China

FCC - TEST REPORT

Report Number	: 7088820696290-00	Date of Issue:	April 22, 2021

Model	: 30798
Product Type	: Swiss Tech Kernstuck Bluetooth Speaker Lantern
FCC ID	: 2AMI2-30798
Applicant	: Hangzhou Great Star Industrial Co., Ltd.
Address	: No.35, Jiuhuan Road, Jianggan District, Hangzhou, 310019 China
Production Facility	: Zhejiang Great Star Industrial Co., Ltd.
Address	: Building 1, NO.11 Qihui Road, ChangAn Town, Haining, Jiaxing, Zhejiang, PEOPLE'S REPUBLIC OF CHINA
Test Result	: n Positive o Negative
Total pages including Appendices	: 56

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2 Details about the Test Laboratory

Details about the Test Laboratory
Test Site 1

Company name:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch No.16 Lane, 1951 Du Hui Road, Shanghai 201108, P.R. China
Test Firm FCC Registration Number:	820234
Test Firm IC Registration Number:	25988
Telephone:	+86 21 6141 0123
Fax:	+86 21 6140 8600

3 Description of the Equipment Under Test

Product:	Swiss Tech Kernstuck Bluetooth Speaker Lantern
Model no.:	30798
FCC ID:	2AMI2-30798
Options and accessories:	N/A
Rating:	5V DC
RF Transmission Frequency:	2402~2480MHz
No. of Operated Channel:	79
Channel list:	00:2402MHz, 01:2403MHz, 02:2404MHz…39:2441MHz…. 77:2479MHz, 78:2480MHz
Channel space:	1MHz
Modulation:	GFSK, π/4DQPSK
Data Rate:	1Mbps (GFSK), 2Mbps (Pi/4 DQPSK)
Duty Cycle:	less than 100%
Antenna Type:	On Board PCB Antenna
Antenna Gain:	-0.58dBi
Description of the EUT:	Swiss Tech Kernstuck Bluetooth Speaker Lantern
Test sample no.:	SHA-548291-2

The sample's mentioned in this report is/are submitted/ supplied/ manufactured by client. The laboratory therefore assumes no responsibility for accuracy of information on the brand name, model number, origin of manufacture, consignment, antenna gain or any information supplied.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to Public Notice DA 00-705 -Frequency Hopper Spread Spectrum Test Procedure released by FCC on March 30, 2000 and C63.10 (2013).

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5 Summary of Test Results

Technical Requirements				
FCC Part 15 Subpart C				
Test Condition		Pages	Test Site	Test Result
§15.207	Conducted emission AC power port	11	Site 1	Pass
§15.247(b)(1)	Conducted peak output power	16	Site 1	Pass
§15.247(a)(2)	6dB bandwidth	---	---	N/A
§15.247(a)(1)	20dB bandwidth	20	Site 1	Pass
§15.247(a)(1)	Carrier frequency separation	24	Site 1	Pass
§15.247(a)(1)(iii)	Number of hopping frequencies	26	Site 1	Pass
§15.247(a)(1)(iii)	Dwell Time	28	Site 1	Pass
§15.247(e)	Power spectral density*	---	---	N/A
§15.247(d)	Spurious RF conducted emissions	30	Site 1	Pass
§15.247(d)	Band edge	43	Site 1	Pass
§15.247(d) & §15.209 &	Spurious radiated emissions for transmitter and receiver	48	Site 1	Pass
§15.203	Antenna requirement	See note 2		Pass

Note 1: N/A=Not Applicable.
Note 2: The EUT uses an On Board PCB Antenna, which gain is -0.58dBi. In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.

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6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2AMI2-30798, complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules.

SUMMARY:

All tests according to the regulations cited on page 5 were

n - Performed

o - **Not** Performed

The Equipment Under Test

n - **Fulfills** the general approval requirements.

o - **Does not** fulfill the general approval requirements.

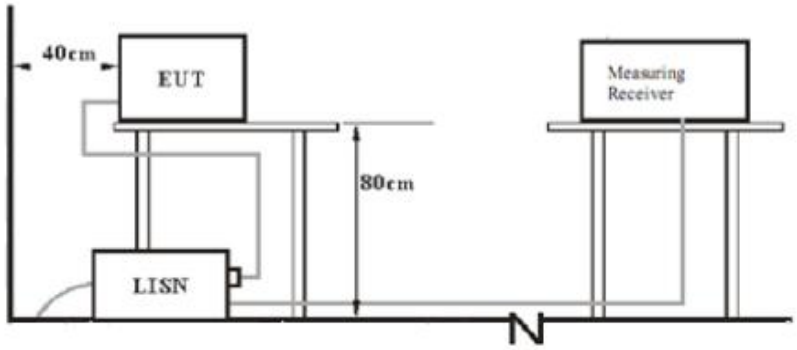
Sample Received Date:	March 22, 2021
Testing Start Date:	March 30, 2021
Testing End Date:	March 30, 2021

TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

Reviewed by:	Prepared by:	Tested by:
Hui TONG	Jiaxi XU	Wenqiang LU
Review Engineer	Project Engineer	Test Engineer

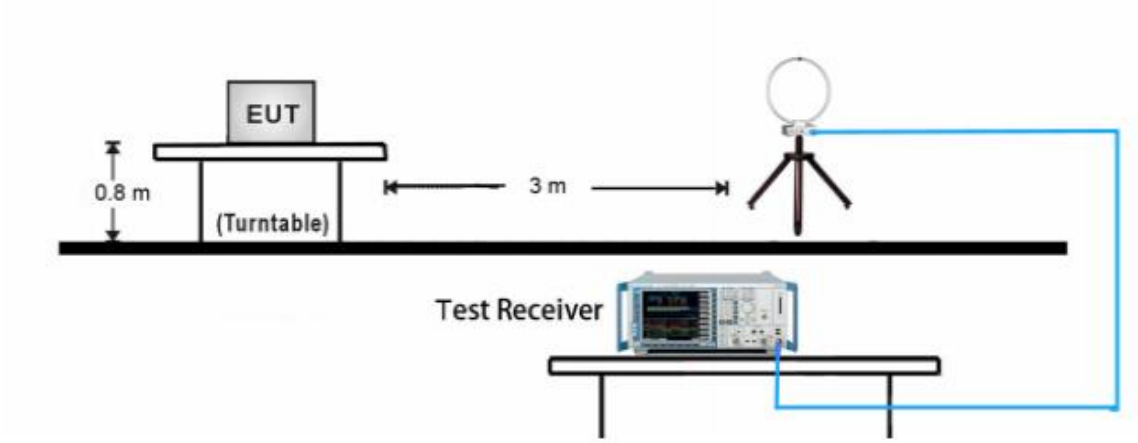
7 Test Setups

7.1 AC Power Line Conducted Emission test setups

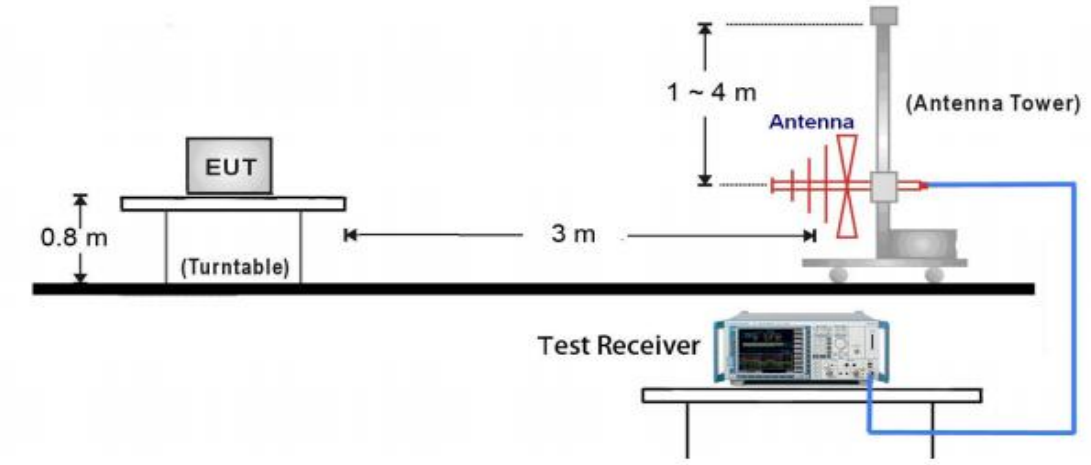


7.2 Radiated test setups

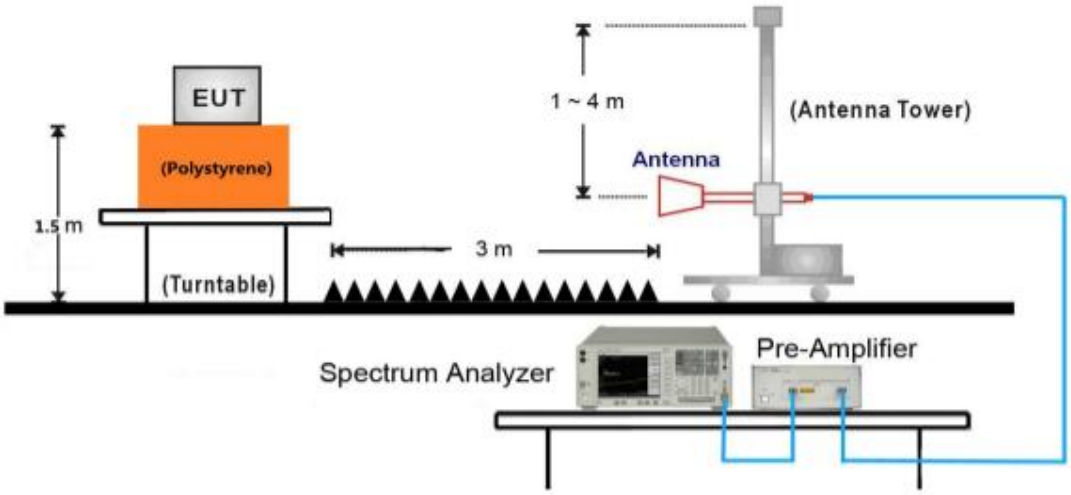
9kHz ~ 30MHz Test Setup:



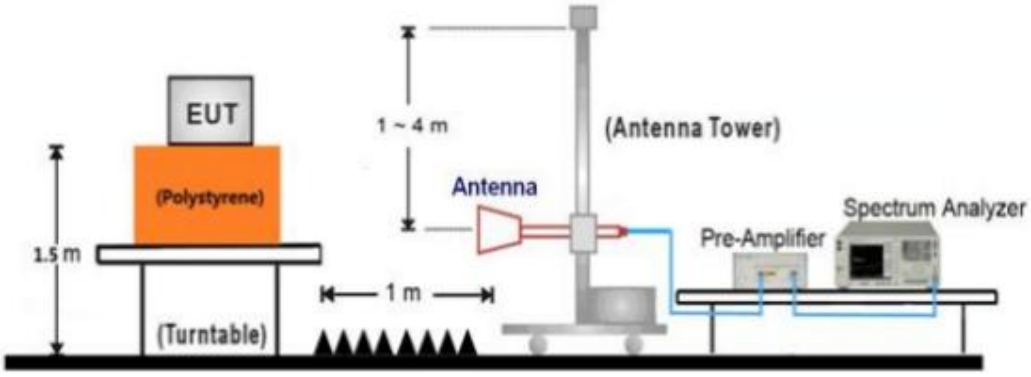
30MHz ~ 1GHz Test Setup:



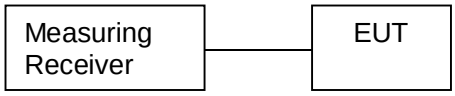
1GHz ~ 18GHz Test Setup:



18GHz ~ 25GHz Test Setup:



7.3 Conducted RF test setups



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8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Laptop	Lenovo	E470	---

Test software: FCCAssist.exe, which used to control the EUT in continues transmitting mode

The system was configured to hopping mode and non-hopping mode.

Hopping mode: typical working mode (normal hopping status)

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power

Each packet types were considered (e.g. DH1/3/5, 2-DH1/3/5), and worst case or representative results are presented.

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9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

Limit

Frequency MHz	QP Limit dBµV	AV Limit dBµV
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

Decreasing linearly with logarithm of the frequency

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150k-30MHz Conducted Emission Test

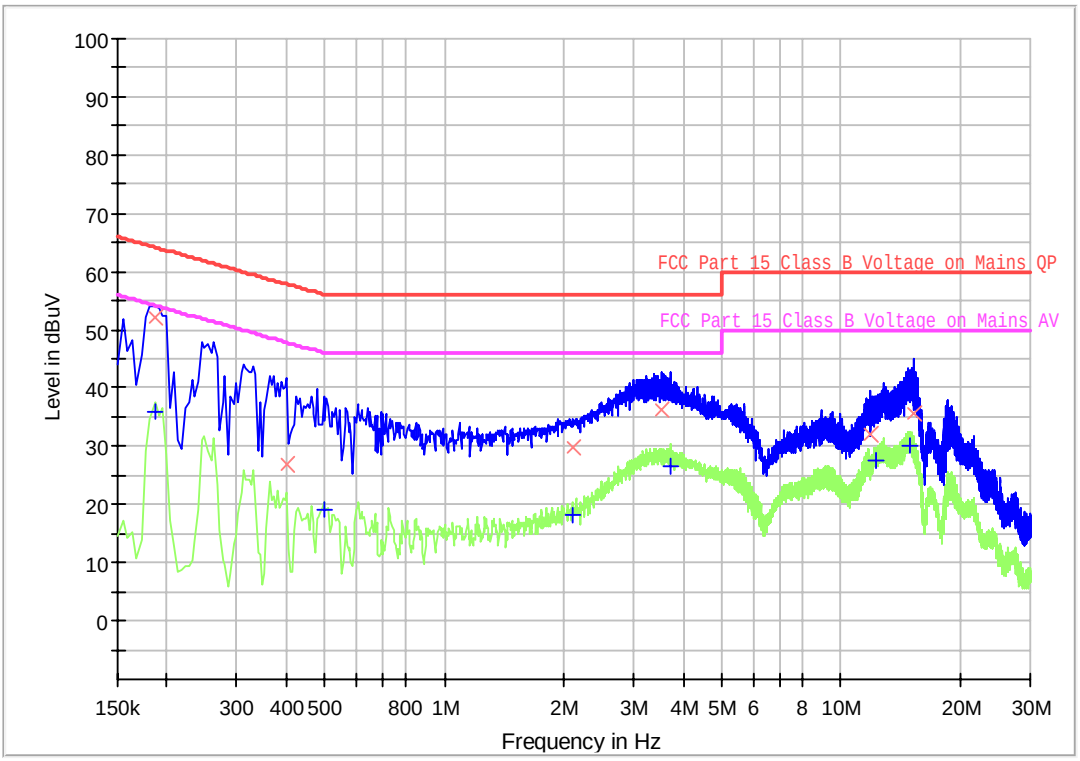
EUT Information

EUT Name:	Swiss Tech Kernstuck Bluetooth Speaker Lantern
Model	30798
Client:	Hangzhou Great Star Industrial Co., Ltd.
Op Cond:	Charge mode by 5V usb Power by Laptop Bluetooth Tx, AC 120V/60Hz, T20.2, H47.1%, P103.1kPa
Operator:	Wenqiang LU
Standard	FCC Part 15
Comment:	Phase L
Sample No.:	SHA-548291-2

Scan Setup: Voltage with 2-Line-LISN pre [EMI conducted]

Hardware Setup:	Voltage with 2-Line-LISN
Receiver:	[ESR 3]
Level Unit:	dBuV

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
9 kHz - 150 kHz	100 Hz	PK+	200 Hz	0.01 s	0 dB
150 kHz - 30 MHz	4.5 kHz	PK+; AVG	9 kHz	0.01 s	0 dB



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Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.186000	---	36.00	54.21	18.21	1000.0	9.000	L1	19.5
0.186000	52.01	---	64.21	12.20	1000.0	9.000	L1	19.5
0.402000	26.83	---	57.81	30.98	1000.0	9.000	L1	19.5
0.496500	---	19.00	46.06	27.06	1000.0	9.000	L1	19.5
2.098500	---	18.13	46.00	27.87	1000.0	9.000	L1	19.5
2.121000	29.79	---	56.00	26.21	1000.0	9.000	L1	19.5
3.529500	36.26	---	56.00	19.74	1000.0	9.000	L1	19.5
3.714000	---	26.54	46.00	19.46	1000.0	9.000	L1	19.5
11.886000	32.18	---	60.00	27.82	1000.0	9.000	L1	19.7
12.214500	---	27.67	50.00	22.33	1000.0	9.000	L1	19.7
14.946000	---	30.03	50.00	19.97	1000.0	9.000	L1	19.7
15.211500	35.48	---	60.00	24.52	1000.0	9.000	L1	19.7

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150k-30MHz Conducted Emission Test

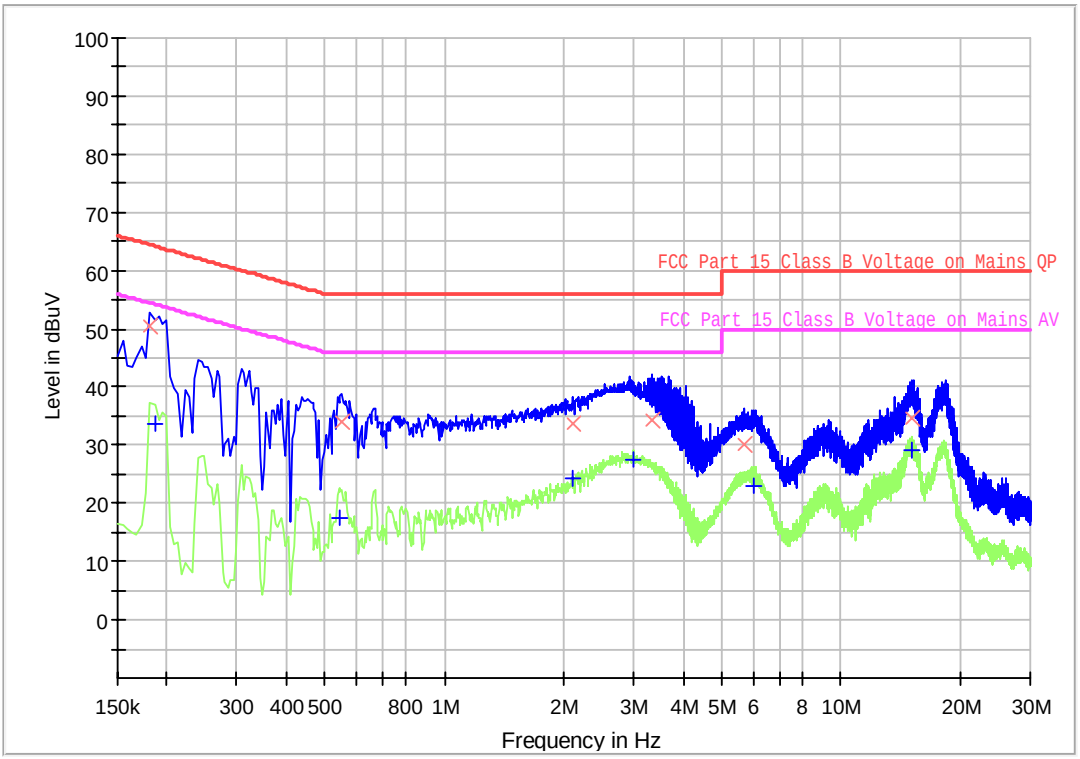
EUT Information

EUT Name:	Swiss Tech Kernstuck Bluetooth Speaker Lantern
Model	30798
Client:	Hangzhou Great Star Industrial Co., Ltd.
Op Cond:	Charge mode by 5V usb Power by Laptop Bluetooth Tx, AC 120V/60Hz, T20.2, H47.1%, P103.1kPa
Operator:	Wenqiang LU
Standard	FCC Part 15
Comment:	Phase N
Sample No.:	SHA-548291-2

Scan Setup: Voltage with 2-Line-LISN pre [EMI conducted]

Hardware Setup:	Voltage with 2-Line-LISN
Receiver:	[ESR 3]
Level Unit:	dBuV

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
9 kHz - 150 kHz	100 Hz	PK+	200 Hz	0.01 s	0 dB
150 kHz - 30 MHz	4.5 kHz	PK+; AVG	9 kHz	0.01 s	0 dB



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Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.181500	50.38	---	64.42	14.04	1000.0	9.000	N	19.5
0.186000	---	33.52	54.21	20.69	1000.0	9.000	N	19.5
0.541500	---	17.34	46.00	28.66	1000.0	9.000	N	19.5
0.550500	33.88	---	56.00	22.12	1000.0	9.000	N	19.5
2.103000	---	24.30	46.00	21.70	1000.0	9.000	N	19.5
2.103000	33.71	---	56.00	22.29	1000.0	9.000	N	19.5
3.003000	---	27.49	46.00	18.51	1000.0	9.000	N	19.6
3.349500	34.17	---	56.00	21.83	1000.0	9.000	N	19.6
5.676000	30.27	---	60.00	29.73	1000.0	9.000	N	19.6
6.013500	---	23.07	50.00	26.93	1000.0	9.000	N	19.6
15.004500	---	29.11	50.00	20.89	1000.0	9.000	N	19.8
15.139500	34.58	---	60.00	25.42	1000.0	9.000	N	19.8

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

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9.2 Conducted peak output power

Test Method

1. Use the following spectrum analyzer settings:
   Span = approximately 5 times the 20dB bandwidth, centered on a hopping channel
   RBW > the 20dB bandwidth of the emission being measured, VBW≥RBW,
   Sweep = auto, Detector function = peak, Trace = max hold
2. Add a correction factor to the display.
3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power

Limits

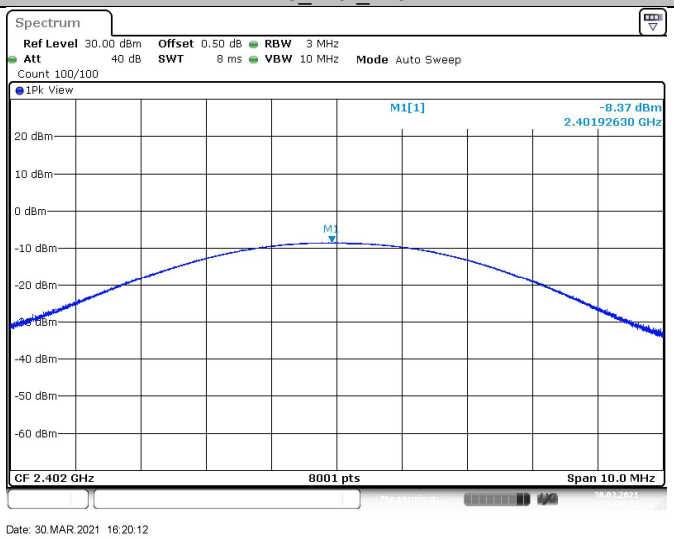
Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤1	≤30

Conducted peak output power

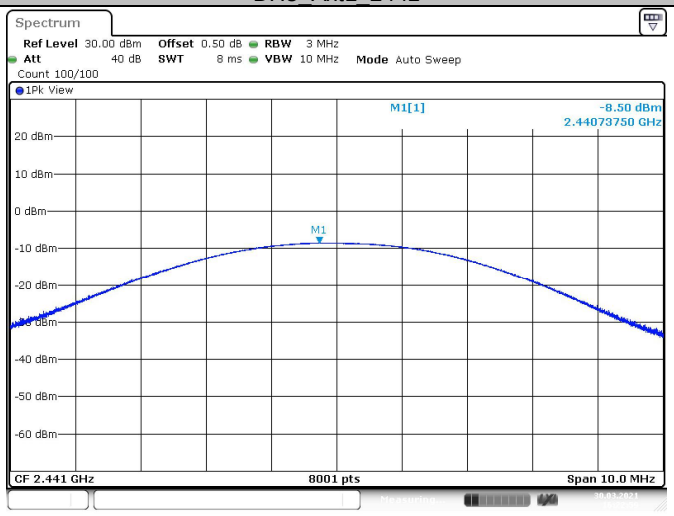
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
DH5	Ant1	2402	-8.37	<=30	PASS
		2441	-8.5	<=30	PASS
		2480	-10.06	<=30	PASS
2DH5	Ant1	2402	-7.89	<=30	PASS
		2441	-7.83	<=30	PASS
		2480	-9.79	<=30	PASS

Test Graphs

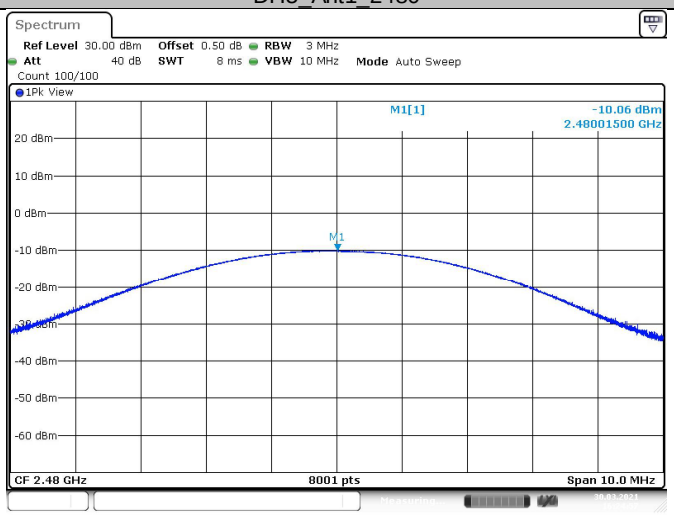
DH5_Ant1_2402



DH5_Ant1_2441



DH5_Ant1_2480



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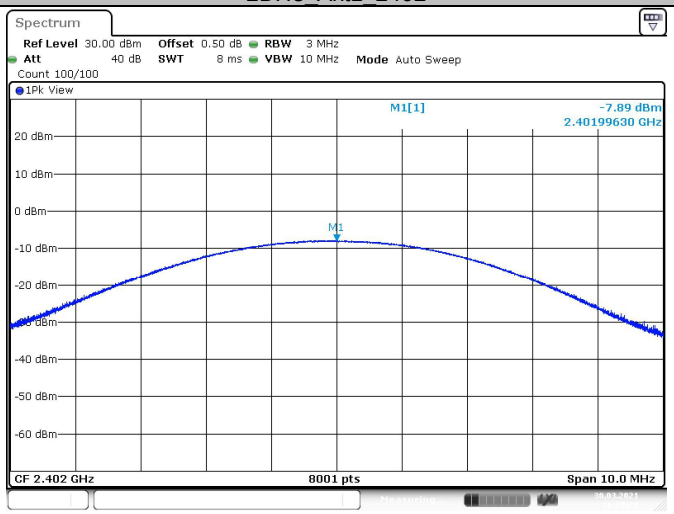
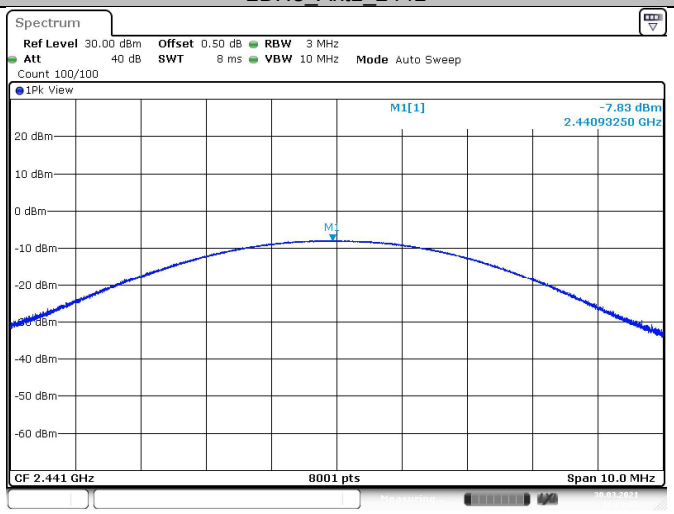
2DH5_Ant1_2402

2DH5_Ant1_2441


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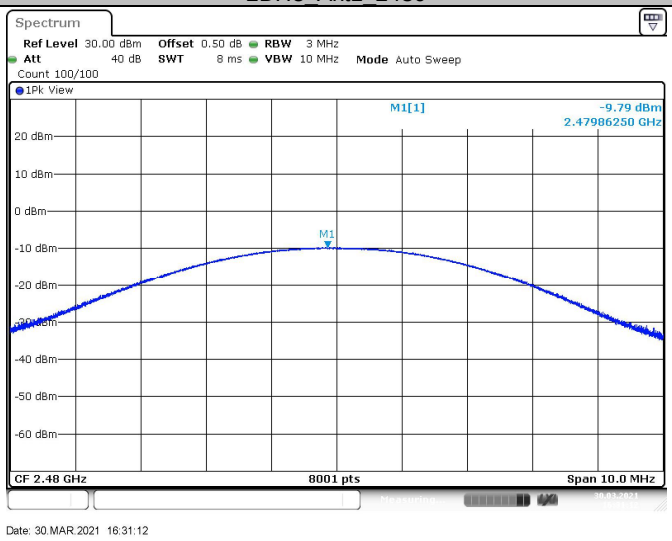
2DH5_Ant1_2480



9.3 20 dB bandwidth

Test Method

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Limit

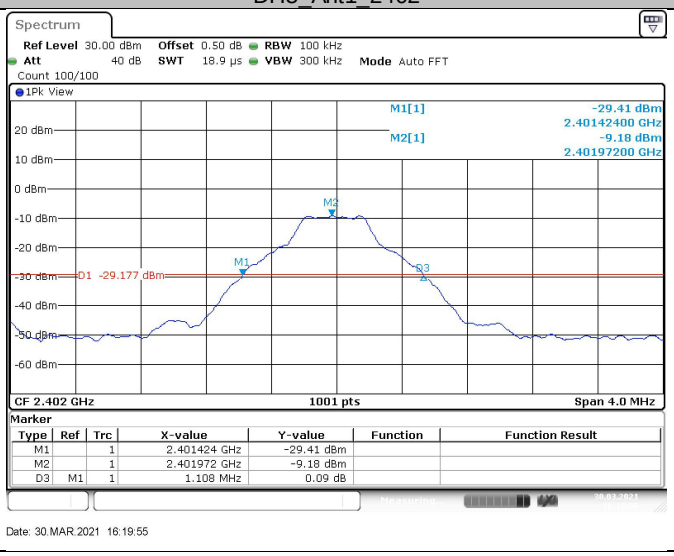
Limit [kHz]
N/A

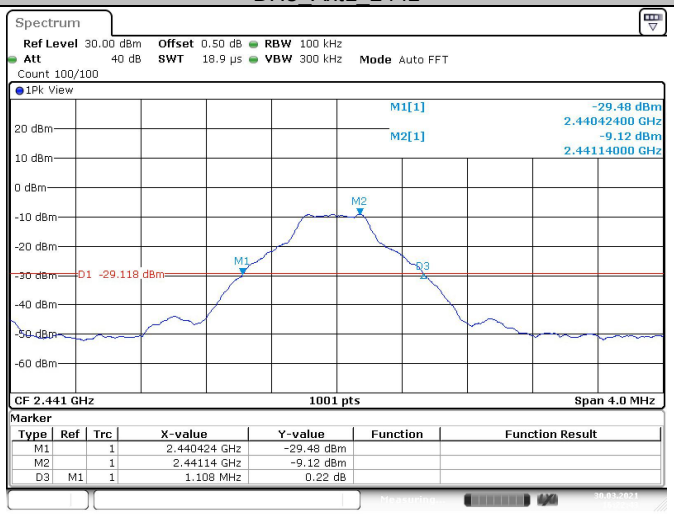
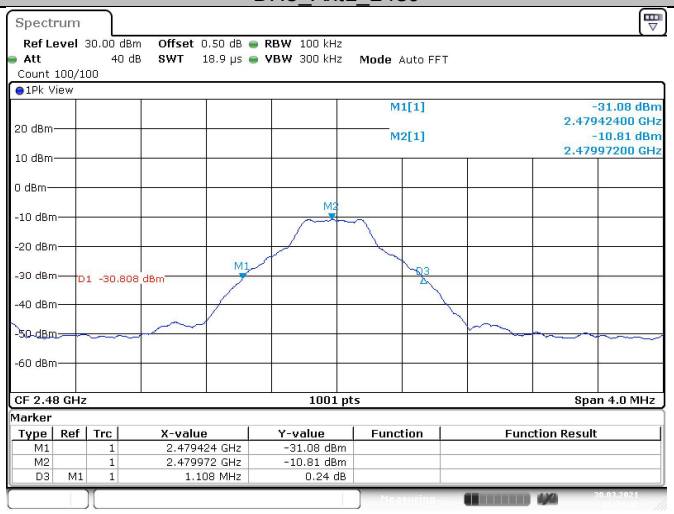
Test Result

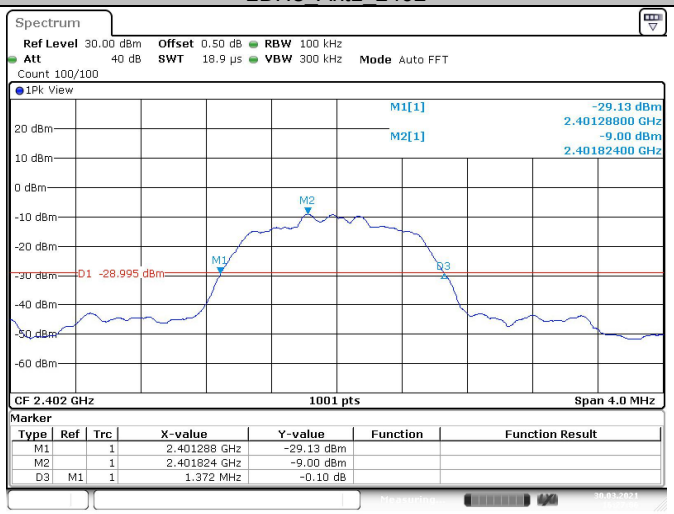
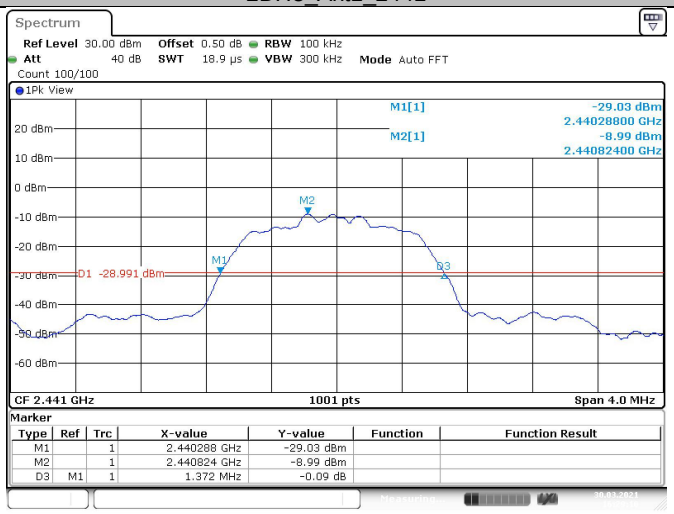
TestMode	Antenna	Channel	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	1.108	2401.424	2402.532	0.5	PASS
		2441	1.108	2440.424	2441.532	0.5	PASS
		2480	1.108	2479.424	2480.532	0.5	PASS
2DH5	Ant1	2402	1.372	2401.288	2402.660	0.5	PASS
		2441	1.372	2440.288	2441.660	0.5	PASS
		2480	1.380	2479.280	2480.660	0.5	PASS

Test Graphs

DH5_Ant1_2402



DH5_Ant1_2441

DH5_Ant1_2480


2DH5_Ant1_2402

2DH5_Ant1_2441


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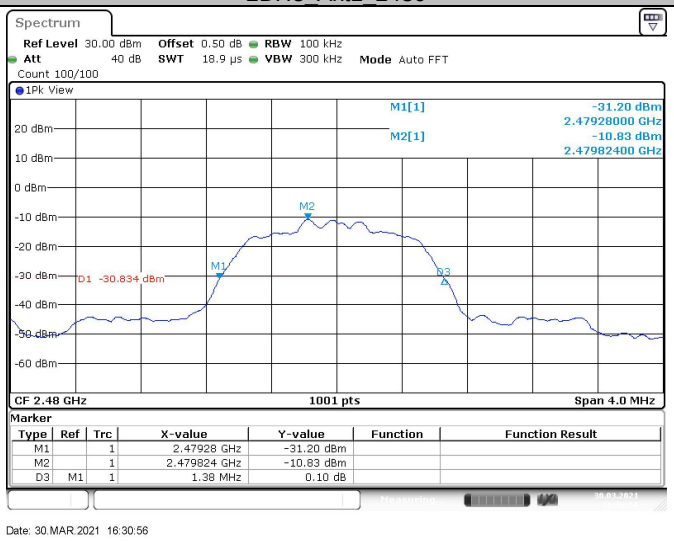
2DH5_Ant1_2480



9.4 Carrier Frequency Separation

Test Method

1. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels, RBW ≥ 1% of the span, VBW) ≥RBW, Sweep = auto, Detector function = peak
2. By using the Max-Hold function record the separation of two adjacent channels.
3. Measure the frequency difference of these two adjacent channels by spectrum analyzer marker function.
4. Repeat above procedures until all frequencies measured were complete.

Limit

Limit kHz
≥25KHz or 2/3 of the 20 dB bandwidth which is greater

Test Result

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
DH5	Ant1	Hop	0.939	>=0.025	PASS
2DH5	Ant1	Hop	1.003	>=0.025	PASS

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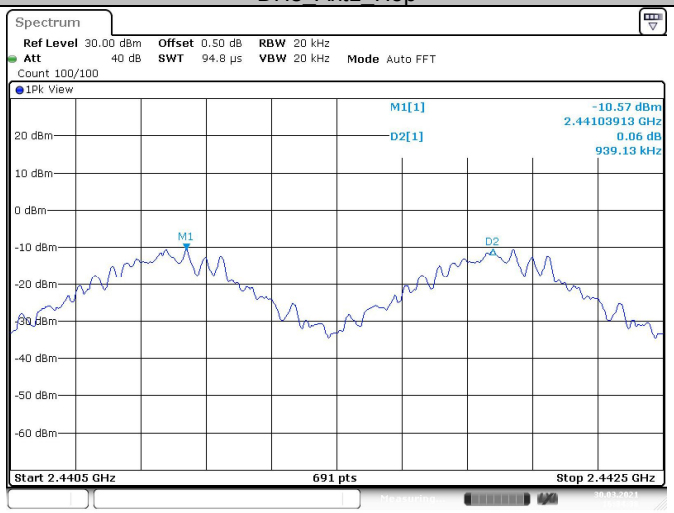
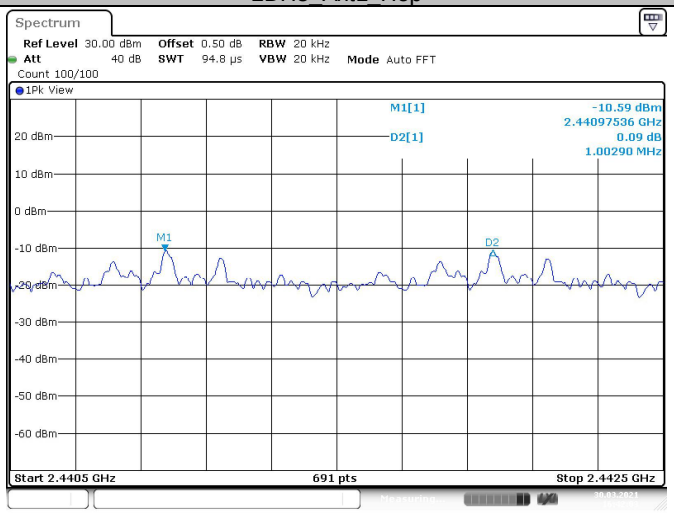
Test Graphs

DH5_Ant1_Hop



2DH5_Ant1_Hop



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9.5 Number of hopping frequencies

Test Method

1. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels, RBW ≥ 1% of the span, VBW) ≥RBW, Sweep = auto, Detector function = peak
2. Set the spectrum analyzer on Max-Hold Mode, and then keep the EUT in hopping mode.
3. Record all the signals from each channel until each one has been recorded.
4. Repeat above procedures until all frequencies measured were complete.

Limit

Limit number
≥ 15

Number of hopping frequencies

Test result: The measurement was performed with the typical configuration (normal hopping status), and the total hopping channels is constant for the all modulation mode according with the Bluetooth Core Specification. Here GFSK modulation mode was used to show compliance.

Number of hopping frequencies	Result
79	Pass

Test Result

TestMode	Antenna	Channel	Result[Num]	Limit[Num]	Verdict
DH5	Ant1	Hop	79	>=15	PASS
2DH5	Ant1	Hop	79	>=15	PASS

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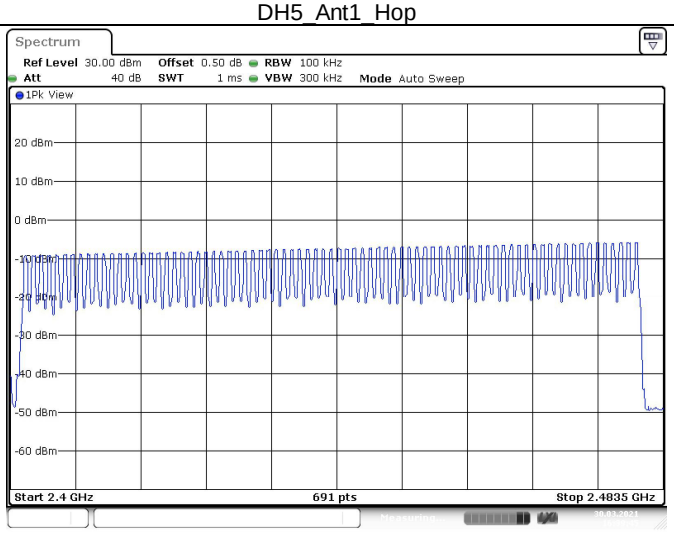
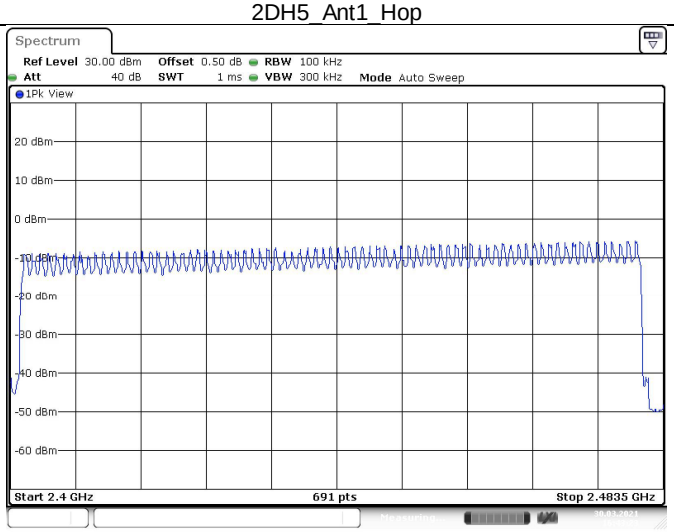
Test Graphs

DH5_Ant1_Hop



2DH5_Ant1_Hop



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9.6 Dwell Time

Test Method

1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable. Equipment mode: Spectrum analyzer
2. RBW: 1MHz; VBW: 1MHz; SPAN: Zero Span
3. Adjust the center frequency of spectrum analyzer on any frequency be measured.
4. Measure the Dwell Time by spectrum analyzer Marker function.
5. Repeat above procedures until all frequencies measured were complete.

Limit

The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Dwell time

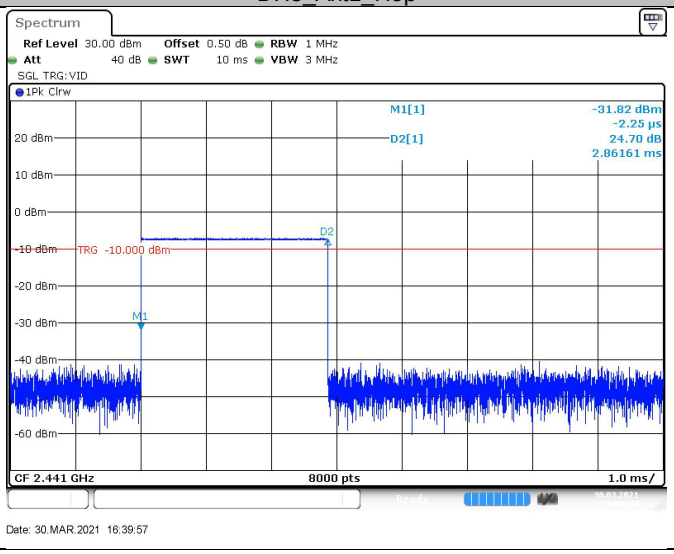
The maximum dwell time shall be 0,4 s.
The Dwell Time = Burst Width * Total Hops.

Test Result

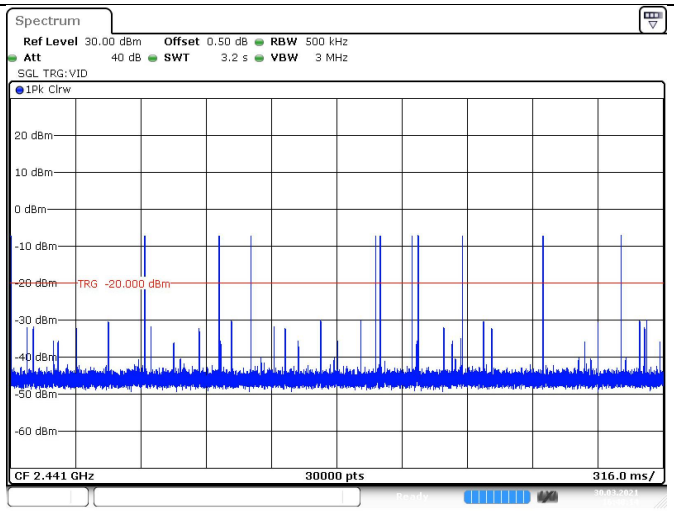
TestMode	Antenna	Channel	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH5	Ant1	Hop	2.86	110	0.315	<=0.4	PASS
2DH5	Ant1	Hop	2.87	110	0.315	<=0.4	PASS

Test Graphs

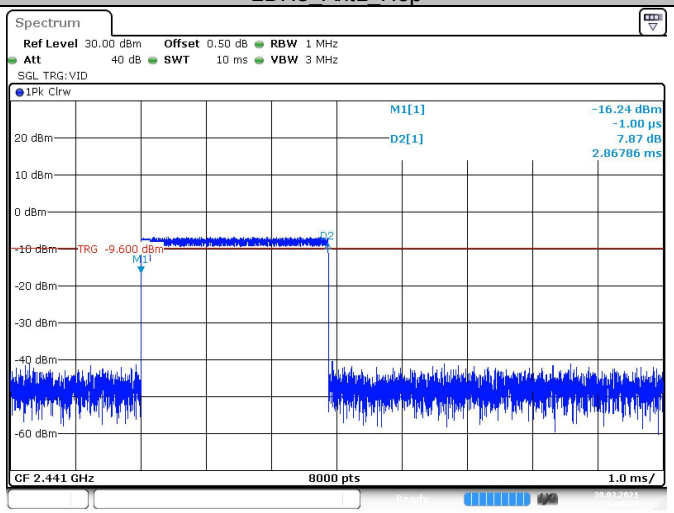
DH5_Ant1_Hop

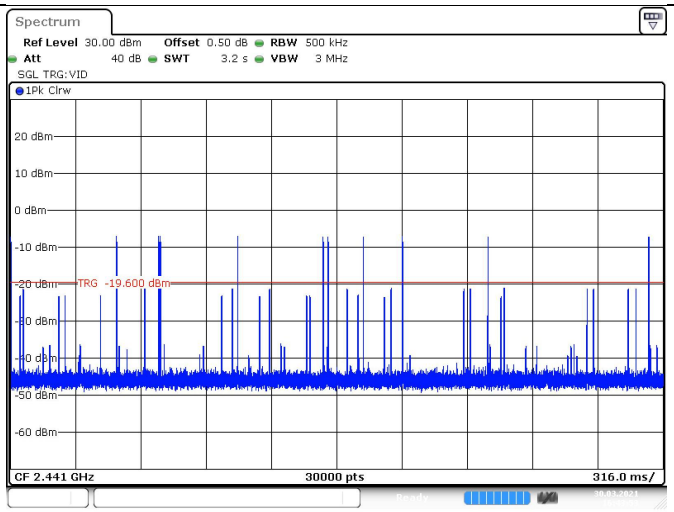


China



2DH5_Ant1_Hop





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9.7 Spurious RF conducted emissions

Test Method

1. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
   RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
3. The level displayed must comply with the limit specified in this Section. Submit these plots.
4. Repeat above procedures until all frequencies measured were complete.

Limit

Frequency Range MHz	Limit (dBc)
30-25000	-20

Spurious RF conducted emissions

Test Result

TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	2402	Reference	-9.26	-9.26	---	PASS
			30~1000	-9.26	-56.48	<=-29.26	PASS
			1000~5000	-9.26	-38.14	<=-29.26	PASS
			5000~26500	-9.26	-51.71	<=-29.26	PASS
		2441	Reference	-9.22	-9.22	---	PASS
			30~1000	-9.22	-55.85	<=-29.22	PASS
			1000~5000	-9.22	-41.25	<=-29.22	PASS
			5000~26500	-9.22	-52.36	<=-29.22	PASS
		2480	Reference	-10.77	-10.77	---	PASS
			30~1000	-10.77	-55.81	<=-30.77	PASS
			1000~5000	-10.77	-31.61	<=-30.77	PASS
			5000~26500	-10.77	-52.92	<=-30.77	PASS
2DH5	Ant1	2402	Reference	-9.12	-9.12	---	PASS
			30~1000	-9.12	-58.47	<=-29.12	PASS
			1000~5000	-9.12	-41.31	<=-29.12	PASS
			5000~26500	-9.12	-51.49	<=-29.12	PASS
		2441	Reference	-9.02	-9.02	---	PASS
			30~1000	-9.02	-59.06	<=-29.02	PASS
			1000~5000	-9.02	-43.11	<=-29.02	PASS
			5000~26500	-9.02	-52.63	<=-29.02	PASS
		2480	Reference	-10.88	-10.88	---	PASS
			30~1000	-10.88	-34.17	<=-30.88	PASS
			1000~5000	-10.88	-39.84	<=-30.88	PASS
			5000~26500	-10.88	-52.58	<=-30.88	PASS

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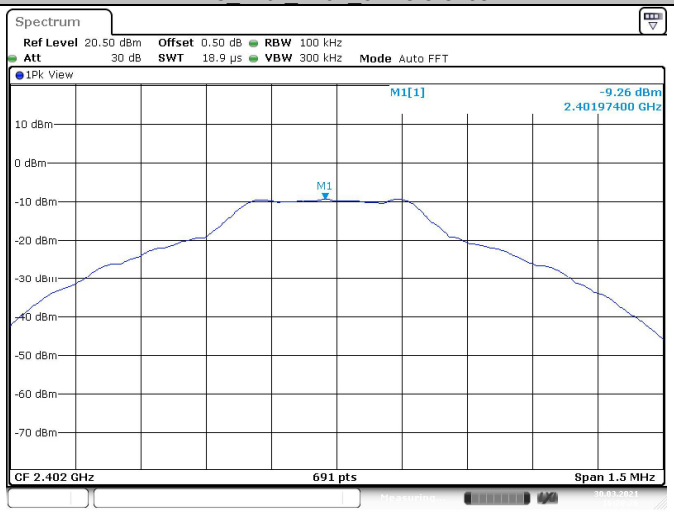
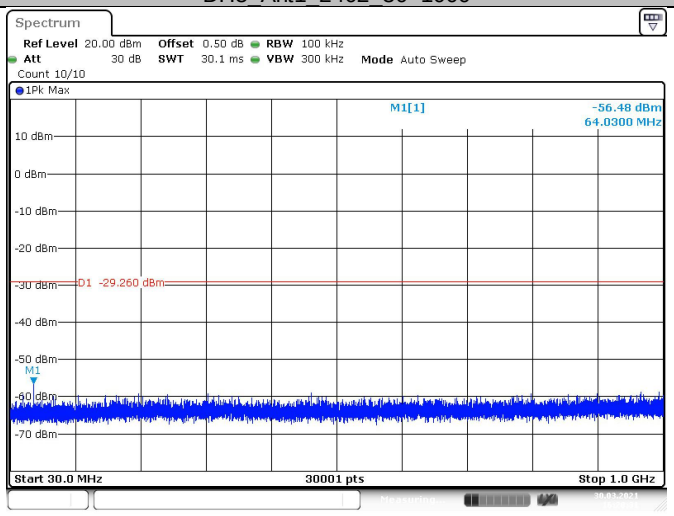
Test Graphs

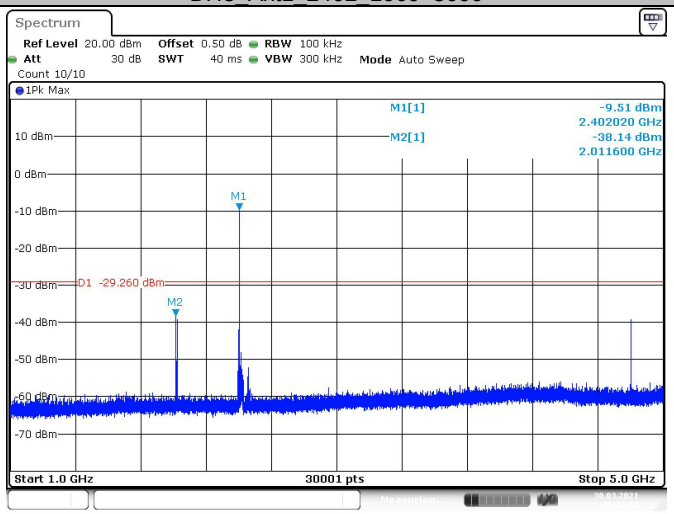
DH5_Ant1_2402_0~Reference



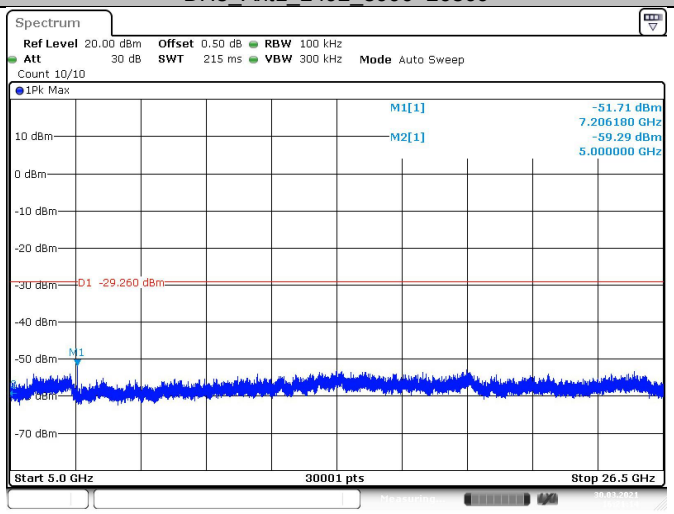
DH5_Ant1_2402_30~1000



DH5_Ant1_2402_1000~5000



DH5_Ant1_2402_5000~26500



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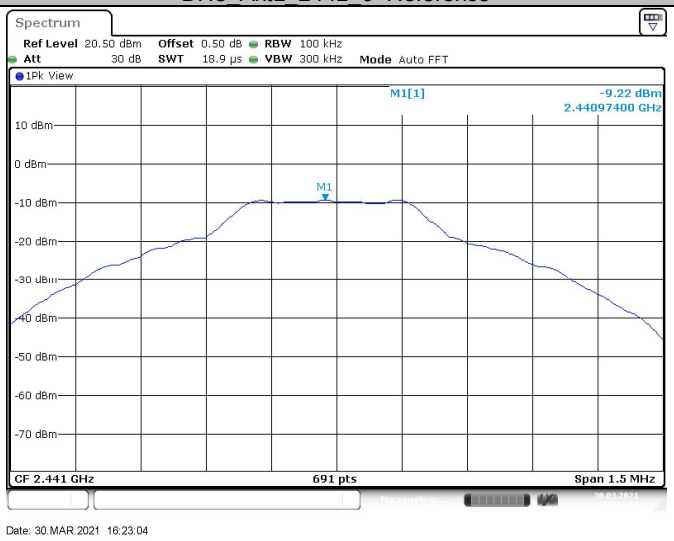
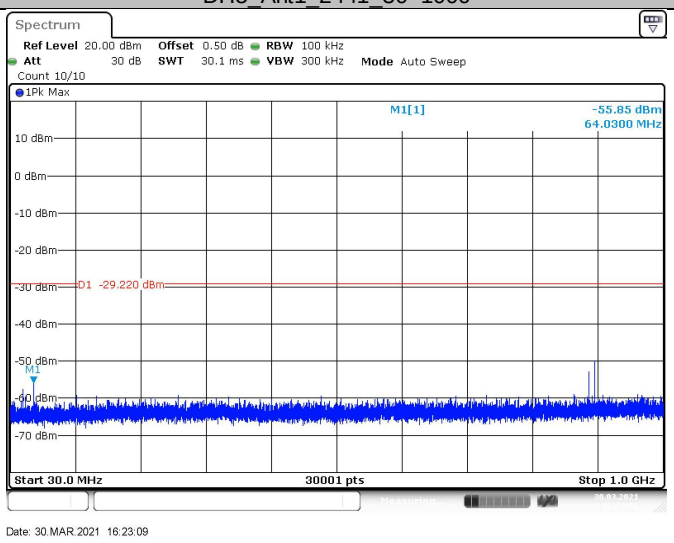
DH5_Ant1_2441_0~Reference

DH5_Ant1_2441_30~1000


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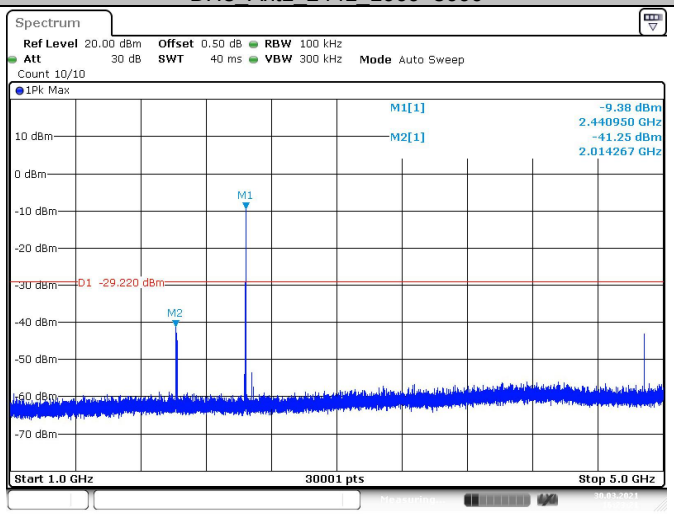
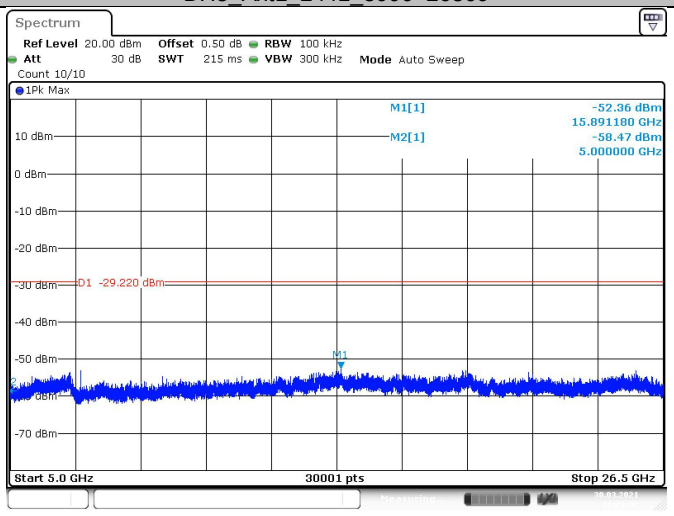
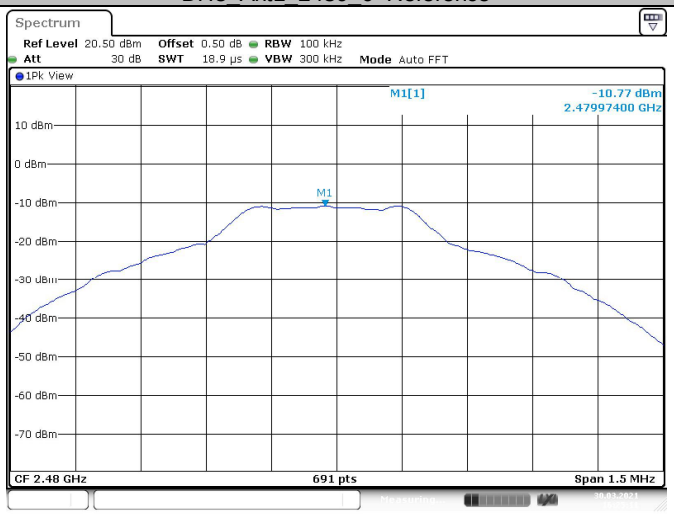
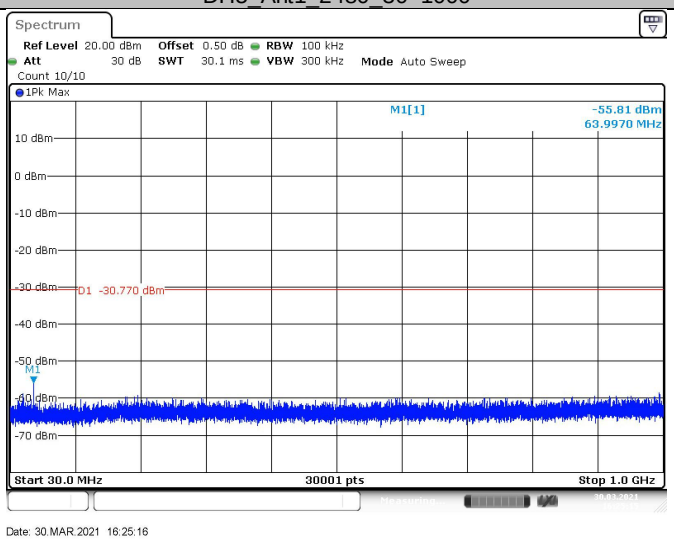
DH5_Ant1_2441_1000~5000



DH5_Ant1_2441_5000~26500



DH5_Ant1_2480_0~Reference

DH5_Ant1_2480_30~1000


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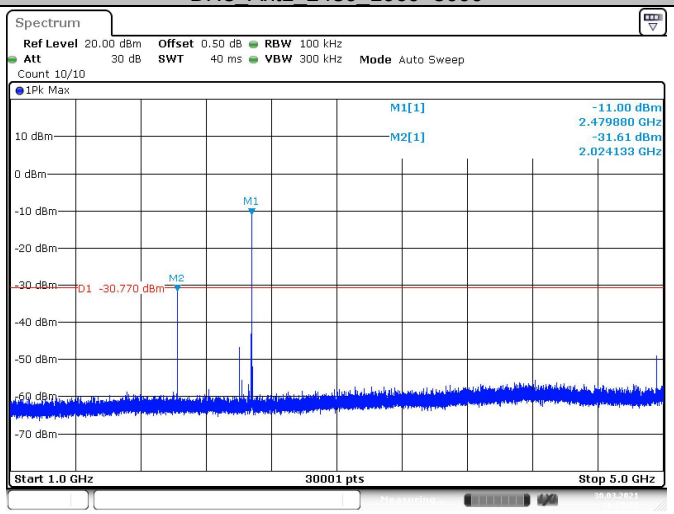
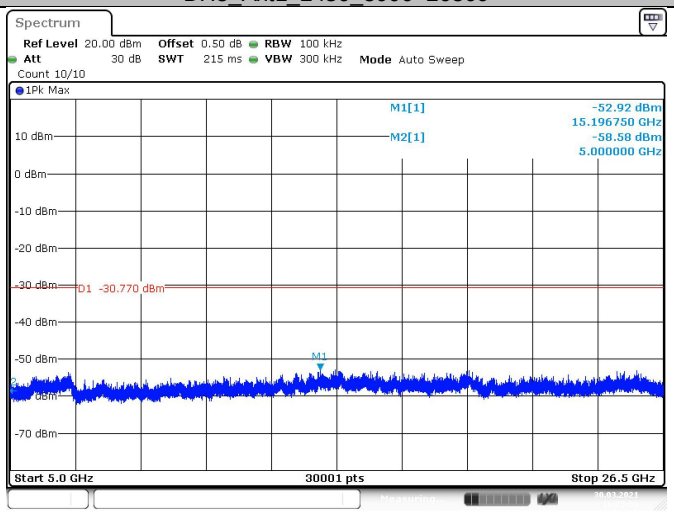
DH5_Ant1_2480_1000~5000



DH5_Ant1_2480_5000~26500



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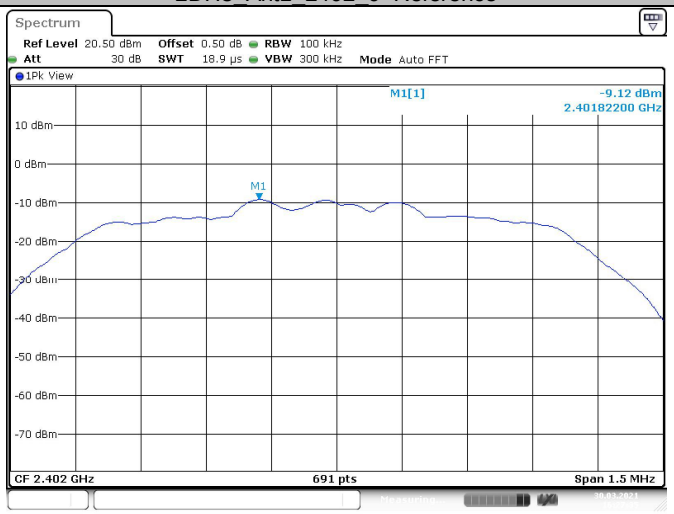
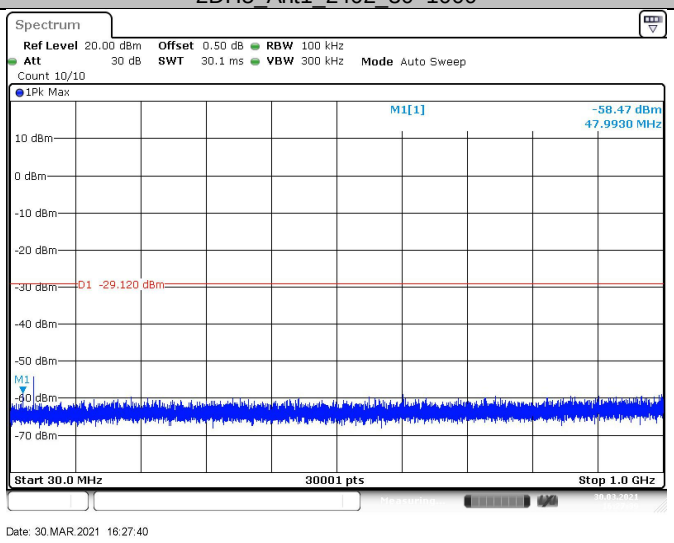
2DH5_Ant1_2402_0~Reference

2DH5_Ant1_2402_30~1000


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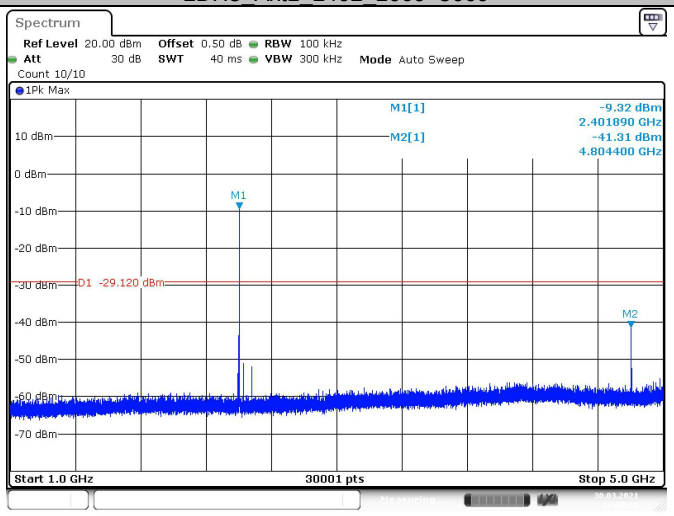
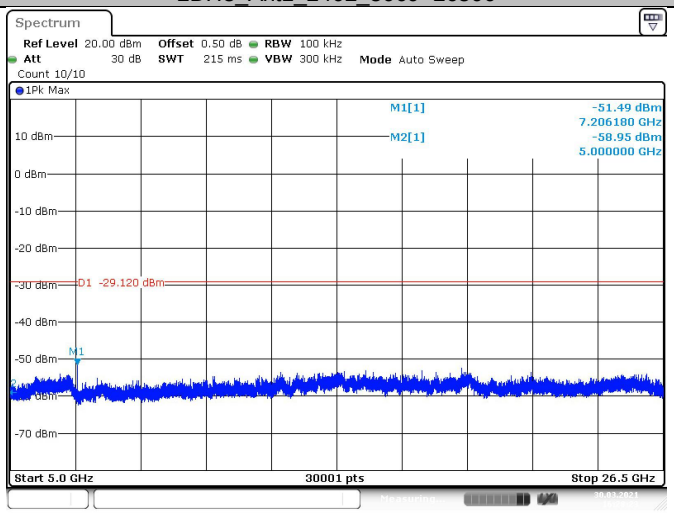
2DH5_Ant1_2402_1000~5000



2DH5_Ant1_2402_5000~26500



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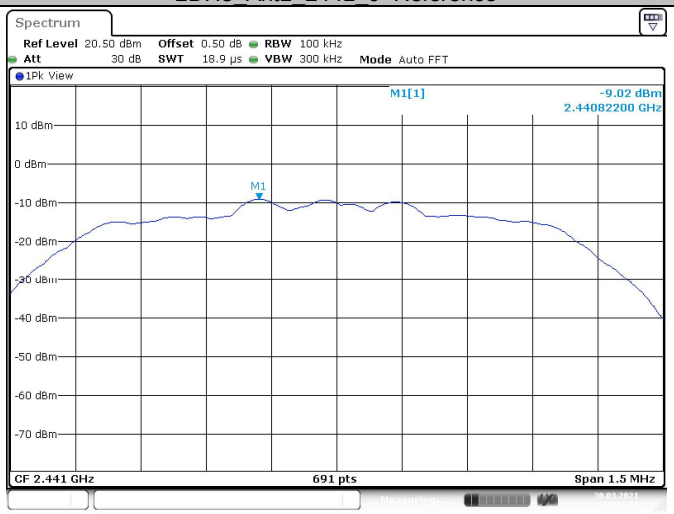
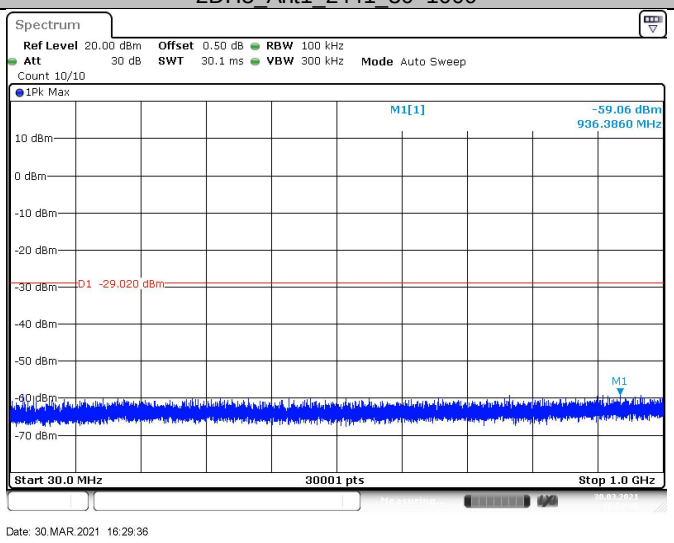
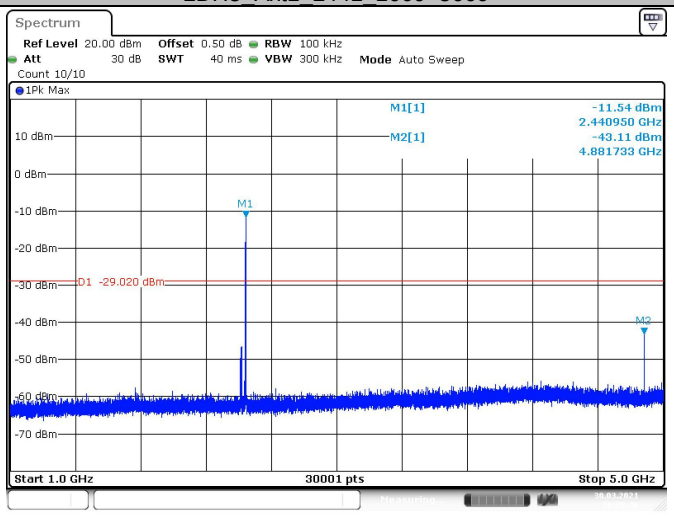
2DH5_Ant1_2441_0~Reference


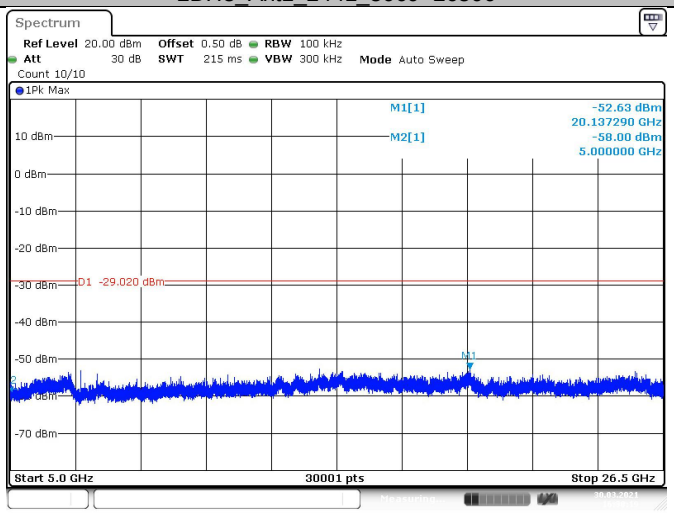
2DH5_Ant1_2441_30~1000


China

2DH5_Ant1_2441_1000~5000



2DH5_Ant1_2441_5000~26500



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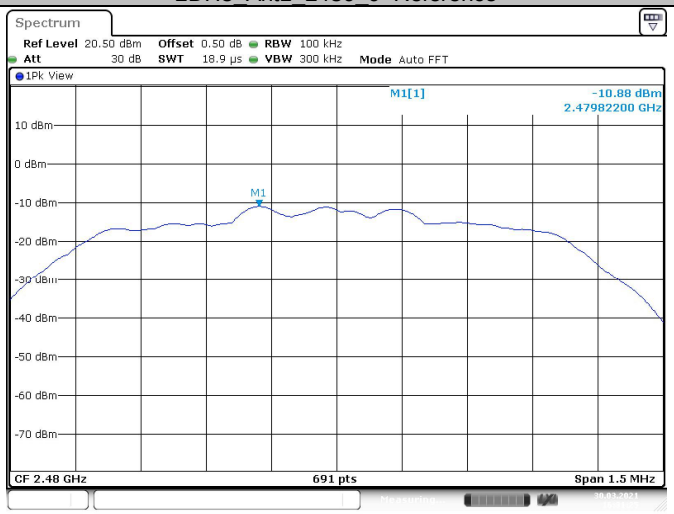
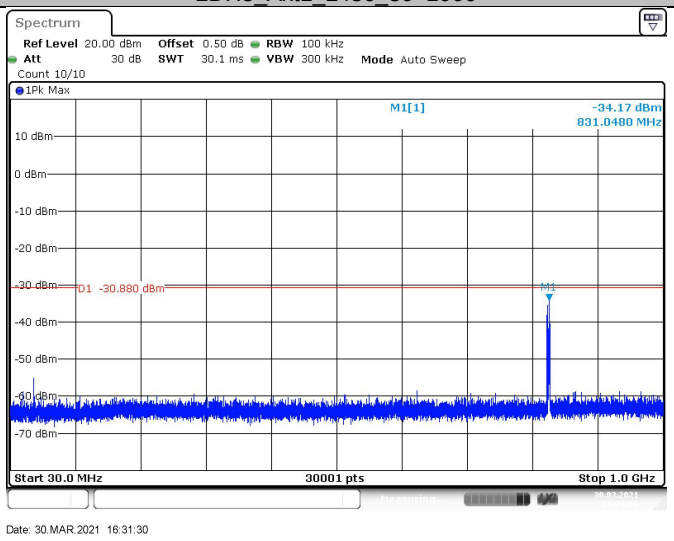
2DH5_Ant1_2480_0~Reference



2DH5_Ant1_2480_30~1000



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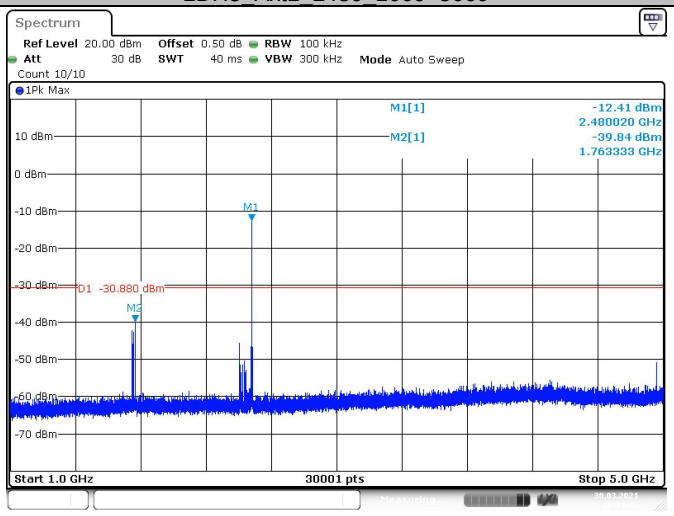
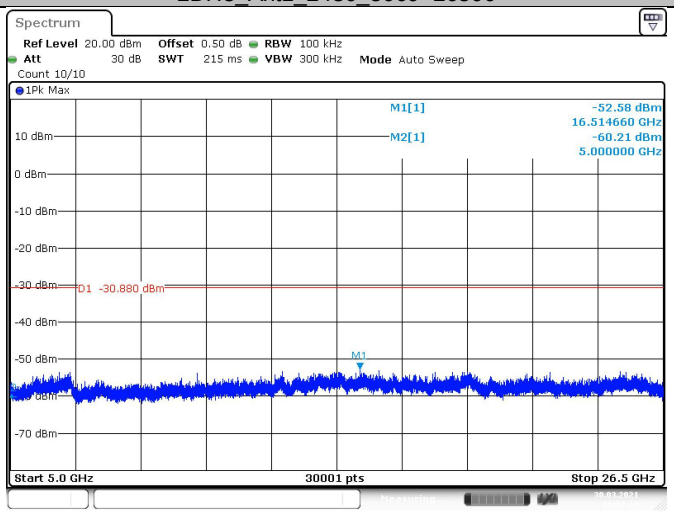
2DH5_Ant1_2480_1000~5000



2DH5_Ant1_2480_5000~26500



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9.8 Band edge testing

Test Method

1 Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
3 The level displayed must comply with the limit specified in this Section.
4 Repeat the test at the hopping off and hopping on mode, submit all the plots.

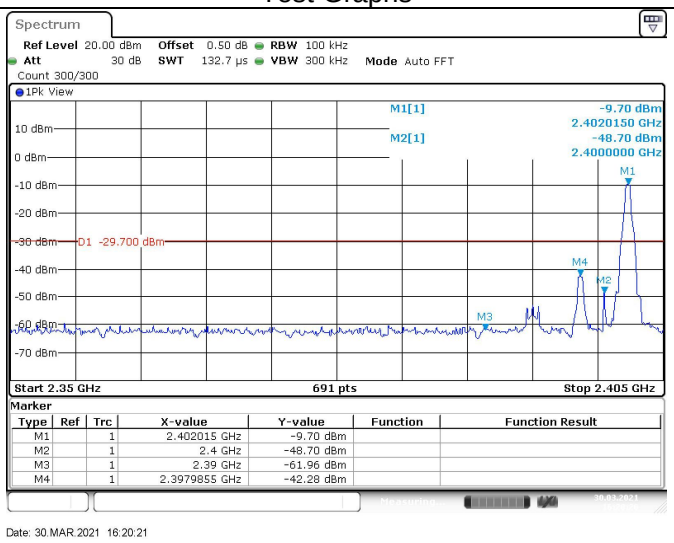
Limit:

In any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in 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) (see Section 15.205(c)).

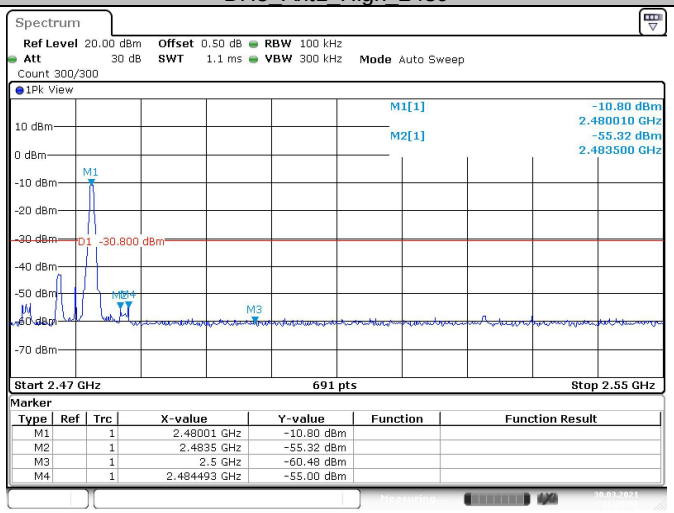
Test Result

TestMode	Antenna	ChName	Channel	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	Low	2402	-9.70	-42.28	<=-29.7	PASS
		High	2480	-10.80	-55	<=-30.8	PASS
		Low	Hop_2402	-9.67	-59.6	<=-29.67	PASS
		High	Hop_2480	-5.72	-55.08	<=-25.72	PASS
2DH5	Ant1	Low	2402	-9.85	-42.76	<=-29.85	PASS
		High	2480	-11.07	-57.03	<=-31.07	PASS
		Low	Hop_2402	-12.06	-60.3	<=-32.06	PASS
		High	Hop_2480	-5.92	-57.27	<=-25.92	PASS

Test Graphs

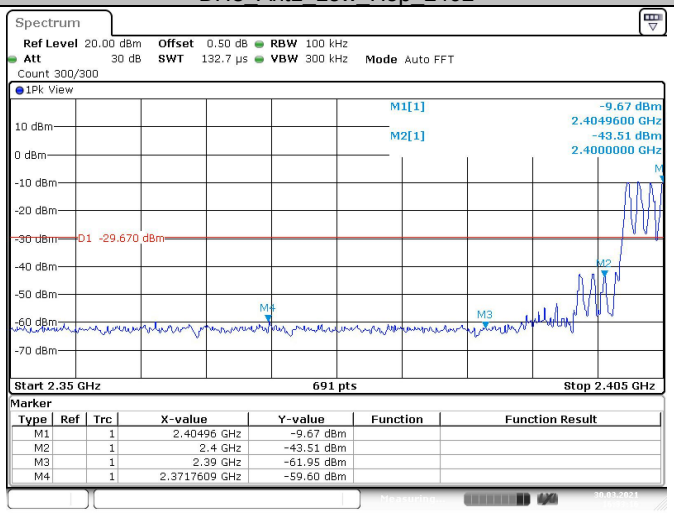


DH5_Ant1_High_2480



Date: 30.MAR.2021 16:25:06

DH5_Ant1_Low_Hop_2402



Date: 30.MAR.2021 16:33:16

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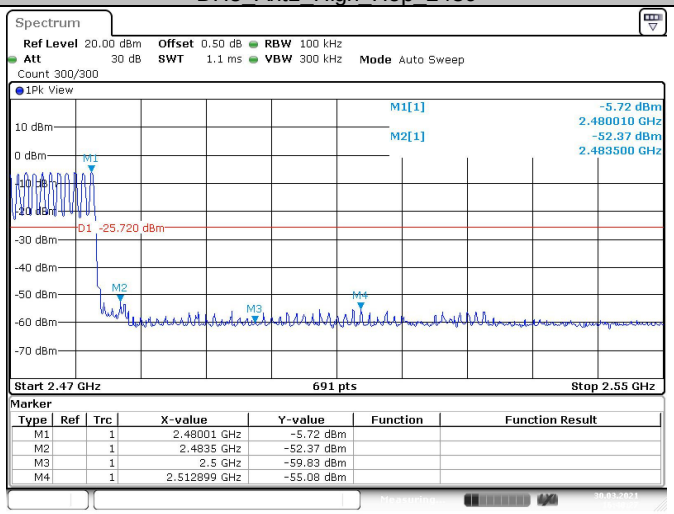
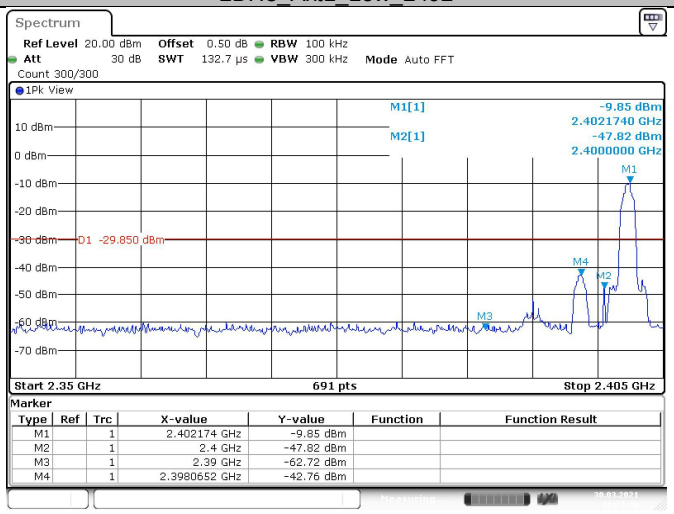
DH5_Ant1_High_Hop_2480



Date: 30.MAR.2021 16:40:27

2DH5_Ant1_Low_2402



Date: 30.MAR.2021 16:27:30

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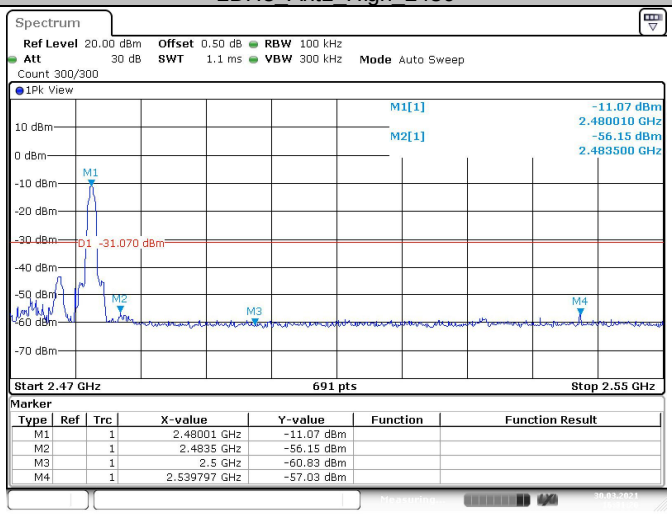
2DH5_Ant1_High_2480

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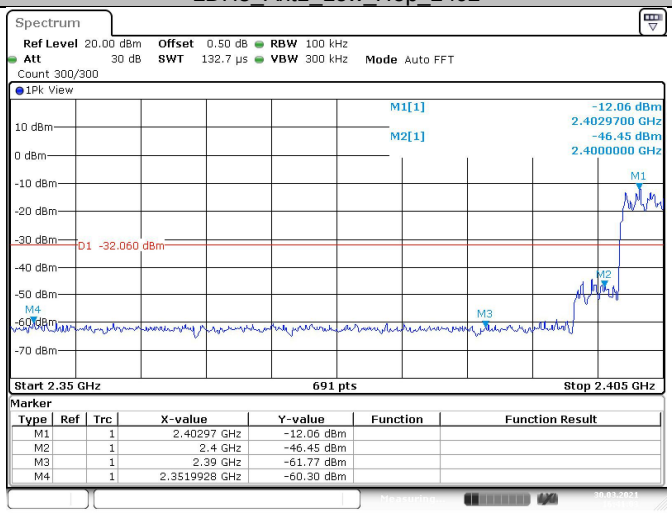

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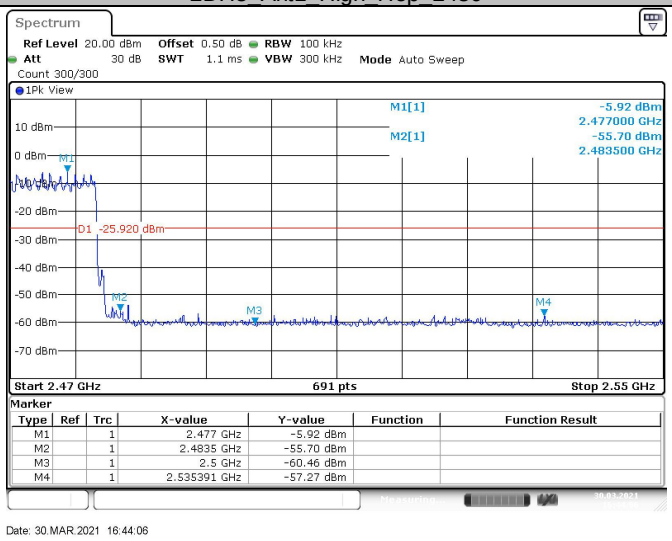

9.9 Spurious radiated emissions for transmitter and receiver

Test Method

1. The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. Use the following spectrum analyzer settings According to C63.10:

For Below 1GHz

Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz to 120 kHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Peak unwanted emissions Above 1GHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 1MHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz

a) RBW = 1MHz.
b) VBW ≥ [3 × RBW].
c) Detector = RMS (power averaging), if [span / (# of points in sweep)] ≤ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)
e) Sweep time = auto.
f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)
g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
1) If power averaging (rms) mode was used in the preceding step e), then the correction

factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.
2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.
3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

Limit

The radio emission outside the operating frequency band 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. Radiated emissions which fall in the restricted bands, as defined in section15.205, must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Measured Distance Meters
0.009~0.490	2400/F (kHz)	300
0.490~1.705	24000/F (kHz)	30
1.705~30	30	30

Frequency MHz	Field Strength uV/m	Field Strength dBµV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

Spurious radiated emissions for transmitter and receiver

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

The only worse case (which is subject to the maximum EIRP, π/4DQPSK mode) test result is listed in the report.

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30-1000MHz Radiated Emission

EUT Information

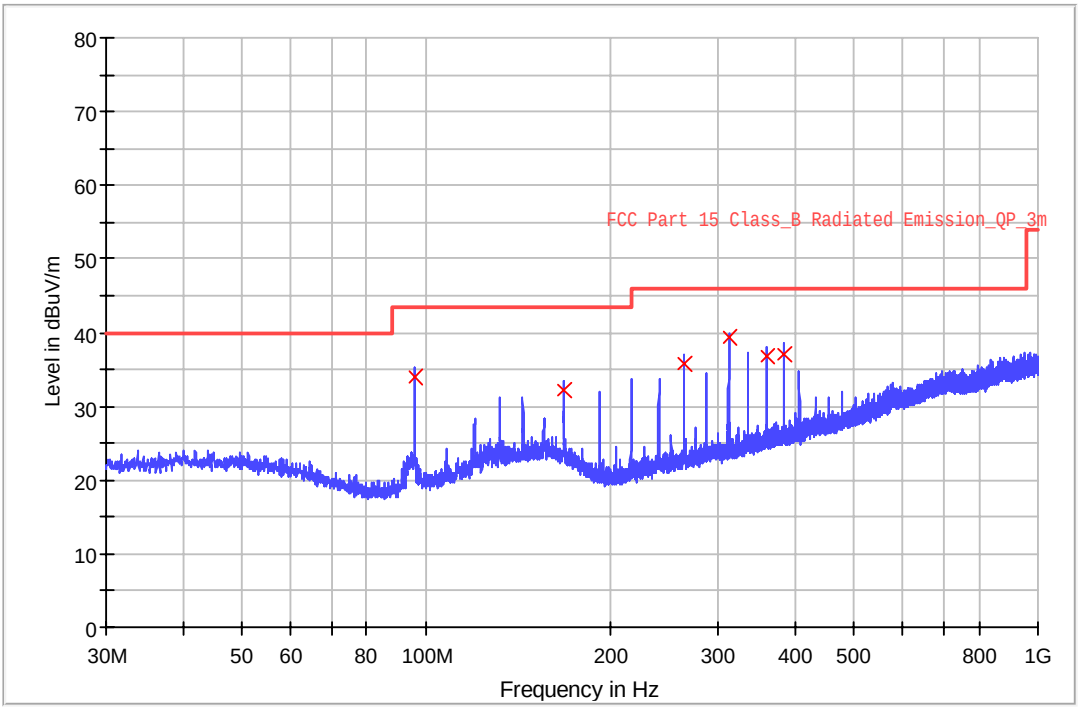
EUT Name:	Swiss Tech Kernstuck Bluetooth Speaker Lantern
Model:	30798
Client:	Hangzhou Great Star Industrial Co., Ltd.
Op Cond:	2441MHz Tx, π/4DQPSK 2DH5, 5VDC by USB, T20.1, H51.1%, P103.1kPa
Operator:	Wenqiang LU
Test Spec:	FCC Part 15
Comment:	Horizontal
Sample No:	SHA-548291-2

Sweep Setup: RE_VULB9168_pre_Cont_30-1000 [EMI radiated]

Hardware Setup:	RE_VULB9168
Receiver:	[ESR 3]
Level Unit:	dBuV/m

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	48.5 kHz	PK+	120 kHz	0.005 s	20 dB

RE_VULB9168_pre_Cont_30-1000



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
95.960000	33.9	1000.0	120.000	100.4	H	172.0	11.0	9.6	43.5
168.040000	32.2	1000.0	120.000	100.4	H	89.0	14.9	11.3	43.5
264.080000	35.7	1000.0	120.000	100.4	H	239.0	13.9	10.3	46.0
312.040000	39.3	1000.0	120.000	100.4	H	119.0	15.3	6.8	46.0
360.000000	36.8	1000.0	120.000	100.4	H	53.0	16.5	9.2	46.0
384.000000	37.1	1000.0	120.000	100.4	H	332.0	17.0	8.9	46.0

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30-1000MHz Radiated Emission

EUT Information

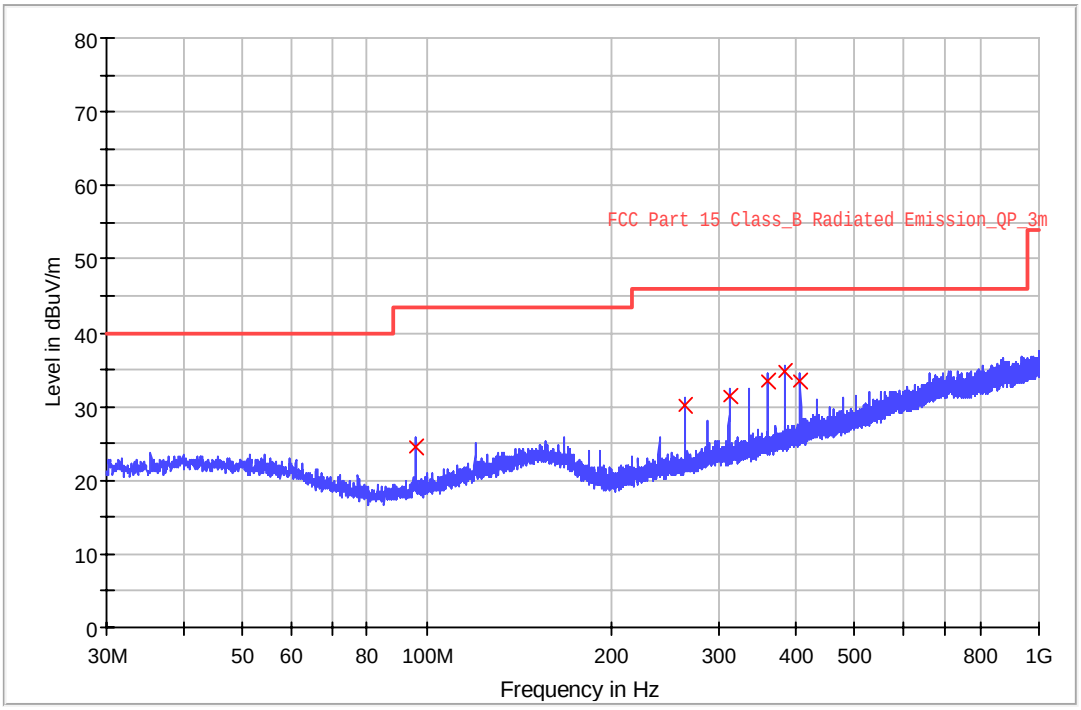
EUT Name:	Swiss Tech Kernstuck Bluetooth Speaker Lantern
Model:	30798
Client:	Hangzhou Great Star Industrial Co., Ltd.
Op Cond:	2441MHz Tx, π/4DQPSK 2DH5, 5VDC by USB, T20.1, H51.1%,
Operator:	Wenqiang LU
Test Spec:	FCC Part 15
Comment:	Vertical
Sample No:	SHA-548291-2

Sweep Setup: RE_VULB9168_pre_Cont_30-1000 [EMI radiated]

Hardware Setup:	RE_VULB9168
Receiver:	[ESR 3]
Level Unit:	dBuV/m

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	48.5 kHz	PK+	120 kHz	0.005 s	20 dB

RE_VULB9168_pre_Cont_30-1000



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
96.040000	24.6	1000.0	120.000	100.4	V	312.0	11.0	18.9	43.5
264.080000	30.1	1000.0	120.000	100.4	V	260.0	13.9	15.9	46.0
312.080000	31.5	1000.0	120.000	100.4	V	177.0	15.3	14.6	46.0
360.040000	33.5	1000.0	120.000	100.4	V	89.0	16.5	12.5	46.0
384.040000	34.8	1000.0	120.000	100.4	V	108.0	17.0	11.2	46.0
408.120000	33.6	1000.0	120.000	100.4	V	359.0	17.5	12.4	46.0

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Transmitting spurious emission test result as below:

Bluetooth Mode π/4DQPSK Modulation 2402MHz Test Result

Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
MHz	dBuV/m		dBµV/m		dBuV/m	
2385.7*	44.07	H	74.0	PK	29.93	Pass
4803.4*	48.78	H	74.0	PK	25.22	Pass
7206.1	45.81	H	74.0	PK	28.19	Pass
2386.8*	43.03	V	74.0	PK	30.97	Pass
4804.0*	51.15	V	74.0	PK	22.85	Pass

Bluetooth Mode π/4DQPSK Modulation 2441MHz Test Result

Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
MHz	dBuV/m		dBµV/m		dBuV/m	
4881.6*	50.98	H	74.0	PK	23.02	Pass
4881.6*	53.05	H	74.0	PK	20.95	Pass
4881.6*	51.7	H	54.0	AV	2.3	Pass

Bluetooth Mode π/4DQPSK Modulation 2480MHz Test Result

Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
MHz	dBuV/m		dBµV/m		dBuV/m	
2483.5*	45.94	H	74.0	PK	28.06	Pass
4960.4*	47.64	H	74.0	PK	26.36	Pass
2483.6*	46.71	V	74.0	PK	27.29	Pass
4959.8*	49.35	V	74.0	PK	24.65	Pass

Remark:

(1) Data of measurement within this frequency range shown "--" in the table above means the reading of emissions are the noise floor or attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(2) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.

(3) Emission Level = Reading level +Correction Factor
Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Pre-amplifier
Below 1GHz: Corrector factor = Antenna Factor + Cable Loss
(The Reading Level is recorded by software which is not shown in the sheet)

Note 1: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

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10 Test Equipment List

List of Test Instruments

Test Site1

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DATE	CAL. DUE DATE
C	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2020-8-4	2021-8-3
RE	EMI Test Receiver	Rohde & Schwarz	ESR3	101906	2020-8-4	2021-8-3
	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2020-8-4	2021-8-3
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9168	961	2019-3-16	2022-3-15
	Horn Antenna	Rohde & Schwarz	HF907	102393	2018-6-11	2021-4-1
	Pre-amplifier	Rohde & Schwarz	SCU-18D	19006451	2020-8-4	2021-8-3
	Loop antenna	Rohde & Schwarz	HFH2-Z2	100443	2020-6-28	2021-6-27
	DOUBLE-RIDGED WAVEGUIDE HORN WITH PRE-AMPLIFIER (18 GHZ - 40 GHZ)	ETS-Lindgren	3116C-PA	002222727	2021-1-27	2024-1-26
	3m Semi-anechoic chamber	TDK	9X6X6	----	2018-5-11	2021-5-10

Measurement Software Information			
Test Item	Software	Manufacturer	Version
RE	EMC 32	Rohde & Schwarz	V9.15.00

C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth
- 20dB bandwidth and 99% Occupied Bandwidth
- Carrier frequency separation
- Number of hopping frequencies
- Dwell Time
- Power spectral density*
- Spurious RF conducted emissions
- Band edge

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11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

Items	Extended Uncertainty
Conducted Disturbance at Mains Terminals	150kHz to 30MHz, LISN, ±3.16dB
Radiated Disturbance	30MHz to 1GHz, ±5.03dB (Horizontal) ±5.12dB (Vertical) 1GHz to 18GHz, ±5.49dB 18GHz to 25GHz, ±5.63dB
Carrier power conducted measurement	50MHz~18GHz, ±1.238dB
Spurious Emission Conducted Measurement	9kHz ~40GHz, ± 1.224dB

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12 Photographs of Test Set-ups

Refer to the < Test Setup photos >.

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13 Photographs of EUT

Refer to the < External Photos > & < Internal Photos >.

THE END

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