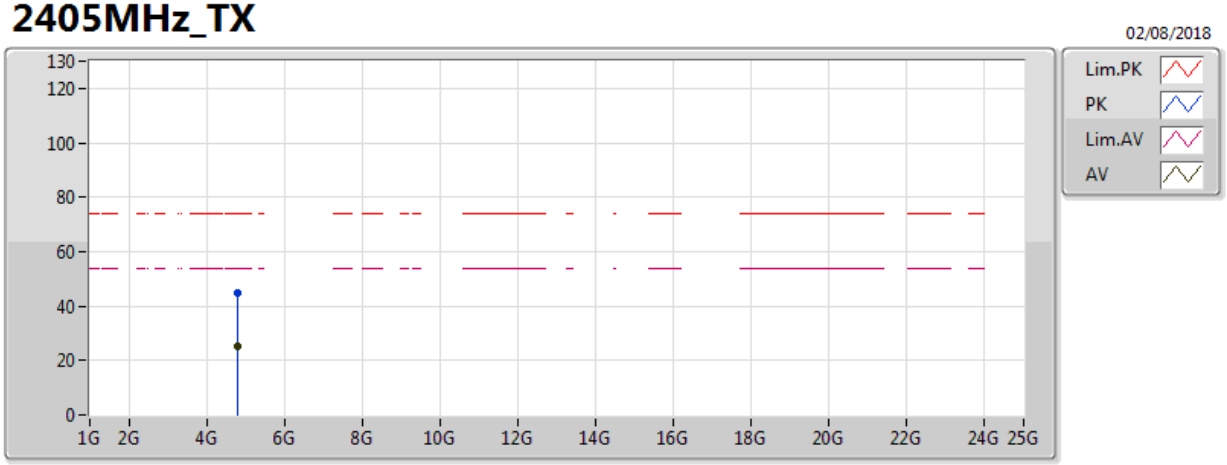
2405MHz_TX



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	2.3898G	36.25	54.00	-17.75	32.28	3	Horizontal	17	2.52	-
AV	2.4046G	82.04	Inf	-Inf	32.33	3	Horizontal	17	2.52	-
PK	2.3898G	56.25	74.00	-17.75	32.28	3	Horizontal	17	2.52	-
PK	2.4046G	102.04	Inf	-Inf	32.33	3	Horizontal	17	2.52	-

Zigbee_Nss1_1TX

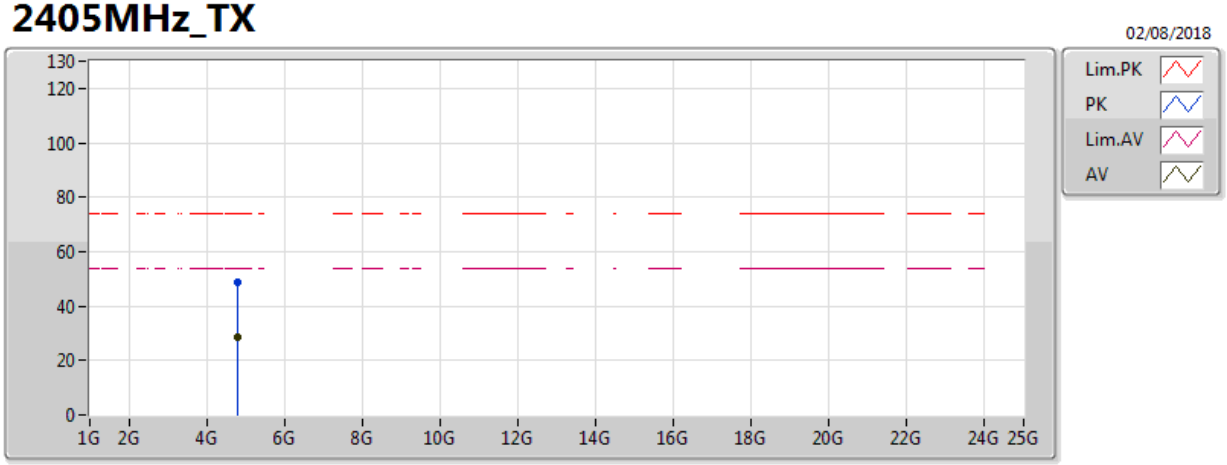
2405MHz_TX



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	4.80892G	25.03	54.00	-28.97	3.00	3	Vertical	172	1.08	-
PK	4.80892G	45.03	74.00	-28.97	3.00	3	Vertical	172	1.08	-

Zigbee_Nss1_1TX

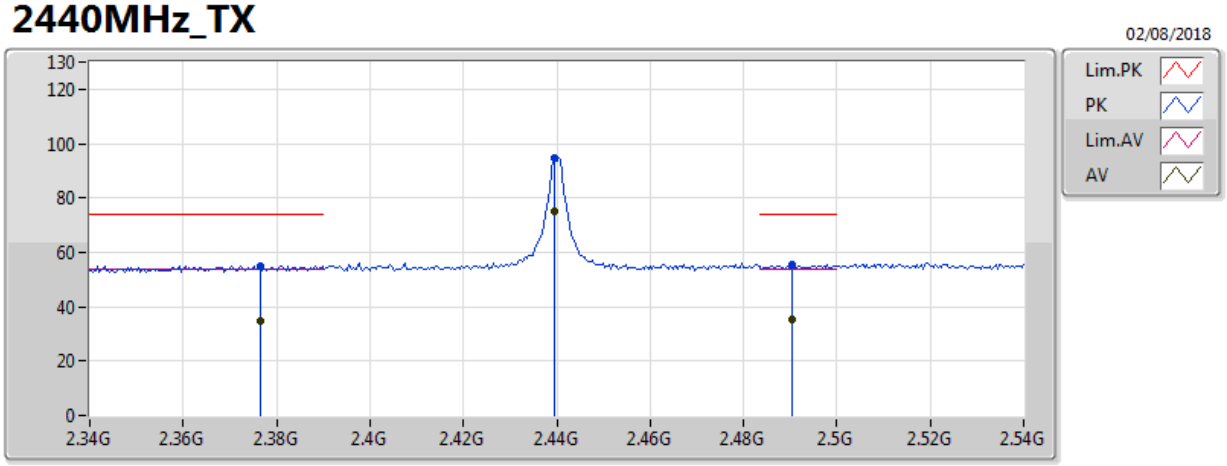
2405MHz_TX



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	4.80898G	28.59	54.00	-25.41	13.04	3	Horizontal	86	3.19	-
PK	4.80898G	48.59	74.00	-25.41	13.04	3	Horizontal	86	3.19	-

Zigbee_Nss1_1TX

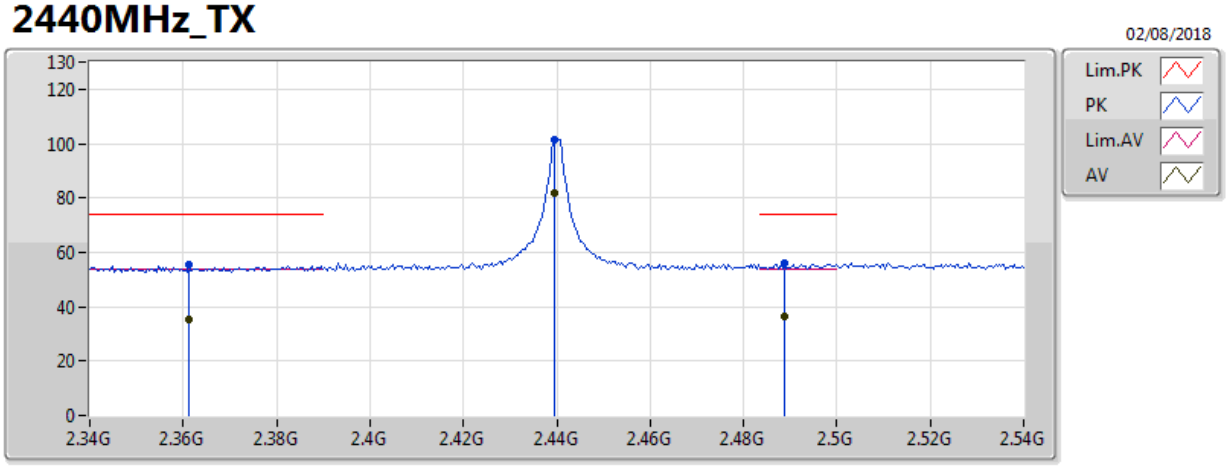
2440MHz_TX



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	2.3764G	34.95	54.00	-19.05	32.22	3	Vertical	146	3.06	-
AV	2.4396G	74.81	Inf	-Inf	32.46	3	Vertical	146	3.06	-
AV	2.4904G	35.40	54.00	-18.60	32.64	3	Vertical	146	3.06	-
PK	2.3764G	54.95	74.00	-19.05	32.22	3	Vertical	146	3.06	-
PK	2.4396G	94.81	Inf	-Inf	32.46	3	Vertical	146	3.06	-
PK	2.4904G	55.40	74.00	-18.60	32.64	3	Vertical	146	3.06	-

Zigbee_Nss1_1TX

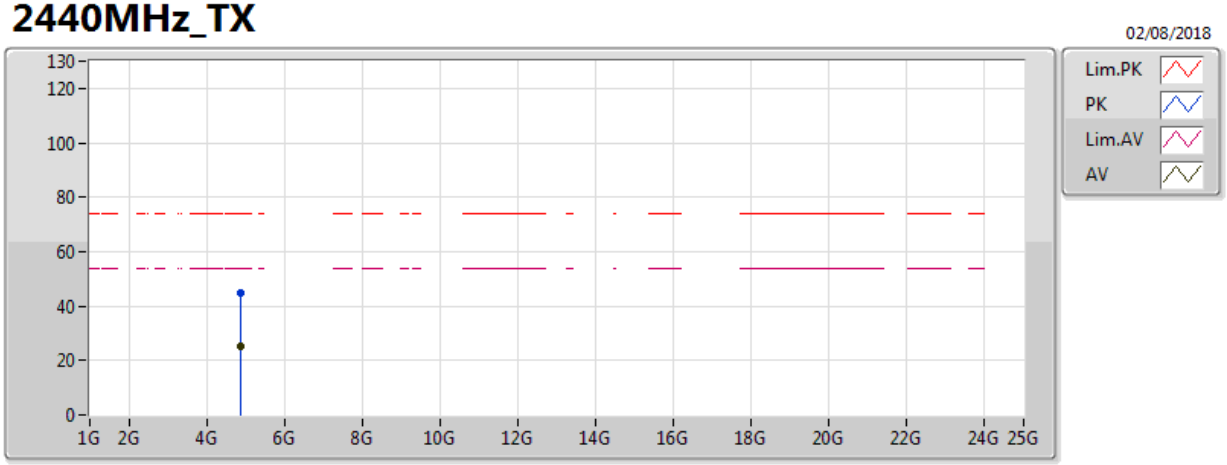
2440MHz_TX



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	2.3612G	35.52	54.00	-18.48	32.17	3	Horizontal	12	2.74	-
AV	2.4396G	81.63	Inf	-Inf	32.46	3	Horizontal	12	2.74	-
AV	2.4888G	36.22	54.00	-17.78	32.63	3	Horizontal	12	2.74	-
PK	2.3612G	55.52	74.00	-18.48	32.17	3	Horizontal	12	2.74	-
PK	2.4396G	101.63	Inf	-Inf	32.46	3	Horizontal	12	2.74	-
PK	2.4888G	56.22	74.00	-17.78	32.63	3	Horizontal	12	2.74	-

Zigbee_Nss1_1TX

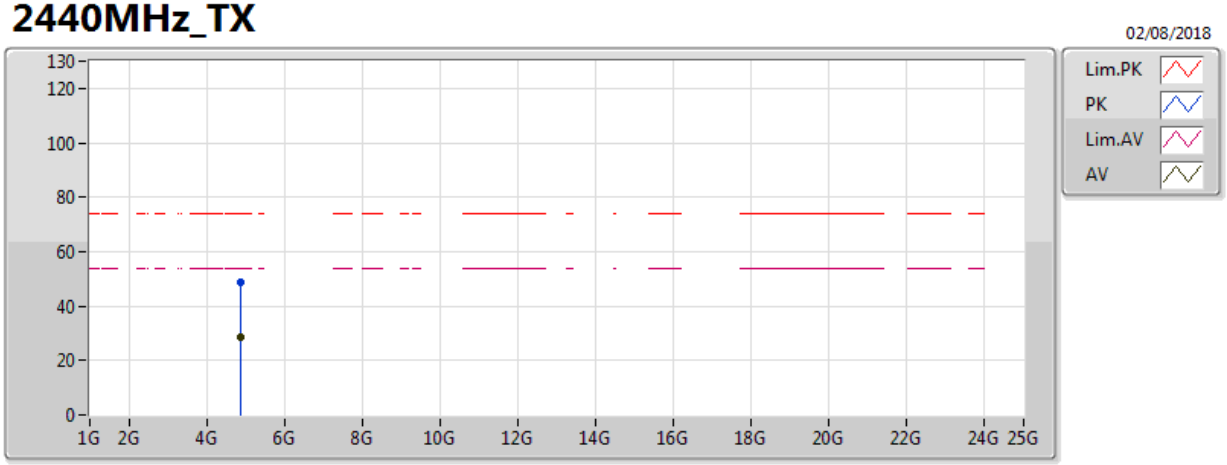
2440MHz_TX



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	4.87886G	24.96	54.00	-29.04	3.16	3	Vertical	169	1.04	-
PK	4.87886G	44.96	74.00	-29.04	3.16	3	Vertical	169	1.04	-

Zigbee_Nss1_1TX

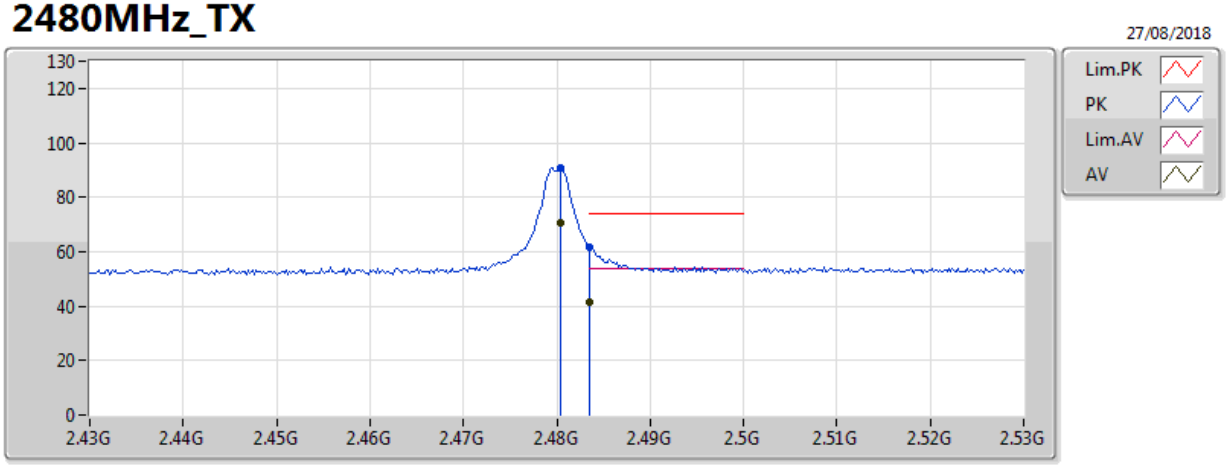
2440MHz_TX



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	4.87898G	28.72	54.00	-25.28	3.16	3	Horizontal	75	2.96	-
PK	4.87898G	48.72	74.00	-25.28	3.16	3	Horizontal	75	2.96	-

Zigbee_Nss1_1TX

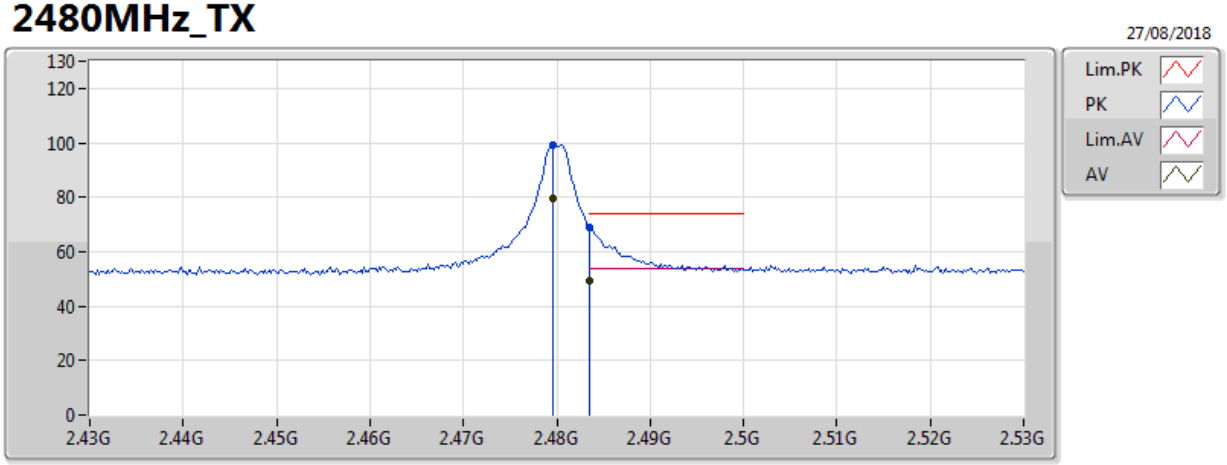
2480MHz_TX



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	2.4804G	70.58	Inf	-Inf	30.68	3	Vertical	61	3.12	-
AV	2.483502G	41.71	54.00	-12.29	30.69	3	Vertical	61	3.12	-
PK	2.4804G	90.58	Inf	-Inf	30.68	3	Vertical	61	3.12	-
PK	2.483502G	61.71	74.00	-12.29	30.69	3	Vertical	61	3.12	-

Zigbee_Nss1_1TX

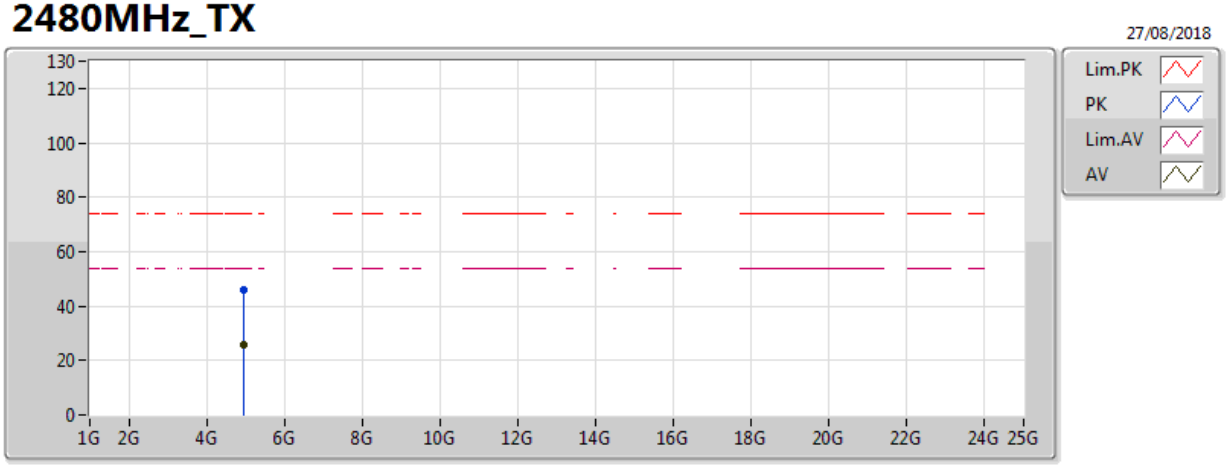
2480MHz_TX



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	2.4796G	79.46	Inf	-Inf	30.68	3	Horizontal	0	1.08	-
AV	2.483502G	49.09	54.00	-4.91	30.69	3	Horizontal	0	1.08	-
PK	2.4796G	99.46	Inf	-Inf	30.68	3	Horizontal	0	1.08	-
PK	2.483502G	69.09	74.00	-4.91	30.69	3	Horizontal	0	1.08	-

Zigbee_Nss1_1TX

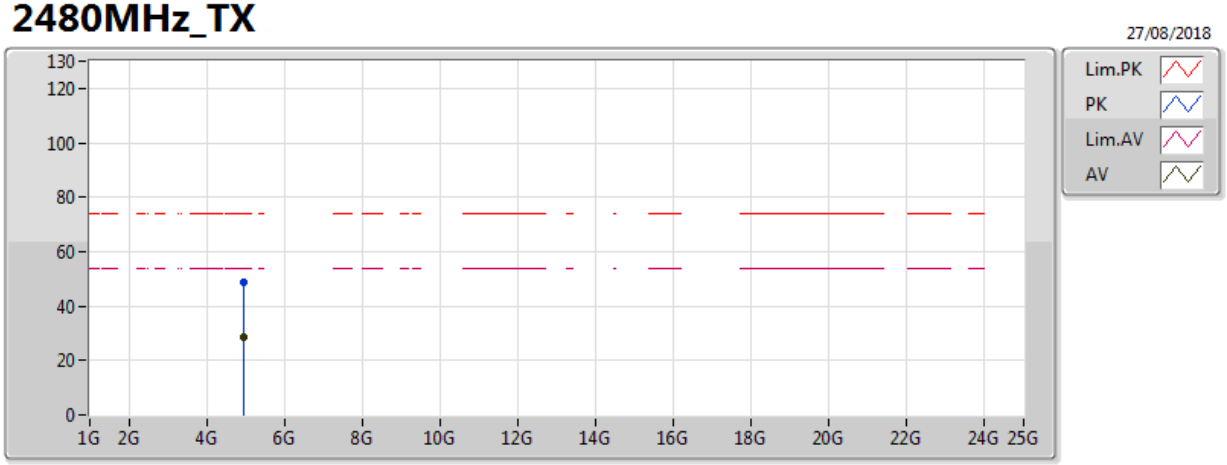
2480MHz_TX



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	4.96066G	25.67	54.00	-28.33	6.11	3	Vertical	62	1.12	-
PK	4.96066G	45.67	74.00	-28.33	6.11	3	Vertical	62	1.12	-

Zigbee_Nss1_1TX

2480MHz_TX



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comments
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
AV	4.96096G	28.60	54.00	-25.40	6.12	3	Horizontal	186	1.07	-
PK	4.96096G	48.60	74.00	-25.40	6.12	3	Horizontal	186	1.07	-