

ELECTROMAGNETIC EMISSIONS **COMPLIANCE REPORT**



FCC Applicant:	Opticon sensors Europé B.V.
FCC Manufacturer:	Opaallaan 35, 2132 XV Hoofddorp, The Netherlands Opticon sensors Europé B.V. Opaallaan 35, 2132 XV Hoofddorp, The Netherlands
Product Name:	ESL Base station
Brand Name:	Opticon
Model No.:	EBS-50
Model Difference:	N/A
Report Number:	E2/2021/20062
FCC ID	Q2Q-EBS50
Issue Date:	April 29, 2021
Date of Test:	March 2, 2021~April 22, 2021
Date of EUT Received:	March 2, 2021

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT comply with FCC rule part §15.247.

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Revision History					
Report Number	Revision	Description	Issue Date	Revised By	
E2/2021/20062	00	Original.	April 29, 2021	Elle Chang	

Note:

1 · Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

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GENERAL INFORMATION 1

1.1 **Product Description**

Product Name:	ESL Base station
Brand Name:	Opticon
Model No.:	EBS-50
Model Difference:	N/A
Hardware Version:	N/A
Firmware Version:	N/A
Power Supply: Adapter 12Vdc	

1.2 **RF** Specification

Radio Technology:	Zigbee
Frequency Range: 2405 – 2480MHz	
Channel number:	16 channels
Modulation type:	O-QPSK
Transmit Power:	6.22 dBm

1.3 Antenna Designation

Antenna	Supplier	Antenna	Freq.	Peak Antenna
Type		Part No.	(MHz)	Gain (dBi)
1/4-dipole	Opticon	N/A	2.4G	2.00

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1.4 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247 FCC KDB 558074 D01 15.247 Meas Guidance v05r02 RSS-247 issue 2 Feb. 2017 RSS-Gen. issue 5, Amendment 1, March 2019 ANSI C63.10:2013 Note: All test items have been performed and record as per the above standards.

1.5 Test Facility

Laboratory	Test Site Address	Test Site Name	FCC Designa- tion number	IC CAB identifier
		SAC 1		
		SAC 3		
		Conduction 1		
	No.134, Wu Kung Road, New Taipei	Conducted 1		
	Industrial Park, Wuku District, New	strial Park, Wuku District, New Taipei City, Taiwan.Conducted 2 Conducted 3 Conducted 4		
	Taipei City, Taiwan.			
SGS Taiwan Ltd.		Conducted 6		
Central RF Lab.		Conduction A		TW3702
(TAF code 3702)	No 2 Kaji 1et Rd. Quishan District	SAC C	TW0028	
		SAC D		
		SAC G		
		Conducted A		
	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	Conducted B		
	habydan oly, falwan 555	Conducted C		
		Conducted D		
		Conducted E	_	
		Conducted F		
		Conducted G		
	ame is remarked on the equipmen measurements occurred in specif		•	s an indica

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1.6 Special Accessories

There are no special accessories used while test was conducted.

1.7 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is a placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed. The two LISNs provide 50uH/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 Conducted Test (RF)

The active antenna port of the unlicensed wireless device is connected to the spectrum analyzer with attenuator to protect the instrumentation. If a second antenna port is available, it is tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port.

2.3.3 Radiated Emissions

The EUT is a placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response."

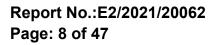
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2.4 **Measurement Results Explanation Example**

2.4.1 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m*9m*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

2.4.2 For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

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2.5 Configuration of Tested System Fig. 2-1 Conducted (Antenna Port) Emission Configuration

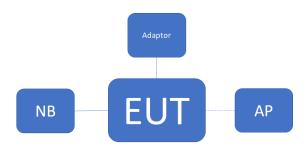


Fig 2-2 Radiated Emission

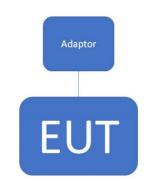


Fig 2-3 Conduction (AC Power Line) Radiated Emission

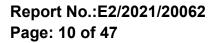


ltem	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1	Zigbee Test Software	N/A	N/A	N/A	N/A	N/A
2	Notebook	Lenovo	L420	S0011721	N/A	N/A
3	AP	ASUS	RT-AX88U	LAITHP000108	N/A	N/A
4	Adapter	Kuantech	KSASB0241200150M2	161-0046	N/A	N/A

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SUMMARY OF TEST RESULTS 3

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§15.247(b) (3)	Peak Output Power	Compliant
§15.247(a)(2)	Emission Bandwidth	Compliant
§15.205 §15.209 §15.247(d)	Conducted Band Edge and Spurious Emission	Compliant
§15.205 §15.209 §15.247(d)	Radiated Band Edge and Spurious Emission	Compliant
§15.247(e)	Peak Power Density	Compliant
§15.203 §15.247(b)	Antenna Requirement	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 Operated in 2400 ~ 2483.5MHz Band

16nnels are provided for Zigbee

ITEM	FREQUENCY	ITEM	FREQUENCY	ITEM	FREQUENCY	ITEM	FREQUENCY
1	2405 MHz	5	2425 MHz	9	2445 MHz	13	2465 MHz
2	2410 MHz	6	2430 MHz	10	2450 MHz	14	2470 MHz
3	2415 MHz	7	2435 MHz	11	2455 MHz	15	2475 MHz
4	2420 MHz	8	2440 MHz	12	2460 MHz	16	2480 MHz

4.2 The Worst Test Modes and Channel Details

- 1. The EUT has been tested under operating condition.
- 2. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.
- 3. Investigation has been done on all the possible configurations for searching the worst case.

MODE	AVAILABLE FREQUENCY (MHz)	TESTED FREQUENCY (MHz)	MODULATION			
	RADIATED EMISSION TEST (BELOW 1 GHz)					
Zigbee	2405 to 2480	2440	O-QPSK			
	RADIATED I	EMISSION TEST (ABO)	/E 1 GHz)			
Zigbee	2405 to 2480	2405, 2440, 2480	O-QPSK			
Note: The field strength of radiation emission was measured as EUT stand-up po- sition (H mode) and lie down position (E1, E2 mode) for channel Low, Mid and High, the worst case position was reported.						

ANTENNA PORT CONDUCTED MEASUREMENT										
MODE	AVAILABLE FREQUENCY (MHz)	TESTED FREQUENCY (MHz)	MODULATION							
Zigbee	2405 to 2480	2405, 2440, 2480	O-QPSK							

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MEASUREMENT UNCERTAINTY 5

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.34 dB
Peak Output Power	+/- 1 dB
6dB Bandwidth	+/- 1.54 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 1.69 dB
Peak Power Density	+/- 1.54 dB
Temperature	+/- 0.4 °C
Humidity	+/- 3.5 %
DC / AC Power Source	DC= +/- 1%, AC= +/- 1%

Radiated Spurious Emission Measurement Uncertainty										
	+/-	2.64	dB	9kHz~30MHz: +-2.3dB						
Polarization: Vertical	+/-	4.93	dB	30MHz - 1000MHz: +/- 3.37dB						
Polarization. Vertical	+/-	4.81	dB	1GHz - 18GHz: +/- 4.04dB						
	+/-	4.52	dB	18GHz - 40GHz: +/- 4.04dB						
	+/-	2.64	dB	9kHz~30MHz: +-2.3dB						
Polarization: Horizontal	+/-	4.45	dB	30MHz - 1000MHz: +/- 4.22dB						
Foldrization: Horizontal	+/-	4.81	dB	1GHz - 18GHz: +/- 4.08dB						
	+/-	4.52	dB	18GHz - 40GHz: +/- 4.08dB						

Note:

- 1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
- 2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

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6 CONDUCTED EMISSION TEST

6.1 Standard Applicable:

Frequency range within 150kHz to 30MHz shall not exceed the Limit table as below.

	Limits							
Frequency range	lge dB(μV)							
MHz	Quasi-peak	Average						
0.15 to 0.50	66 to 56	56 to 46						
0.50 to 5	56	46						
5 to 30	60	50						

Note

1. The lower limit shall apply at the transition frequencies

2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

6.2 Measurement Equipment Used:

Radiated Emission Test Site: Conduction A												
EQUIPMENT TYPE	MFR	MODEL NUM- BER	SERIAL NUM- BER	LAST CAL.	CAL DUE.							
Test Software	audix	e3	Ver. 6.11- 20180419c	N.C.R	N.C.R							
LISN	SCHWARZ- BECK Mess- Elektronik	NSLK8127	973	03/25/2021	03/24/2022							
Coaxial Cable	EC Lab	RF-HY-CAB- 250	RF-HY-CAB- 250-01	03/27/2021	03/26/2022							
Pulse Limiter	EC Lab	VTSD 9561F-N	485	03/27/2021	03/26/2022							

6.3 EUT Setup:

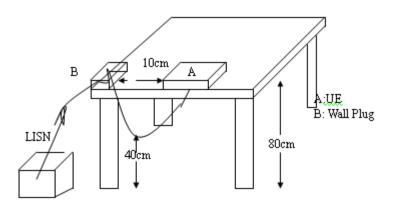
- 1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
- 2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- 3. The LISN was connected with 120Vac/60Hz power source.

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6.4 Test SET-UP (Block Diagram of Configuration)



6.5 **Measurement Procedure:**

- 1. The EUT was placed on a table which is 0.8m above ground plan.
- 2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 3. Repeat above procedures until all phases of power being supplied by given UE are completed

6.6 Measurement Result:

Note: Refer to next page for measurement data and plots.

Note2: The * reveals the worst-case results that closet to the limit.

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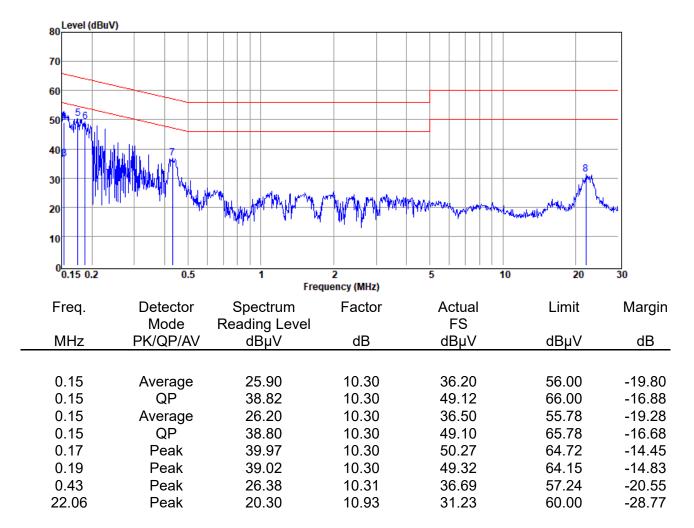
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number	:E2/2021/20062	Test Site	:Conduction Room C
Test Mode	:Zigbee	Test Date	:2021-04-13
Power	:120V/60Hz	Temp./Humi.	:24.9/62
Probe	:L1	Engineer	:Ashton Chiu
Note:	: Adapter:KSAB0241200150M2		



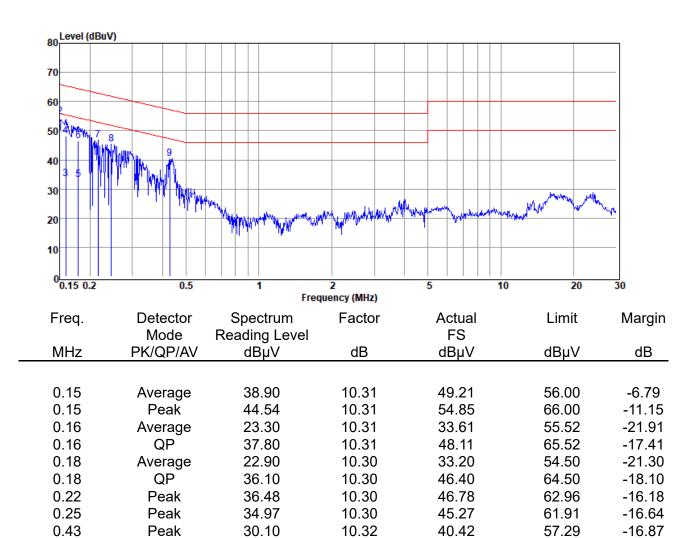
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Report Number	:E2/2021/20062	Test Site	:Conduction Room C
Test Mode	:Zigbee	Test Date	:2021-04-13
Power	:120V/60Hz	Temp./Humi.	:24.9/62
Probe	:N	Engineer	:Ashton Chiu
Note:	: Adapter:KSAB0241200150M2		



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7 PEAK OUTPUT POWER MEASUREMENT

7.1 Standard Applicable:

For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt.

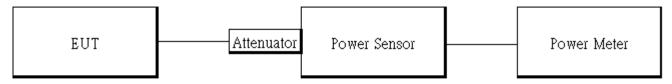
If the transmitting antenna of directional gain greater than 6dBi are used the peak output power form the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of Antenna exceeds 6dBi.

7.2 Measurement Equipment Used:

Conducted Emission Test Site: Conducted C											
EQUIPMENT TYPE	MFR	MODEL NUM- BER	SERIAL NUMBER	LAST CAL.	CAL DUE.						
Power Meter	Anritsu	ML2496A	1512003	07/23/2020	07/22/2021						
Power Sensor	Anritsu	MA2411B	1339378	07/23/2020	07/22/2021						
Power Sensor	Anritsu	MA2411B	1339379	07/23/2020	07/22/2021						
Attenuator	Marvelous	MVE2213-10	RF09	11/19/2020	11/18/2021						
Coaxial Cables	Woken	00100A1F2A196C	RF70	11/19/2020	11/18/2021						

7.3 Test Set-up:



7.4 Measurement Procedure:

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.
- 4. Record the max. Reading as observed from Power Meter.

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5. Repeat above procedures until all test default channel measured was complete.

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7.5 Duty Factor:

	Duty Cycle (%) = Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
Zigbee	100.00	0.00	0.33	0.01

Duty Cycle Zigbee MidCH18-2440

	ysight (Spect	rum /	Analyzer		t SA															
LXI R			RF		50 Ω	DC				SE	NSE:I	NT			ALIGN AU			PM Mar 10			Frequency
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-60.0			_															_			2.44000000000112
Cen	ter 2	2.44	400	0000	0 GI	Ηz												Span	0 Hz	11	CF Step
Res	вw	81	MH:	z				#∖	/BW	8.0 MHz				S	Sweep	5.	000 ms	(1001	pts)	Ш	8.000000 MHz
MKD	MODE	трс	SCI			х				v		FUNC	TION	CUN	CTION WI	пти	EUNC	TION VALU		4	<u>Auto</u> Man
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2	F	1	t				1.00)0 ms		5.08 d	Bm										
3	<u>Δ4</u> F	1	t	<u>(</u> ∆)				<u>)0 ms</u>)0 ms	<u>(Δ)</u>	0.01 5.08 d						_			-1		Freq Offset
4	F	1	τ	<u> </u>			1.00	JU MS		5.08 Q	вт			<u> </u>		-+					0 Hz
6																				ŀ	
7																			-1		
8											\rightarrow					-+			-1		
10																					
11																			-		
•										III					_				•		
MSG															ST	ATUS					

Duty Cycle Factor:10*log(1/(100/100))=0

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7.6 Output Power:

7.6.1 Peak & Avg

Zigbee mode:

СН	Frequency (MHz)	Power set	Peak Power Output (dBm)	Required Limit
Low	2405	default	6.22	1 Watt = 30 dBm
Mid	2440	default	5.38	1 Watt = 30 dBm
High	2480	default	4.26	1 Watt = 30 dBm
СН	Frequency (MHz)	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Required Limit
Low	2405	default	5.98	1 Watt = 30 dBm
Mid	2440	default	5.01	1 Watt = 30 dBm
High	2480	default	3.90	1 Watt = 30 dBm

*Note: Measured by power meter, cable loss 10.2 dB + Duty cycle factor has been offseted to the

power meter for Avg. power and cable loss has been offseted for Peak power measurement.

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8 EMISSION BANDWIDTH MEASUREMENT

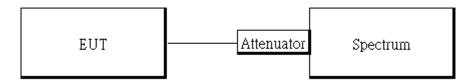
8.1 Standard Applicable

The minimum 6 dB bandwidth shall be at least 500 kHz.

8.2 Measurement Equipment Used

Conducted Emission Test Site: Conducted C											
EQUIPMENT TYPE	MFR	MODEL NUM- BER	SERIAL NUMBER	LAST CAL.	CAL DUE.						
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	07/08/2020	07/07/2021						
Attenuator	Marvelous	MVE2213-10	RF09	11/19/2020	11/18/2021						
DC Block	PASTER- NACK	PE8210	RF151	11/19/2020	11/18/2021						
Coaxial Cables	Woken	00100A1F2A196C	RF70	11/19/2020	11/18/2021						

8.3 Test Set-up:



8.4 Measurement Procedure:

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
 - 4. Set the spectrum analyzer as RBW= 1 % to 5% of OBW , VBW = 3 X RBW, Span= 2 to 5 times of the OBW, Sweep=auto, Detector = Peak, and Max hold for 20dB Bandwidth test.
- 5. Mark the peak frequency and -20dB (upper and lower) frequency
- 6. Repeat above procedures until all test default channel is completed

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8.5 Measurement Result:

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Zigbee mode			
Frequency (MHz)	6dB BW (MHz)	Required BW (MHz)	Result
2405	1.63	> 0.5	PASS
2440	1.627	> 0.5	PASS
2480	1.631	> 0.5	PASS

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OBW 6dB_Low_CH11-2405

	im Analyzer - Occupied BV	V				
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30.0 40.0 50.0						
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Transmit x dB Bar	t Freq Error ndwidth	-18.364 kHz 1.630 MHz	OBW Power x dB		00 % 0 dB	0 H
SG				STATUS		L

OBW 6dB_Mid_CH18-2440

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enter 2.4	4 GH7				Span 5 MHz	
Res BW		#	VBW 300 kHz		Sweep 1 ms	CF Ste 500.000 kH
Occup	ied Bandwidt 2.	։հ 6974 MHz	Total Power	12.0 d	Bm	Auto Ma Freq Offse
Transm	it Freq Error	-20.928 kHz	OBW Power	99.0	0 %	01
x dB Ba	ndwidth	1.627 MHz	x dB	-6.00	dB	

OBW 6dB_High_CH26-2480

Keysight Spect	rum Analyzer - Occupied BV RF 50 Ω DC	1	cover-turi		02-10-21-5	M Mar 10, 2021	
	eq 2.480000000		SENSE:INT r Freq: 2.480000000 GHz	ALIGN AUTO	Radio Std		Frequency
		Trig:	Free Run Avg Holo n: 30 dB	d:>100/100	Radio Dev	rice: BTS	
10 dB/div	Ref Offset 10.2 d Ref 30.00 dBn						
20.0							Center Fred
10.0							2.48000000 GH
0.00							
20.0				1 m			
0.0	~ 1				\searrow	~~~~	
40.0							
0.0	+						
50.0							
enter 2.4 Res BW 1		#	VBW 300 kHz		Sp Sw	an 5 MHz ep 1 ms	CF Ster 500.000 kH
Occupi	ied Bandwidt	h	Total Power	11.0) dBm		<u>Auto</u> Mar
	2.	6992 MHz					Freq Offse
Transmit Freg Error -21.745 kHz		-21.745 kHz	OBW Power 9		99.00 %		он
x dB Ba	ndwidth	1.631 MHz	x dB	-6.	00 dB		
G				STATU			
~				STATU	0		

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CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT 9

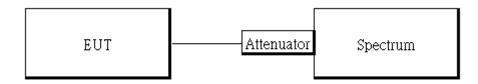
9.1 **Standard Applicable**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, 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).

Conducted Emission Test Site: Conducted C									
EQUIPMENT TYPE	MFR	MODEL NUM- BER	SERIAL NUMBER	LAST CAL.	CAL DUE.				
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	07/08/2020	07/07/2021				
Attenuator	Attenuator Marvelous		RF09	11/19/2020	11/18/2021				
DC Block	PASTER- NACK	PE8210	RF151	11/19/2020	11/18/2021				
Coaxial Cables	Woken	00100A1F2A196C	RF70	11/19/2020	11/18/2021				

Measurement Equipment Used: 9.2

9.3 Test SET-UP:



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9.4 Measurement Procedure

9.4.1 Reference Level of Emission Limit:

- 1. Set analyzer center frequency to DTS channel center frequency.
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
- 3. Set the span to 1.5 times the DTS channel bandwidth.
- 4. Set the RBW = 100kHz & VBW = 300 kHz.
- 5. Detector = peak.
- 6. Sweep time = auto couple.
- 7. Trace mode = max hold.
- 8. Allow trace to fully stabilize.
- 9. Use the peak marker function to determine the maximum amplitude level.

9.4.2 Conducted Band Edge:

- 1. To connect Antenna Port of EUT to Spectrum.
- **2.** The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
- **3.** Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- **4.** Set start to edge frequency, and stop frequency of spectrum analyzer so as to encompass the spectrum to be examined.
- **5.** Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Detector = Peak, Sweep = auto
- **6.** Set DL as the limit = reading on marker of reference level measurement 20dBm
- 7. Mark the highest readings of the emissions outside of 2400MHz~2483.5MHz.
- 8. Repeat above procedures until all default test channel (low, middle, and high) was complete.

9.4.3 Conducted Spurious Emission:

1. To connect Antenna Port of EUT to Spectrum.

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- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
- 3. Set RBW = 100 kHz & VBW=300 kHz, Detector =Peak, Sweep = Auto
- 4. Allow trace to fully stabilize.
- 5. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
- 6. Repeat above procedures until all default test channel measured were complete.

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Measurement Result 9.5

Reference Level of Limit

Frequency (MHz)	RF Power Density (dBm)	Reference Level of Limit = PSD - 20dB (dBm)
2405	2.45	-17.55
2440	1.55	-18.45
2480	0.53	-19.47

NOTE: cable loss as 10.2dB that offsets in the spectrum NOTE: Refer to next page for plots.

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Reference Level Low CH11-2405

						er - Swept SA		
02:11:06 PM Mar 10, 2021		Ave Tve	NSE:INT	SE1	242	50 Ω DC		R
DET P N N N N	-	10.819	e Run 0 dB	Trig: Free #Atten: 3	PNO: Wide IFGain:Low	5000000	req 2.405	
404 709 0 GHz 2.45 dBm	Mkr1 2.					et 10.2 dB 00 dBm	Ref Offset Ref 30.0	0 dB/div
								0.0
					1			0.0
~~	~		~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	m	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		.00
- man							1	0.0
								0.0
								0.0
								0.0
								0.0
								0.0
Span 2.445 MHz						Hz		
000 ms (1001 pts)	Sweep 1.			300 kHz	#VBW		100 kHz	Res BW
	Span 2.445 MH:	Mkr1 2.40 / DN / D	Avg Type: Log-Pwr Trace [2:3:42 cgr] A HAN Mkr1 2.404 709 0 GH- 2.45 dBn	Avg Type: Log-Pwr THACE [] 2 4 2 4 THACE [] 2 4 2 4 THACE [] 2 4 4 THACE [] 2 4 THACE	Avg Type: Log-Pwr Trocc [] 3 4 3 Trig: Free Run #Atten: 30 dB Mkr1 2.404 TOP 0 GH: 2.45 dBn Mkr1 2.404 TOP 0 GH: 2.45 dBn J J J J	GHZ Trig: Free Run #Atten: 30 dB Avg Type: Log-Pwr Trig: Free Run #Atten: 30 dB Trig: Free Run #Atten: 30 dB Mkr1 2.404 709 0 GH: 2.45 dBn Mkr1 2.404 709 0 GH: 2.45 dBn	ODODOO CHZ PRO: Wide Trig: Free Run Praintow Avg Type: Log-Pwr Trice [2: 24: 24: 24: 24: 24: 24: 24: 24: 24: 2	Reg 2.405000000 GHz Trig: Free Run If Galan Low Avg Type: Log-Rwr Trice [Free Run Ref 0.00 dBm Ref Offset 10.2 dB Ref 30.00 dBm Mkr1 2.404 709 0 GHz 2.45 dBn Avg Type: Log-Rwr 2.45 dBn Avg Type: Log-Rwr 1 Ref 0.00 dBm 1 Avg Type: Log-Rwr 1

Reference Level_Mid_CH18-2440

	ectrum Analyzer - Swept SA					
Center F	RF 50 Ω DC	GHz	SENSE:INT	ALIGN AUTO Avg Type: Log-Pw	TRACE 1 2 3 4 5 6	Frequency
10 dB/div	Ref Offset 10.2 dB Ref 30.00 dBm	PNO: Wide C	^J Trig: Free Run #Atten: 30 dB	Mkr1	2.440 219 6 GHz 1.55 dBm	Auto Tun
20.0						Center Fre 2.440000000 GH
0.00				1		Start Fre 2.438779750 GH
20.0	~~					Stop Fre 2.441220250 Gi
80.0						CF Ste 244.050 ki Auto M
40.0 50.0						Freq Offs
60.0	440000 GHz				Span 2.441 MHz	
Res BW	100 kHz	#VBW	300 kHz	Sweep	1.000 ms (1001 pts)	
					1	

Reference Level_High_CH26-2480

	ectrum Analyzer - Swept					
R Center F	RF 50 Ω I req 2.480000	000 GHz	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	02:19:18 PM Mar 10, 2021 TRACE 1 2 3 4 5	Frequency
10 dB/div	Ref Offset 10.2 o	PNO: Wide G IFGain:Low	Trig: Free Run #Atten: 30 dB	Mkr1 2	480 222 6 GHz 0.53 dBm	Auto Tune
20.0						Center Frec 2.480000000 GH;
0.00				▲ ¹		Start Free 2.478776750 GH:
20.0						Stop Free 2.481223250 GH
30.0						CF Stej 244.650 kH <u>Auto</u> Ma
50.0						Freq Offse
-60.0	480000 GHz				Span 2.447 MHz	2
#Res BW	100 kHz	#VBI	W 300 kHz	Sweep 1	.000 ms (1001 pts	
50				STATU		

Band Edge_Low_CH11-2405

Center Freq 2.36000000 GHz Trig: Free Run IFGainLow Avg Type: Log-Pwr Matter: 30 dB Trig: Free Run Microsoft Microsoft Auto T Auto T 0.00 </th <th>Keysight Spectrum Analyzer - Sv</th> <th></th> <th></th> <th></th>	Keysight Spectrum Analyzer - Sv			
PNC Fast Thill Free Run Thill Free Run Thill Free Run Thill Free Run Autor 1 Statutor Statutor Statutor Statutor Statutor Autor Autor 1 Statutor Statutor Statutor Statutor Statutor Autor Autor 1 Statutor Statutor Statutor Statutor Statutor Autor Center Statutor Autor Center Statutor Center Statutor		00000 GHz	ALIGN AUTO 02:14:40 PM Mar 10, 2021 Avg Type: Log-Pwr TRACE 1 2 3 4 5 6	Frequency
Log 20 100 100 100 100 100 100 100	Ref Offset 1	PNO: Fast Trig: Free Run IFGain:Low #Atten: 30 dB	Mkr2 2.400 0 GHz	Auto Tune
10 0 20 0 30 0 40 0 50 0	0g 20.0 10.0		1	Center Freq 2.360000000 GHz
420 420 5 <td>20.0</td> <td></td> <td></td> <td>Start Freq 2.310000000 GHz</td>	20.0			Start Freq 2.310000000 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 9.600 ms (1001 pts) 10.000000 Mx8 M008 Tricl Scil x Y Function Function Function Function Auto	50.0 	ag gyppinalgine the desire have a first side type day a side to be	2 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	Stop Free 2.410000000 GH:
	Res BW 100 kHz		Sweep 9.600 ms (1001 pts)	10.000000 MH
2 N 1 f 2.400 0 GHz -45.89 dBm Freq Of	N 1 f 2 N 1 f 3 - - - 4 - - - 5 - 6 - 7 - - - 8 - - - 9 - - -	2.404 7 GHz 2.54 dBm 2.400 0 GHz 46.89 dBm		Freq Offsel 0 Hz
sg status	1			

Band Edge_High_CH26-2480

📕 Keysight Spectrum Analyzer -					
Center Freq 2.487	0 Ω DC 500000 GHz	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	02:20:43 PM Mar 10, 2021 TRACE 1 2 3 4 5 6 TYPE M	Frequency
Ref Offset 10 dB/div Ref 30.0		#Atten: 30 dB	Mkr2	2.483 500 GHz -43.91 dBm	Auto Tune
20.0 10.0	1				Center Freq 2.487500000 GHz
-10.0	A2			-19.48 dBm	Start Freq 2.475000000 GHz
-40.0 -60.0			and the second	014/20	Stop Freq 2.50000000 GHz
Center 2.48750 GH #Res BW 100 kHz		7 300 kHz	Sweep 2	Span 25.00 MHz 400 ms (1001 pts)	CF Step 2.500000 MHz Auto Man
1 N 1 f 2 N 1 f 3 4 5 6 5 6 6 7 8 9 10 11	2.480 200 GHz 2.483 500 GHz	0.50 dBm -43.91 dBm		F	Freq Offset 0 Hz
MSG		m	STATU	3	

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Spurious Emission_Low_CH11-2405

🐹 Keysight Spe	ectrum Analyzer - Sw	rept SA					- 0 ×
Center F	RF 50 Ω req 13.0150	000000 GHz	SENSE:I	Avg Typ	ALIGN AUTO be: Log-Pwr	02:13:11 PM Mar 10, 2021 TRACE 1 2 3 4 5 0 TYPE MWWWW	Frequency
10 dB/div	Ref Offset 10 Ref 30.00		Trig: Free Ru #Atten: 30 dE		Mkr	4 25.575 8 GHz -41.06 dBm	Auto Tune
20.0 10.0	0 1						Center Freq 13.015000000 GHz
-10.0 -20.0 -30.0						-17.55 dBm	Start Freq 30.000000 MHz
-40.0 -50.0 -60.0							Stop Freq 26.000000000 GHz
Center 13 #Res BW	100 kHz	#VE	W 300 kHz	FUNCTION FU	Sweep 2	Span 25.97 GHz 2.482 s (30001 pts)	
1 N 1 2 N 1 3 N 1 4 N 1 5 6	1 1 1	2.404 5 GHz 4.810 0 GHz 7.215 0 GHz 25.575 8 GHz	0.90 dBm -46.95 dBm -50.23 dBm -41.06 dBm		INC HOR MIDTH		Freq Offset 0 Hz
7 8 9 10 11							
MSG					STATUS	5	

Spurious Emission_Mid_CH18-2440

									Analyzer - Swe		rsight Sp
Frequency	M Mar 10, 2021	02:27:18 Pf	ALIGN AUTO	A	ISE:INT	SET				RF	
	PE MWWWW ET P NNNNN	TYP	: Log-Pwr	Avgi		Trig: Free #Atten: 3	HZ Ю:Fast ↔ Sain:Low	100000 G	13.0150	req	ter F
Auto Tur	3 1 GHz 97 dBm		Mkr4						f Offset 10. f 30.00 d		B/div
Center Fre 13.015000000 GR									1	0	
Start Fro 30.000000 M	-18.45 dBm										
Stop Fr 26.00000000 G								20	Ó		
CF St 2.597000000 G Auto M		2.482 s (3	Sweep 2			300 kHz	#VBV	×	kHz	100	ter 13 s BW
Freq Offs 0		FUNCTION	CTON MOTH	CHOK	3m 3m 3m	-0.65 dE -49.35 dE -51.16 dE -39.97 dE) GHz) GHz	2.440 4.880 7.320 25.593		1 f 1 f 1 f	N 1
											+

Spurious Emission_High_CH26-2480

📕 Keysight Spectrum Analyzer - S					
Center Freq 13.015		SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	02:21:23 PM Mar 10, 2021 TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N	Frequency
Ref Offset / 10 dB/div Ref 30.00	IFGain:Low	#Atten: 30 dB	Mkr	4 25.633 0 GHz -40.41 dBm	Auto Tune
20.0 10.0 0.00					Center Freq 13.015000000 GHz
-10.0 -20.0 -30.0				-19,48 dBm	Start Freq 30.000000 MHz
-40.0 -50.0 -60.0	0 ² 3				Stop Fred 26.000000000 GH2
Center 13.02 GHz #Res BW 100 kHz		W 300 kHz	· · ·	Span 25.97 GHz 2.482 s (30001 pts)	CF Step 2.597000000 GHz Auto Man
MXR: MADDE ERG SQL 1 N 1 f 2 N 1 f 3 N 1 f 4 N 1 f 5 5 5 6 7 7 8 9 9	x 2.479 8 GHz 4.960 0 GHz 7.440 0 GHz 25.633 0 GHz	Y FU -1.35 dBm -49.04 dBm -50.42 dBm -40.41 dBm	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	Freq Offset 0 Hz
10					

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10 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

10.1 Standard Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands must also comply with the §15.209 limit as below.

And according to §15.33(a) (1) for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

Frequency (MHz)	Field strength (microvolts/meter)	Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

- 1. The lower limit shall apply at the transition frequencies.
- 2. Emission level (dB μ V/m) = 20 log Emission level (μ V/m)

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10.2 Measurement Equipment Used

Radiated Emission Test Site: SAC D							
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUM- BER	LAST CAL.	CAL DUE.		
Broadband Antenna	TESEQ	CBL 6112D	35240	09/08/2020	09/07/2021		
Horn Antenna	Schwarzbeck	BBHA9120D	1341	06/22/2020	06/21/2021		
Horn Antenna	Schwarzbeck	BBHA9170	185	07/30/2020	07/29/2021		
Loop Antenna	ETS.LIND- GREN	6502	143303	04/28/2020	04/27/2021		
3m Site NSA	SGS	966 chamber D	N/A	07/12/2020	07/11/2021		
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	07/08/2020	07/07/2021		
Pre-Amplifier	EMC Instru- ments	EMC184045B	980135	10/27/2020	10/26/2021		
Pre-Amplifier	EMC Instru- ments	EMC9135	980234	11/19/2020	11/18/2021		
Pre-Amplifier	EMC Instru- ments	EMC12630SE	980271	11/19/2020	11/18/2021		
Attenuator	Marvelous	WATT- 218FS-10	RF25	11/19/2020	11/18/2021		
High Pass Filter	R&S	F13 HPF 3GHz	RF175	11/19/2020	11/18/2021		
Lowpass Filter	Woken	EWT-56-0019	RF173	11/19/2020	11/18/2021		
Notch Filter	Woken	EWT-54-0038	RF178	11/19/2020	11/18/2021		
Coaxial Cable	Huber Suhner	EMC106-SM- SM-7200	150703	11/19/2020	11/18/2021		
Coaxial Cable	Huber+Suhner	RG 214/U	W21.01	11/19/2020	11/18/2021		
Coaxial Cable	Huber Suhner	SUCOFLEX 104	MY17413/4	11/19/2020	11/18/2021		

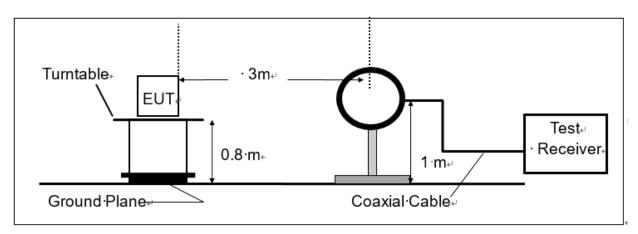
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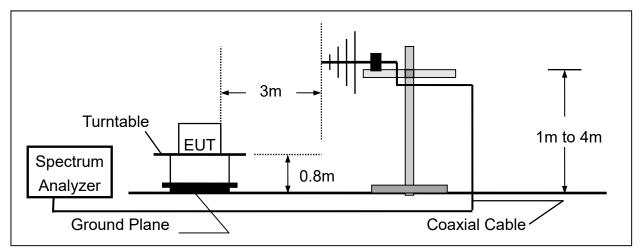


10.3 Test SET-UP

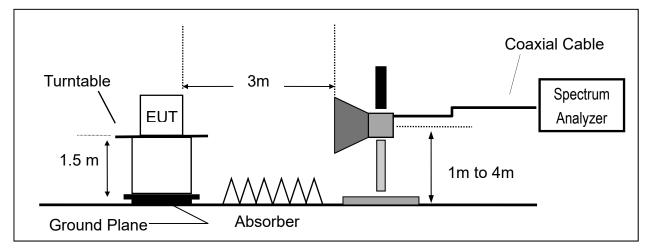
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



(B) Radiated Emission Test Set-Up, Frequency form 30MHz to 1000MHz



(C) Radiated Emission Test Set-UP Frequency Over 1 GHz



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10.4 Measurement Procedure

- 1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
- 2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 1.5m for frequency> 1GHz above ground plan.
- 3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
- 4.EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
- 5. Set the spectrum analyzer as RBW=120 kHz and VBW=300 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency below 1 GHz.
- 6. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
- 7. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
- 8. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
- 9. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 10. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
- 11.Repeat above procedures until all default test channel measured were complete.

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10.5 **Field Strength Calculation**

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where FS = Field Strength RA = Reading Amplitude AF = Antenna Factor

CL = Cable Attenuation Factor (Cable Loss) AG = Amplifier Gain

The limit of the emission level is expressed in dBuV/m, which converts 20*log(uV/m)

Actual FS($dB\mu V/m$) = SPA. Reading level($dB\mu V$) + Factor(dB) Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

10.6 Test Results of Radiated Spurious Emissions form 9 kHz to 30 MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) was not reported.

10.7 Measurement Result:

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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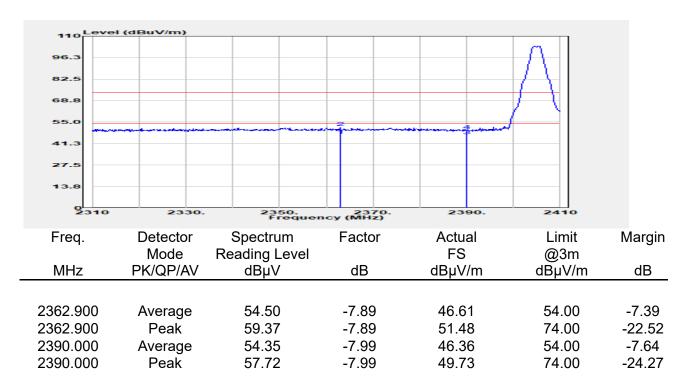
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10.7.1 **Radiated Band Edge Measurement Result**

Report Number	:E2/2021/20062	Test Site	:966 Chamber D
Operation Mode	:Zigbee	Test Date	:2021-03-11
Test Frequency	:2405 MHz	Temp./Humi.	:21.8/67
Test Mode	:BE CH LOW	Antenna Pol.	:Vertical
EUT Pol	:E2 Plan	Engineer	:Jack Tseng



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Report Number Operation Mode Test Frequency Test Mode	:E2/2021/20 :Zigbee :2405 MHz :BE CH LOV			Test Site Test Date Temp./Humi. Antenna Pol.	:966 Chamber E :2021-03-11 :21.8/67 :Horizontal)
EUT Pol	:E2 Plan			Engineer	:Jack Tseng	
96.3 92.5 68.8 55.0 41.3 27.5 13.8	IBuV/m)					
2310	2330.		2370 cy (MHz)			
Freq. MHz	Detector Mode F PK/QP/AV	Spectrum Reading Level dBµV	Factor dB	Actual FS dBµV/m	Limit @3m n dBµV/m	Margin dB
2381.500 2381.500 2390.000 2390.000	Average Peak Average Peak	53.98 59.70 54.20 58.35	-7.73 -7.73 -7.99 -7.99	46.25 51.96 46.21 50.36	54.00 74.00 54.00 74.00	-7.75 -22.04 -7.79 -23.64

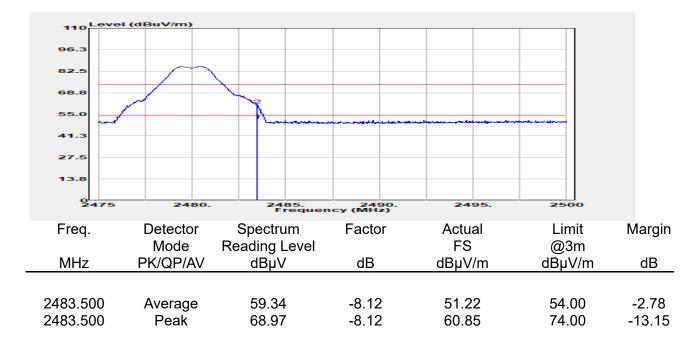
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Report Number	:E2/2021/20062
Operation Mode	:Zigbee
Test Frequency	:2480 MHz
Test Mode	:BE CH HIGH
EUT Pol	:E2 Plan

Test Site	:966 Chamber D
Test Date	:2021-04-08
Temp./Humi.	:21.2/66
Antenna Pol.	:Vertical
Engineer	:Jack Tseng



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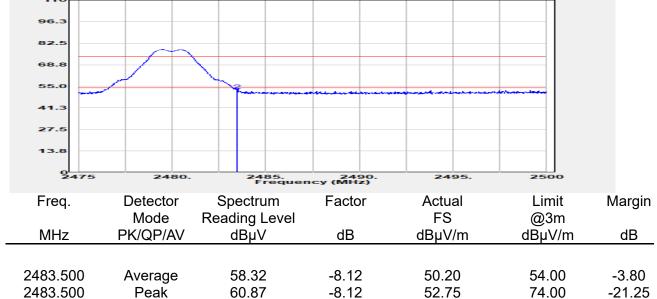
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Report Number	:E2/2021/20062	Test Site
Operation Mode	:Zigbee	Test Dat
Test Frequency	:2480 MHz	Temp./H
Test Mode	:BE CH HIGH	Antenna
EUT Pol	:E2 Plan	Enginee
110 Level (d	BuV/m)	1
96.3		
82.5		
68.8		
55.0		
41.3		

Test Site	:966 Chamber D
Test Date	:2021-04-08
Temp./Humi.	:21.2/66
Antenna Pol.	:Horizontal
Engineer	:Jack Tseng



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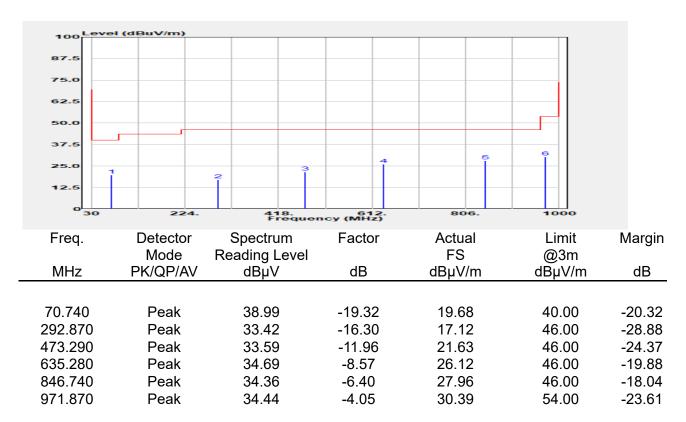
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10.7.2 Radiated Spurious Emission from 30MHz to 1000MHz

Report Number	:E2/2021/20062	Test Site	:966 Chamber D
Operation Mode	:Zigbee	Test Date	:2021-03-12
Test Frequency	:2440 MHz	Temp./Humi.	:21.8/68
Test Mode	:TX CH MID	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Jack Tseng



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Report Number Operation Mode Test Frequency Test Mode EUT Pol	:E2/2021/20 :Zigbee :2440 MHz :TX CH MID :E2 Plane			Test Site Test Date Temp./Humi. Antenna Pol. Engineer	:966 Chamber I :2021-03-12 :21.8/68 :Horizontal :Jack Tseng)
100 Level (d 87.5 75.0	IBuV/m)					
62.5 50.0 37.5 25.0 1 12.5	2	3	4		5 6	
0 30	224.	418. Frequen	612. cy (MHz)	806.	1000	
Freq.	Detector Mode F	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV/m		dB
50.370 141.550 374.350 593.570 840.920 969.930	Peak Peak Peak Peak Peak Peak	38.78 33.38 32.69 33.62 34.84 33.93	-17.62 -16.98 -14.54 -9.37 -6.36 -3.85	21.16 16.40 18.15 24.25 28.47 30.08	40.00 43.50 46.00 46.00 46.00 54.00	-18.84 -27.10 -27.85 -21.75 -17.53 -23.92

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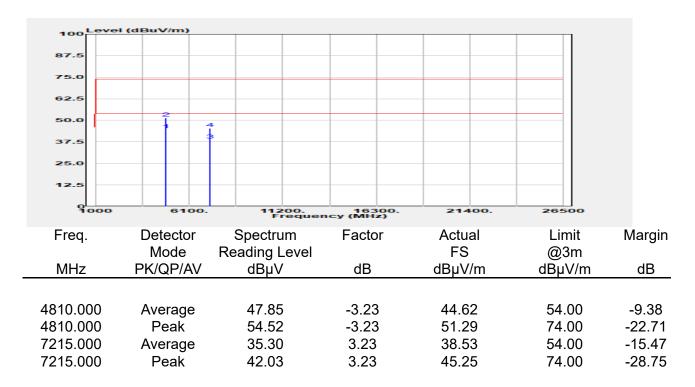
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10.7.3 **Radiated Spurious Emission above 1GHz**

Report Number	:E2/2021/20062	Test Site	:966 Chamber D
Operation Mode	:Zigbee	Test Date	:2021-03-12
Test Frequency	:2405 MHz	Temp./Humi.	:21.8/68
Test Mode	:TX CH LOW	Antenna Pol.	:Vertical
EUT Pol	:E2 Plane	Engineer	:Jack Tseng



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Report Number	:E2/2021/	20062		Test Site	:966 Chamber	. D
Operation Mode	:Zigbee			Test Date	:2021-03-12	
Test Frequency	:2405 MH	Z		Temp./Humi.	:21.8/68	
Test Mode	:TX CH L	WC		Antenna Pol.	:Horizontal	
EUT Pol	:E2 Plane			Engineer	:Jack Tseng	
				0	U	
100 Level (d	dBuV/m)				1	
87.5						
75.0						
62.5						
50.0		4				
37.5	2					
25.0						
12.5						
9000	6100.	11200. Frequer	16300 1cy (MHz)	0. 2140	0. 26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level	15	FS	@3m	
MHz	PK/QP/AV	dBµV	dB	dBµV/m	n dBµV/n	n dB
4810.000	Average	38.30	-3.23	35.07	54.00	-18.93
4810.000	Peak	44.00	-3.23	40.77	74.00	-33.23
7215.000	Average	33.26	3.23	36.49	54.00	-17.51
7215.000	Peak	40.43	3.23	43.66	74.00	-30.34

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f (886-2) 2298-0488
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Report Number	:E2/2021/2	20062		Test Site	:966 Chamber	D
Operation Mode	:Zigbee			Test Date	:2021-03-12	
Test Frequency	:2440 MH	z		Temp./Humi.	:21.8/68	
Test Mode	:TX CH M	ID		Antenna Pol.	:Vertical	
EUT Pol	:E2 Plane			Engineer	:Jack Tseng	
				-	-	
100 Level (dBuV/m)				1	
87.5						
75.0						
62.5	2					
50.0		4				
37.5		8				
25.0						
12.5						
1000	6100.	11200. Frequer	16300 icy (MHz)). 21400	D. 26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode PK/QP/AV	Reading Level dBµV	dB	FS dBµV/m	@3m dBµV/m	dB
		dDµv	dD	dDµv/m		
4880.000	Average	50.22	-2.87	47.36	54.00	-6.64
4880.000	Peak	58.92	-2.87	56.05	74.00	-17.95
7320.000	Average Peak	32.48 40.72	3.42	35.89 44.13	54.00 74.00	-18.11 -29.87
7320.000	reak	40.72	3.42	44.13	74.00	-29.07

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Report Number	:E2/2021/	20062	-	Test Site	:966 Chamber D	
Operation Mode	:Zigbee		-	Test Date	:2021-03-12	
Test Frequency	:2440 MH	Z	-	Temp./Humi.	:21.8/68	
Test Mode	:TX CH M	ID		Antenna Pol.	:Horizontal	
EUT Pol	:E2 Plane			Engineer	:Jack Tseng	
				-	_	
100 Level (dBuV/m)					
87.5						
75.0						
62.5						
50.0	2	4				
37.5		3				
25.0						
12.5						
1000	6100.	11200. Frequen	16300 icy (MHz)	. 21400	. 26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode PK/QP/AV	Reading Level dBµV	dB	FS dBµV/m	@3m dBµV/m	dB
4880.000	Average	45.67	-2.87	42.80	54.00	-11.20
4880.000	Peak	53.77	-2.87	50.90	74.00	-23.10
7320.000 7320.000	Average Peak	32.34 40.09	3.42 3.42	35.75 43.51	54.00 74.00	-18.25 -30.49
1020.000	i our	10.00	0.72	10.01	7-1.00	00.40

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Report Number	:E2/2021/	20062	-	Test Site	:966 Chamber D	
Operation Mode	:Zigbee		-	Test Date	:2021-03-12	
Test Frequency	:2480 MH	Z	-	Temp./Humi.	:21.8/68	
Test Mode	:TX CH H	IGH	/	Antenna Pol.	:Vertical	
EUT Pol	:E2 Plane		I	Engineer	:Jack Tseng	
100 Level (c	iBuV/m)					
87.5						
75.0						
62.5						
50.0	1	4				
37.5		3				
25.0						
12.5						
9000	6100.	11200. Frequen	16300. icy (MHz)	. 21400	0. 26500	
Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	Mode PK/QP/AV	Reading Level dBµV	dB	FS dBµV/m	@3m dBµV/m	dB
			4 2			
4960.000	Average	51.52	-2.89	48.63	54.00	-5.37
4960.000	Peak	56.05	-2.89	53.15	74.00	-20.85
7440.000 7440.000	Average Peak	32.26 39.98	3.65 3.65	35.91 43.63	54.00 74.00	-18.09 -30.37
1 1 10.000	1 Oun	00.00	0.00	10.00	7 1.00	00.07

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Report Number	:E2/2021/	20062		Test Site	:966 Chamber [)
Operation Mode	:Zigbee			Test Date	:2021-03-12	
Test Frequency	:2480 MH	Z		Temp./Humi.	:21.8/68	
Test Mode	:TX CH H	IGH		Antenna Pol.	:Horizontal	
EUT Pol	:E2 Plane			Engineer	:Jack Tseng	
100 Level (d	lBuV/m)					
87.5						
75.0						
62.5						
50.0	2	4				
37.5		3				
25.0						
12.5						
1000	6100.	11200. Frequen				
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz F	PK/QP/AV	dBµV	dB	dBµV/m	0	dB
4960.000	Average	43.10	-2.89	40.21	54.00	-13.79
4960.000 7440.000	Peak Average	46.58 31.92	-2.89 3.65	43.69 35.57	74.00 54.00	-30.31 -18.43
7440.000	Peak	38.63	3.65	42.28	74.00	-31.72

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11 POWER SPECTRAL DENSITY

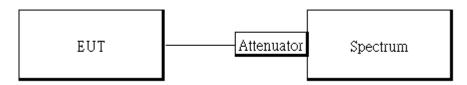
11.1 Standard Applicable:

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

11.2 Measurement Equipment Used:

Conducted Emission Test Site: Conducted C							
EQUIPMENT TYPE	MFR	MODEL NUM- BER	SERIAL NUMBER	LAST CAL.	CAL DUE.		
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510568	07/08/2020	07/07/2021		
Attenuator	Marvelous	MVE2213-10	RF09	11/19/2020	11/18/2021		
DC Block	PASTER- NACK	PE8210	RF151	11/19/2020	11/18/2021		
Coaxial Cables	Woken	00100A1F2A196C	RF70	11/19/2020	11/18/2021		

11.3 Test Set-up:



11.4 Measurement Procedure:

- 1. Set analyzer center frequency to DTS channel center frequency.
- 2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance.
- 3. Set the span to 1.5 times the DTS channel bandwidth.
- 4. Set the RBW = 3 kHz. & the VBW = 10 kHz
- 5. For defining Restricted Band Edge Limit:

Set the RBW = 100kHz & VBW = 300 kHz.

- 6. Detector = peak.
- 7. Sweep time = auto couple.
- 8. Trace mode = max hold.
- 9. Allow trace to fully stabilize.
- 10. Use the peak marker function to determine the maximum amplitude level.

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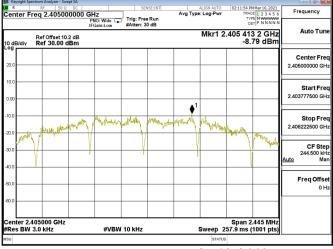
11.5 Measurement Result:

Zigbee mode

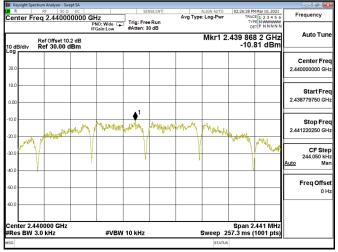
Frequency (MHz)	RF Power Density (dBm/3kHz)	Maximum Limit (dBm/3kHz)	Result
2405	-8.790	8	PASS
2440	-10.810	8	PASS
2480	-11.110	8	PASS

NOTE: cable loss as 10.2dB that offsets in the spectrum

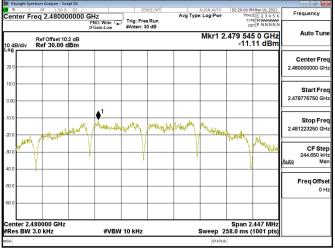
Power Density_Low_CH11-2405



Power Density Mid CH18-2440



Power Density_High_CH26-2480



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12 ANTENNA REQUIREMENT

12.1 Standard Applicable:

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

If the transmitting antenna is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi.

In case of point-to-point operation, the power shall be reduced by the one dB for every 3 dB that the directional gain of antenna exceeds 6dBi.

12.2 Antenna Connected Construction:

The antenna is designed with unique RF connector and no consideration of replacement. Please see EUT photo for details.

~ End of Report ~

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