



CMA Testing and Certification Laboratories

廠商會檢定中心

TEST REPORT

Report No. : AW0069050(9) Date : Dec 12, 2018

Application No. : LW030449(9)

Applicant : Kondor Limited
Radar Way
Christchurch Business Park
Christchurch, BH23, 4FL
United Kingdom

Sample Description :	Sample Description	Model No.
	KitSound FreePlay	KSFRPL

Date Received : Sep 27, 2018

Test Period : Oct 5, 2018 – Nov 28, 2018

Test Requested : FCC Certification for FCC Part 15, subpart C
ISED Certification for License-exempt Device


Test Method : 47 CFR Part 15 (10-1-17 Edition),
ANSI C63.10 – 2013,
ANSI C63.4 – 2014
RSS-247 Issue 2,
RSS-Gen Issue 5,

Test Engineer : Mr. Leung Shu Kan, Ken

Conclusion : The submitted sample was found to comply with technical requirement of FCC Part 15 Subpart C, section 15.247, and ISED Canada Radio Standards Specification RSS-247 Issue 2.

For and on behalf of
CMA Industrial Development Foundation Limited

Authorized Signature : _____


Mr. WONG Lap-pong, Andrew
Manager
Electrical Division

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RESULT SUMMARY

Test Item	FCC Requirement	RSS Requirement	Test Method	Result
Number of hopping frequency	§15.247(a)(1)(iii)	RSS-247 §5.1(d)	ANSI C63.10 §7.8.3	PASS
Band-edge	§15.247(d)	RSS-247 §5.5	ANSI C63.10 §7.8.6 and 6.10	PASS
Carrier frequency separation	§15.247(a)	RSS-247 §5.1(b)	ANSI C63.10 §7.8.2	PASS
Time of occupancy (dwell time)	§15.247(a)	RSS-247 §5.1(b)	ANSI C63.10 §7.8.4	PASS
Output power	§15.247(b)(1)	RSS-247 §5.4	ANSI C63.10 §7.8.5	PASS
Occupied bandwidth	§15.247(a)	RSS-247 §5.1(a)	ANSI C63.10 §7.8.7 and 6.9.2	PASS
Conducted spurious emission (Transmitter)	§15.247(d)	RSS-247 §5.5	ANSI C63.10 §5.5, 5.6, 7.8.8, and 11.12.2.1	PASS
Radiated spurious emission (Transmitter)	§15.247(d)	RSS-247 §5.5	ANSI C63.10 §6.4 – 6.6	PASS
Radiated spurious emission (Receiver)	§15.109(a)	RSS-Gen, §7.0	ANSI C63.4 §8.3	PASS
Conducted emission on AC mains	§15.207(a)	RSS-Gen, §8.8	ANSI C63.4 §7.3	N/A
Frequency Stability	N/A	RSS-Gen §8.11	ANSI C63.10 §6.8 and RSS-Gen §6.11	PASS
Frequency Hopping System Requirement	§15.247(a)(1), (g), (h)	RSS-247 §5.1	N/A	PASS

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1 Product Information

1.1 General Information

Product Description:	Model:
KitSound FreePlay	KSFRPL

Primary function : Receive the audio signal from player by Bluetooth communication, provide USB charging, handfree/voice recognition (Alexa) function.

Power supply : DC 12V

RF related function : Bluetooth communication for audio communication

Electric Accessories sold with : NIL

Interconnection cable associated sold with : NIL

Operating condition : Not specified

Model difference : Not applicable

Remark : NIL

1.2 Technical Information

Operating Frequency : 2402 – 2480MHz

Digital Modulation : FHSS

Modulation : GFSK, $\pi/4$ QDPSK, 8DPSK

Number of Channel : 79

Channel Bandwidth : 1MHz

Occupied Bandwidth : 1.20MHz

Signal Type : Data

Number of Antenna : One

Antenna Type : PCB Type Antenna

Antenna Gain : 1.0 dBi

Rated Input Voltage : DC 12V

RF Technology Used : Bluetooth 4.2+EDR (non BLE)

Simplex or Duplex : Half-duplex

Adaptivity : FHSS adaptivity

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1.3 Associated Electric Accessories Information

NIL

1.4 Associated Cables

NIL

2.0 Equipment Units Tested (EUT)

Product Description : KitSound FreePlay
Model : KSFRPL
Serial No. : Not specified
Sample Type : Production Sample and engineering sample
Sample No. : RW035236-004(1)
Rationale of selection : Only one model number

3.0 Location of Test Facility

CMA Industrial Development Foundation Ltd.
Room 1302, Yan Hing Centre,
9-13 Wong Chuk Yeung,
Fo Tan, Shatin,
New Territories
Hong Kong.

FCC Accredited Lab (Designation Number: HK0004)
ISED Wireless Test Site (ISED Assigned Code: 4093A)

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4.0 List of test equipment, supporting equipment and cables

4.1 Test equipment

Equipment	Manufacturer	Model No.	Serial No.	Calibration Due Date	Calibration Period
EMI Test Receiver	Rohde & Schwarz	ESCS30	100001	01 Feb 2019	1Year
EMI Test Receiver	Rohde & Schwarz	ESCI	100152	06 Dec 2019	1Year
Spectrum Analyzer	R&S	FSV40	100964	08 Feb 2019	1Year
Spectrum Analyzer	Rohde & Schwarz	FSP30	100628	27 Mar 2019	1Year
Broadband Antenna	Schaffner	CBL6112B	2692	28 Mar 2019	2Years
Loop Antenna	EMCO	6502	00056620	25 Jan 2020	2Years
Horn Antenna	Schwarzbeck	BBHA 9120D	9120D-531	21 Dec 2018	2Years
Broadband Pre-Amplifier	Schwarzbeck	BBV 9718	9718-119	21 Dec 2018	2Years
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170442	01 Aug 2020	2Years
Broadband Pre-Amplifier	Schwarzbeck	BBV 9719	9719-010	01 Aug 2020	2Years
Coaxial Cable	Schaffner	RG 213/U	N/A	17 May 2019	1Year
Coaxial Cable	Suhner	RG 214/U	N/A	17 May 2019	1Year
Coaxial Cable	Suhner	Sucoflex_104	N/A	21 Dec 2018	1Year
LISN	Rohde & Schwarz	ENV216	101323	16 Jan 2019	1Year
Coaxial Cable	Tyco Electronics	RG 58C/U	N/A	23 Oct 2019	1Year
Rohde & Schwarz TS8997 Testing System					
Spectrum Analyzer	Rohde & Schwarz	FSV 40	101190	08 Aug 2019	1Year
Vector Generator	Rohde & Schwarz	SMBV100A	262024	08 Aug 2019	1Year
Generator	Rohde & Schwarz	SMB100A	103230	08 Aug 2019	1Year
OSP	Rohde & Schwarz	OSP	OSP120 V02	08 Aug 2019	1Year

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4.2 Supporting equipment

Equipment Name	Manufacturer	Model	Serial	Provided by
USB-UART serial adaptor*	Not labelled	FT232	Not labelled	Applicant

Remark: *only used for configure engineering mode

4.3 Cables

Cable Type	Length	Shielding	Ferrite used	Provided by
USB Cable*	1m	Not shielded	No	CMA

Remark: *only used for configure engineering mode

4.4 Software

Software Name	Version	Function	Provided by
Bluetooth MP Tools*	V1.08	Configure Engineering mode	Applicant

Remark: *only used for configure engineering mode

5.0 Measurement Uncertainty

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%.

Radiated emissions

Frequency	Uncertainty (U_{lab})
30MHz ~ 200MHz (Horizontal)	4.59dB
30MHz ~ 200MHz (Vertical)	4.49dB
200MHz ~1000MHz (Horizontal)	4.94dB
200MHz ~1000MHz (Vertical)	4.97dB
1GHz ~6GHz	4.52dB
6GHz ~18GHz	4.58dB

Line-conducted emissions

Frequency	Uncertainty (U_{lab})
150kHz~30MHz	2.80dB

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6.0 Measurement

6.1 General Test condition

Temperature : 23.6 °C
 Test Voltage : DC 12V
 Humidity : 52.3%
 Atmosphere Pressure : 101.0kPa

6.2 Number of hopping frequency

6.2.1 Measurement

Requirement : FCC Part 15 § 15.247(a)(1)(iii) and RSS-247 §5.1(d)
 Measuring procedure : ANSI C63.10:2013, clause 7.8.3
 Span : 83.5MHz
 RBW : 300kHz
 VBW : 300kHz
 Frequency range : 2.4000 – 2.4835GHz
 Modulation tested : GFSK
 Packet Type tested : DH5
 Additional measuring procedure : Nil

6.2.2 Final Result

No. of hopping channels measured	Limit	Result	Worst case mode
79	≥ 15	PASS	GFSK and DH5

Remark: Detail test result and equipment setting refer to appendix A, A3

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6.3 Band-edge measurement

6.3.1 Measurement

Requirement : FCC Part 15 §15.247(d) and RSS-247 §5.5
Measuring procedure : ANSI C63.10:2013, section 7.8.6 and 6.10
Hopping mode : Enabled and Disable
RBW : 100kHz
VBW : 300kHz
Frequency range : 2310 – 2400MHz and 2483.5 – 2500MHz
Modulation tested : GFSK, $\pi/4$ QDPSK, 8DPSK
Packet Type tested : DH5
Channel tested for non-hopping mode : 2402MHz for lowed band edge and 2480MHz for higher band edge
Additional measuring procedure : For lower band edge (2400MHz)

1. Using the “Measurement 1” setting shown below the scan plot within the frequency span from 2400 – 2483.5MHz to measure the maximum peak value of fundamental
2. Using the “Measurement 2” setting shown below the scan plot within the frequency span from 2310 – 2400MHz to measure the bandedge reading
3. Compare that reading in procedure with the limit which equal to the measured maximum peak in procedure 1 minus 20dB

For Upper bandedge (2483.5MHz)

1. Using the “Measurement 1” setting shown below the scan plot within the frequency span from 2400 – 2483.5MHz to measure the maximum peak value of fundamental
2. Using the “Measurement 2” setting shown below the scan plot within the frequency span from 2483.5 – 2500MHz to measure the bandedge reading
3. Compare that reading in procedure with the limit which equal to the measured maximum peak in procedure 1 minus 20dB

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6.3.2 Final Result

Banded frequency for lower bandedge (Worst Case)	Worst case (dBc) ²	Detector	Limit ¹ (dBc)	Result	Worst case
2399.725000MHz	43.9	Peak	≥20.0	PASS	GFSK and DH5
Bandedge frequency for higher bandedge (Worst Case)	Worst case in (dBc) ²	Detector	Limit ¹	Result	Worst case
2484.575000MHz	54.3	Peak	≥20.0	PASS	GFSK and DH5

Remark: 1) The limit is based on the transmitter demonstrated compliance with peak conducted power limit on section 6.4.2 of this report.

2) The Worst case dBc is the peak values measured in procedure 1 minus the worst case bandedge emission

3) Detail test result and equipment setting refer to appendix A, A4-7, A12-13, A16-17

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6.4 Carrier Frequency Separation

6.4.1 Measurement

Requirement : FCC Part 15 §15.247(a) and RSS-247 §5.1(b)
 Measuring procedure : ANSI C63.10:2013, section 7.8.2
 Hopping mode : Enabled
 RBW : 300kHz
 VBW : 300kHz
 Frequency range : 2401 – 2404MHz, 2440 – 2443MHz, 2478 – 2481MHz¹
 Modulation tested : GFSK²
 Packet Type tested : DH5
 Additional measuring procedure : Nil

Remark : 1) Since the measured value is more than 1.5 times of limit, only middle channel is measured.
 2) Since the modulation and packet type does not affect the channel separation, GFSK and DH5 are selected as represented modulation and data type

6.4.2 Final Result

Carrier Frequency Separation	Limit ¹	Result	Worst case mode
0.980198MHz	≥0.906867MHz	PASS	GFSK and DH5

Remark: 1) Limit is 2/3 of the 20dB bandwidth in section 6.7 and conducted peak power is less than 0.125W in section 6.6 of this report.

2) Detail test result and equipment setting refer to appendix A, A18-20

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6.5 Time of occupancy (dwell time)

6.5.1 Measurement

Requirement : FCC Part 15 §15.247(a) and RSS-247 §5.1(a)
 Measuring procedure : ANSI C63.10:2013, section 7.8.4
 Hopping mode : Disable
 RBW : 500kHz
 VBW : 1MHz
 Modulation tested : GFSK¹
 Packet Type tested : DH1, DH3, DH5
 Channel tested for non-hopping mode : 2441MHz
 Additional measuring procedure : 1) Setup engineering sample to channel 2441MHz and DH1 packet size to perform the measurement according to ANSI C63.10, section 7.8.4
 2) Find the worst case packet size
 3) Repeat procedure1 with the worst case packet size for channel 2402MHz and 2480MHz
 Remark : 1) Since the modulation does not affect the dwell time, GFSK is selected as represented modulation.

6.5.2 Final Result

Dwell time (worst case)	Limit	Result	Worst case mode
296.550ms	≤400ms	PASS	GFSK and DH5

Remark: 1) Detail test result and equipment setting refer to appendix A, A8-10

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6.6 Output Power

6.6.1 Measurement

Requirement : FCC Part 15 §15.247(b) (1) and RSS-247 §5.4
 Measuring procedure : ANSI C63.10:2013, section 7.8.5
 Hopping mode : Disable
 Modulation tested : GFSK, $\pi/4$ QPSK, 8DPSK
 Packet Type tested : DH5¹
 Channel tested for non-hopping mode : 2402MHz, 2441MHz, 2480MHz
 Additional measuring procedure : Nil
 Remark : 1) Since the packet size does not affect the output power, DH5 is selected as represented packet size.

6.6.2 Final Result

(a) Maximum peak conducted output power

Maximum peak conducted output power	Limit(s) ¹	Result	Modulation
0.8dBm	≤ 21.0 dBm	PASS	GFSK
0.8dBm	≤ 21.0 dBm	PASS	$\pi/4$ QPSK
0.8dBm	≤ 21.0 dBm	PASS	8DPSK

Remark: 1) 0.125W (21.0dBm) limit is used for 2/3 20dB bandwidth requirement for channel separation.

2) Detail test result and equipment setting refer to appendix A, A11, A14, A15

(b) Maximum peak e.i.r.p.(for RSS-247)

Maximum peak e.i.r.p. ¹	Limit(s) ²	Result	Modulation
1.8dBm	≤ 27.0 dBm	PASS	GFSK
1.8dBm	≤ 27.0 dBm	PASS	$\pi/4$ QPSK
1.8dBm	≤ 27.0 dBm	PASS	8DPSK

Remark: 1) Maximum peak e.i.r.p. = Maximum peak conducted output power + antenna gain (dBi)

2) Maximum peak e.i.r.p. limit = Maximum peak conducted output power limit + 6dBi

3) Detail test result and equipment setting refer to appendix A, A11, A14, A15

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6.7 Occupied Bandwidth

6.7.1 Measurement

Requirement : FCC Part 15 §15.247(a) and RSS-247 §5.1(a)
 Measuring procedure : ANSI C63.10:2013, section 7.8.7 and 6.9.2
 Hopping mode : Disable
 Modulation tested : GFSK, $\pi/4$ QPSK, 8DPSK
 Packet Type tested : DH5¹
 Channel tested for non-hopping mode : 2402MHz, 2441MHz, 2480MHz
 Additional measuring procedure : Nil
 Remark : 1) Since the packet size does not affect the bandwidth, DH5 is selected as represented packet size.

6.7.2 Final Result

20dB bandwidth	99% OBW	Modulation
1.0536MHz	0.9262MHz	GFSK
1.3603MHz	1.2012MHz	$\pi/4$ QPSK
1.3097MHz	1.1867MHz	8DPSK

Remark: 1) Detail test result and equipment setting refer to appendix A, A30 - 39

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6.8 Conducted Spurious emission (Transmitter)

6.8.1 Measurement

- Requirement : FCC Part 15 §15.247(d) and RSS-247 §5.5
- Measuring procedure : ANSI C63.10:2013, section 5.5, 5.6, 7.8.8 and 11.12.2.1
- Hopping mode : Disable
- RBW : Refer to pre-measurement and final measurement setting
- Detector : Refer to pre-measurement and final measurement setting
- Modulation tested : GFSK¹
- Packet Type tested : DH5²
- Channel tested for non-hopping mode : 2402MHz, 2441MHz, 2480MHz
- Additional measuring procedure :
 - 1) Setup engineering sample to channel 2402MHz to perform the measurement according to ANSI C63.10, section 7.8.8 with pre-measurement setting
 - 2) If the pre-measurement is over the limit, the final measurement is performed for the specific frequency according to final measurement setting or restricted band frequency
 - 3) For non-restricted band frequency, peak detector and 100kHz RBW will be used for final measurement.
 - 4) Repeat the procedure 1 to 3 for channel frequency of 2441MHz and 2480MHz
- Remark :
 - 1) Since the GFSK generates a higher SPD with power level, GFSK is selected as represented modulation for testing.
 - 2) Since DH5 generates a higher dwell time, DH5 is selected as representative packet size for testing

6.8.2 Final Result

Worst case spurious emission frequency	Worst case spurious emission power ¹	Limit ²	Margin	Result	Worst case mode
282.625MHz	-55.4dBm	-53.9dBm	-2.0dB	PASS	GFSK and DH5

- Remark: 1) Spurious emission power = measured conducted power + antenna gain(dBi) + ground reflection factor according to ANSI C63.10 section 11.12.2.2 for restricted band emission.
- 2) For restricted band emission, limit = restricted band field strength limit (dBuV/m) + 4.7dB – 104.8dB according to ANSI C63.10 section 11.12.2.2 For non-restricted band, limit = SPD/100kHz – 20dB.
- 3) Detail test result and equipment setting refer to appendix A, A21-29

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6.9 Radiated Spurious emission (Transmitter)

6.9.1 Measurement

The equipment under test (EUT) was placed on a non-conductive turntable with dimensions of 1.5m x 0.4m and 0.8m high above the ground for below 1GHz measurement and 1.5m high above the ground for above 1GHz measurement. 3m from the EUT, a broadband antenna mounting on the mast received the signal strength. The turntable was rotated to maximize the emission level. The antenna was then moving along the mast from 1m up to 4m until no more higher value was found. Both horizontal and vertical polarization of the antenna were placed and investigated.

For below 30MHz, a loop antenna with its vertical plane is placed 3m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. And the centre of the loop shall be 1 m above the ground.

For 30MHz to 300MHz, biconical antenna with its vertical and horizontal plane is placed 3m from the EUT and rotated about its vertical and horizontal axis for maximum response at each azimuth about the EUT. And the reference point of antenna shall be 1 m above the ground. Same procedure for frequency 300MHz to 1000MHz but Log-periodic antenna is used for final measurements.

For above 1GHz, horn antenna with its vertical and horizontal plane is placed 3m from the EUT and rotated about its vertical and horizontal axis for maximum response at each azimuth about the EUT. Preamplifier and High Pass filter was used for measurements. The reference point of antenna shall be 1 m above the ground.

The device was rotated through three X, Y, Z orthogonal to determine which attitude and configuration produce the highest emission during measurement for Radiated Emission measurement.

The Frequencies from fundamental up to the tenth harmonics were investigated, and emissions more 20dB below limit were not reported.

Bluetooth hopping + charging mode with GFSK modulation and DH5packet type are selected as worst case mode for spurious radiated emission test from cabinet. Other non-bluetooth operating mode such as charging mode and Aux-in mode for digital part of EUT may be tested.

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6.9.2 Final Result

a) Test mode: Bluetooth hopping

Polarization	Frequency (MHz)	Reading at 3m (dBμV)	Transducer Factor (dB/m)	Field Strength at 3m ¹ (dBμV/m)	Limit at 3m (dBμV/m)	Margin (dB)	Detector (PK/QP/AV)
V	2400.000	67.3	-4.7	62.6	74.0	-11.4	Peak
H	2400.000	57.2	-4.7	52.5	54.0	-1.5	Average
H	2483.500	61.0	-4.7	56.3	74.0	-17.7	Peak
H	2483.500	48.7	-4.7	44.0	54.0	-10.0	Average
V	4956.650	47.0	2.8	49.8	54.0	-4.2	Peak
V	7439.110	36.0	9.6	45.6	54.0	-8.4	Peak
H	9920.836	34.9	12.7	47.6	54.0	-6.4	Peak

Remark: 1) Field Strength = Reading + transducer factor.

2) Other emission with more than 20dB margin are not reported in this report.

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6.10 Radiated Spurious emission (Receiver and othe digital device)

6.10.1 Measurement

The equipment under test (EUT) was placed on a non-conductive turntable with dimensions of 1.5m x 0.4m and 0.8m high above the ground for below 1GHz measurement and 1.5m high above the ground for above 1GHz measurement. 3m from the EUT, a broadband antenna mounting on the mast received the signal strength. The turntable was rotated to maximize the emission level. The antenna was then moving along the mast from 1m up to 4m until no more higher value was found. Both horizontal and vertical polarization of the antenna were placed and investigated.

For below 30MHz, a loop antenna with its vertical plane is placed 3m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. And the centre of the loop shall be 1 m above the ground.

For 30MHz to 300MHz, biconical antenna with its vertical and horizontal plane is placed 3m from the EUT and rotated about its vertical and horizontal axis for maximum response at each azimuth about the EUT. And the reference point of antenna shall be 1 m above the ground. Same procedure for frequency 300MHz to 1000MHz but Log-periodic antenna is used for final measurements.

For above 1GHz, horn antenna with its vertical and horizontal plane is placed 3m from the EUT and rotated about its vertical and horizontal axis for maximum response at each azimuth about the EUT. Preamplifier and High Pass filter was used for measurements. The reference point of antenna shall be 1 m above the ground.

The device was rotated through three X, Y, Z orthogonal to determine which attitude and configuration produce the highest emission during measurement for Radiated Emission measurement.

The Frequencies from fundamental up to the tenth harmonics were investigated, and emissions more 20dB below limit were not reported.

Bluetooth receiving mode and Aux-in are selected for spurious radiated emission test from cabinet.

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6.10.2 Final Result

Test mode: Receiving mode

Polarization	Frequency (MHz)	Reading at 3m (dB μ V)	Transducer Factor (dB/m)	Field Strength at 3m ¹ (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)	Detector (PK/QP/AV)
H	1069.218	57.1	-9.8	47.3	54.0	-6.7	Peak
V	1094.024	53.4	-9.8	43.6	54.0	-10.4	Peak
H	1217.112	51.3	-8.2	43.1	54.0	-10.9	Peak
V	1241.388	49.4	-8.2	41.2	54.0	-12.8	Peak
H	1315.187	23.1	-7.8	15.3	54.0	-38.7	Peak
V	1462.502	45.7	-7.6	38.1	54.0	-15.9	Peak
H	1487.100	50.9	-7.6	43.3	54.0	-10.7	Peak
V	1708.694	47.6	-7.9	39.7	54.0	-14.3	Peak
H	1757.971	53.2	-7.9	45.3	54.0	-8.7	Peak
V	1880.513	47.6	-7.6	40.0	54.0	-14.0	Peak

Remark: 1) Field Strength = Reading + transducer factor.

2) Other emission with more than 20dB margin are not reported in this report.

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6.11 Conducted Emission

6.11.1 Measurement

Requirement	: FCC Part 15 §15.207(a) and RSS-Gen, clause 8.8
Measuring procedure	: ANSI C63.4:2014, section 7.3
Test mode	: Bluetooth Hopping, Aux-in
RBW	: 9kHz
VBW	: 30kHz
Modulation tested	: GFSK ¹
Packet Type tested	: DH5
Additional measuring procedure	: Nil
Remark	: Nil

6.11.2 Final Result

Not Applicable

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6.12 Frequency Stability

6.12.1 Measurement

Requirement : RSS-Gen, clause 8.11
 Measuring procedure : ANSI C63.4:2014, section 6.8 and RSS Gen clause 6.11
 Test mode : Non-hopping mode without modulation
 RBW : 500Hz
 VBW : 3kHz
 Modulation tested : GFSK
 Packet Type tested : DH5
 Additional measuring procedure : Nil
 Remark : Nil

6.11.2 Final Result

Test Temperature (°C)	Test Channel (MHz)	Measured Channel Frequency (MHz)	Frequency range of 80% of channel bandwidth	Result
20	2402.00000	2402.03180	2401.60000 – 2402.40000	PASS
20	2441.00000	2441.02890	2440.60000 – 2441.40000	PASS
20	2480.00000	2480.02890	2479.60000 – 2480.40000	PASS
-20	2402.00000	2402.00028	2401.60000 – 2402.40000	PASS
-20	2441.00000	2441.00026	2440.60000 – 2441.40000	PASS
-20	2480.00000	2480.00026	2479.60000 – 2480.40000	PASS
50	2402.00000	2402.00281	2401.60000 – 2402.40000	PASS
50	2441.00000	2441.00279	2440.60000 – 2441.40000	PASS
50	2480.00000	2480.00278	2479.60000 – 2480.40000	PASS

Remark: 1) Test Voltage: DC12V
 2) Channel Bandwidth: 1MHz

Test Voltage	Test Channel (MHz)	Measured Channel Frequency (MHz)	Frequency range of 80% of channel bandwidth	Result
DC 13.8V	2402.00000	2402.03180	2401.60000 – 2402.40000	PASS
DC 13.8V	2441.00000	2441.02891	2440.60000 – 2441.40000	PASS
DC 13.8V	2480.00000	2480.02890	2479.60000 – 2480.40000	PASS
DC 10.2V	2402.00000	2402.03180	2401.60000 – 2402.40000	PASS
DC 10.2V	2441.00000	2441.02890	2440.60000 – 2441.40000	PASS
DC 10.2V	2480.00000	2480.02890	2479.60000 – 2480.40000	PASS

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Remark: 1) Test temperature: 20°C
2) Channel Bandwidth: 1MHz

7.0 Frequency Hopping System Requirement

Test Requirement: Section 15.247(a)(1), (g), (h) and RSS-247, section 5.1 requirement

The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom order list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

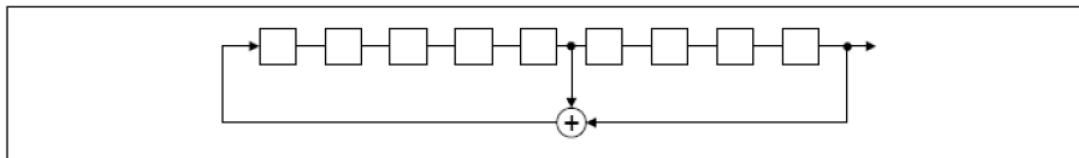
Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmissions bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hop sets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

Compliance for section 15.247(a)(1) and RSS-247 section 5.1(a)

According to Bluetooth Core Specification, the pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES; i.e. the shift register is initialized with nine ones.

- Number of shift register stage: 9
- Length of pseudorandom sequence: $2^9-1=511$ bits
- Longest sequence of zero: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

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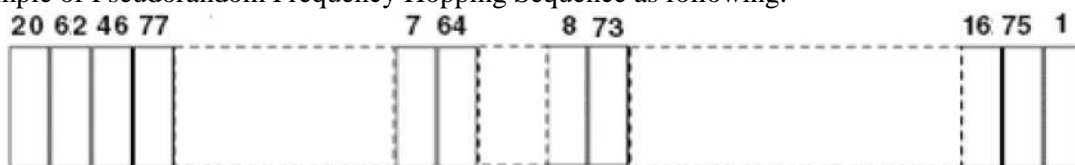
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An example of Pseudorandom Frequency Hopping Sequence as following:



Each frequency used equally on the average by each transmitter.

According to Bluetooth Core Specification, Bluetooth receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any Bluetooth transmitters and shift frequencies in synchronization with the transmitted signals.

Compliance for section 15.247(g) and RSS-247 section 5.1 2nd paragraph

According to Bluetooth Core Specification, the Bluetooth system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.

Compliance for section 15.247(h) and RSS-247 section 5.1 3rd paragraph

According to Bluetooth Core specification, the Bluetooth system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels.

According to the Bluetooth Core specification, the Bluetooth system is designed not have the ability to coordinate with other FHSS System in effort to avoid the simultaneous occupancy of the individual hopping frequencies by multiple transmitter.

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APPENDIX A Test Result

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FCC Part 47 §15.247 2400-2483.5 MHz 2016

DUT Information

Frequencies

BT CH 0 (2402 MHz)	BT CH 1 (2403 MHz)	BT CH 2 (2404 MHz)
BT CH 3 (2405 MHz)	BT CH 4 (2406 MHz)	BT CH 5 (2407 MHz)
BT CH 6 (2408 MHz)	BT CH 7 (2409 MHz)	BT CH 8 (2410 MHz)
BT CH 9 (2411 MHz)	BT CH 10 (2412 MHz)	BT CH 11 (2413 MHz)
BT CH 12 (2414 MHz)	BT CH 13 (2415 MHz)	BT CH 14 (2416 MHz)
BT CH 15 (2417 MHz)	BT CH 16 (2418 MHz)	BT CH 17 (2419 MHz)
BT CH 18 (2420 MHz)	BT CH 19 (2421 MHz)	BT CH 20 (2422 MHz)
BT CH 21 (2423 MHz)	BT CH 22 (2424 MHz)	BT CH 23 (2425 MHz)
BT CH 24 (2426 MHz)	BT CH 25 (2427 MHz)	BT CH 26 (2428 MHz)
BT CH 27 (2429 MHz)	BT CH 28 (2430 MHz)	BT CH 29 (2431 MHz)
BT CH 30 (2432 MHz)	BT CH 31 (2433 MHz)	BT CH 32 (2434 MHz)
BT CH 33 (2435 MHz)	BT CH 34 (2436 MHz)	BT CH 35 (2437 MHz)
BT CH 36 (2438 MHz)	BT CH 37 (2439 MHz)	BT CH 38 (2440 MHz)
BT CH 39 (2441 MHz)	BT CH 40 (2442 MHz)	BT CH 41 (2443 MHz)
BT CH 42 (2444 MHz)	BT CH 43 (2445 MHz)	BT CH 44 (2446 MHz)
BT CH 45 (2447 MHz)	BT CH 46 (2448 MHz)	BT CH 47 (2449 MHz)
BT CH 48 (2450 MHz)	BT CH 49 (2451 MHz)	BT CH 50 (2452 MHz)
BT CH 51 (2453 MHz)	BT CH 52 (2454 MHz)	BT CH 53 (2455 MHz)
BT CH 54 (2456 MHz)	BT CH 55 (2457 MHz)	BT CH 56 (2458 MHz)
BT CH 57 (2459 MHz)	BT CH 58 (2460 MHz)	BT CH 59 (2461 MHz)
BT CH 60 (2462 MHz)	BT CH 61 (2463 MHz)	BT CH 62 (2464 MHz)
BT CH 63 (2465 MHz)	BT CH 64 (2466 MHz)	BT CH 65 (2467 MHz)
BT CH 66 (2468 MHz)	BT CH 67 (2469 MHz)	BT CH 68 (2470 MHz)
BT CH 69 (2471 MHz)	BT CH 70 (2472 MHz)	BT CH 71 (2473 MHz)
BT CH 72 (2474 MHz)	BT CH 73 (2475 MHz)	BT CH 74 (2476 MHz)
BT CH 75 (2477 MHz)	BT CH 76 (2478 MHz)	BT CH 77 (2479 MHz)
BT CH 78 (2480 MHz)		

Hardware Setup: WMS Measurements\TS8997

Spectrum Analyzer:	SA FSV 40 (SA FSV 40) @ VISA (ADR TCPIP::192.168.48.148::inst0::instr), SN 1321.3008K39/101190, FW 2.30 SP4
Vector Generator:	VG SMBV100A (VG SMBV100A) @ VISA (ADR TCPIP::192.168.48.149::inst0::instr), SN 262024, FW 3.1.19.8- 3.20.281.28.7
Generator:	SMB100A (SMB100A) @ VISA (ADR TCPIP::192.168.48.152::inst0::instr), SN 103230, FW 3.20.390.24 / Drv:Rev 2.21.0, 07/2016, CVI 2015

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OSP:

OSP-B157W (OSP-B157W) @ VISA (ADR
TCP/IP::192.168.48.157::inst0::instr), SN 1527.1144.03 / 101057,
FW 1.23.0.2

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TEST REPORT

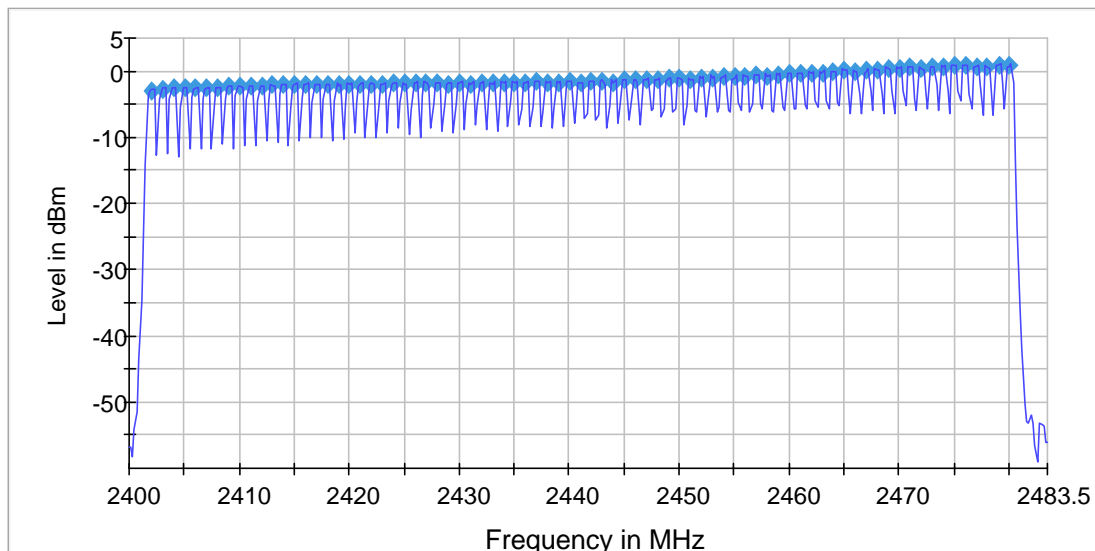
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Hopping Frequencies (GFSK, DH5)

Channels

Channels	Limit Min	Limit Max	Result
79	15	---	PASS



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.40000 GHz	2.40000 GHz
Stop Frequency	2.48350 GHz	2.48350 GHz
Span	83.500 MHz	83.500 MHz
RBW	200.000 kHz	<= 299.000 kHz
VBW	200.000 kHz	>= 200.000 kHz
SweepPoints	418	~ 418
SweepTime	1.060 ms	AUTO
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	59 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.45 dB	0.50 dB

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TEST REPORT

Report No. : AW0069050(9)

Date : Dec 12, 2018

Band Edge low (GFSK, DH5)

Result

DUT Frequency (MHz)	Result
hopping	PASS

Inband Peak

Frequency (MHz)	Level (dBm)
2478.175000	1.0

Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2346.825000	-60.1	31.1	-29.0	PASS
2346.875000	-60.4	31.4	-29.0	PASS
2340.825000	-60.9	32.0	-29.0	PASS
2394.725000	-61.0	32.0	-29.0	PASS
2340.875000	-61.1	32.1	-29.0	PASS
2399.975000	-61.5	32.5	-29.0	PASS
2399.925000	-61.8	32.8	-29.0	PASS
2344.725000	-61.9	32.9	-29.0	PASS
2344.675000	-61.9	32.9	-29.0	PASS
2350.375000	-61.9	32.9	-29.0	PASS
2388.025000	-62.0	33.0	-29.0	PASS
2394.675000	-62.1	33.1	-29.0	PASS
2395.025000	-62.1	33.2	-29.0	PASS
2388.075000	-62.3	33.3	-29.0	PASS
2394.775000	-62.3	33.3	-29.0	PASS

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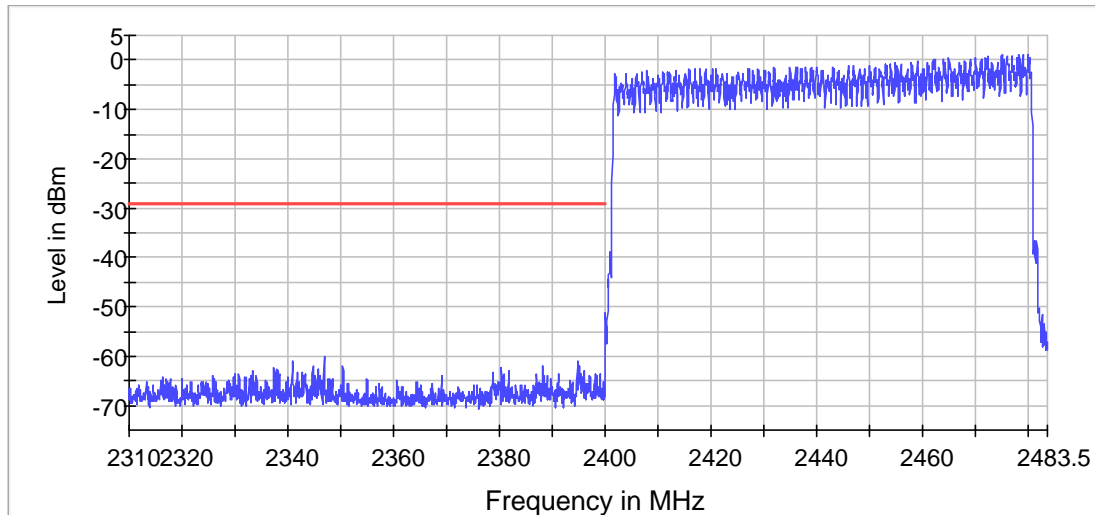
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— Limit — Sum Level × Fail

Measurement 1

Setting	Instrument Value	Target Value
Start Frequency	2.31000 GHz	2.31000 GHz
Stop Frequency	2.40000 GHz	2.40000 GHz
Span	90.000 MHz	90.000 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	1800	~ 1800
SweepTime	1.800 ms	AUTO
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	4 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.50 dB

Measurement 2

Setting	Instrument Value	Target Value
Start Frequency	2.40000 GHz	2.40000 GHz
Stop Frequency	2.48350 GHz	2.48350 GHz
Span	83.500 MHz	83.500 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz

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SweepPoints	1670	~ 1670
Sweeptime	1.670 ms	AUTO
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	150 / max. 150	max. 150
Stable	0 / 3	3
Max Stable Difference	4.94 dB	0.50 dB

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TEST REPORT

Report No. : AW0069050(9)

Date : Dec 12, 2018

Band Edge high (GFSK DH5)

Result

DUT Frequency (MHz)	Result
hopping	PASS

Inband Peak

Frequency (MHz)	Level (dBm)
2478.175000	1.0

Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2488.825000	-52.2	23.2	-29.0	PASS
2488.775000	-53.2	24.2	-29.0	PASS
2488.875000	-53.2	24.2	-29.0	PASS
2495.975000	-54.3	25.3	-29.0	PASS
2486.675000	-54.3	25.3	-29.0	PASS
2496.025000	-54.4	25.4	-29.0	PASS
2486.725000	-54.4	25.4	-29.0	PASS
2490.725000	-54.9	25.9	-29.0	PASS
2490.675000	-54.9	25.9	-29.0	PASS
2488.925000	-55.4	26.4	-29.0	PASS
2497.975000	-55.8	26.8	-29.0	PASS
2488.975000	-55.9	26.9	-29.0	PASS
2495.925000	-56.0	27.0	-29.0	PASS
2498.025000	-56.1	27.1	-29.0	PASS
2488.675000	-56.1	27.2	-29.0	PASS

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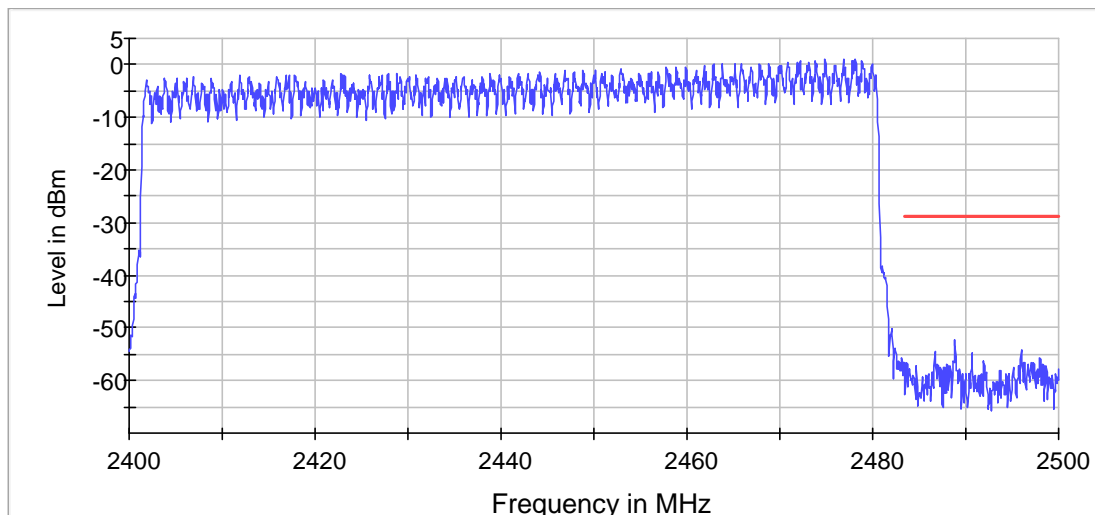
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— Limit — Sum Level × Fail

Measurement 1

Setting	Instrument Value	Target Value
Start Frequency	2.40000 GHz	2.40000 GHz
Stop Frequency	2.48350 GHz	2.48350 GHz
Span	83.500 MHz	83.500 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	1670	~ 1670
SweepTime	1.670 ms	AUTO
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	150 / max. 150	max. 150
Stable	0 / 3	3
Max Stable Difference	1.54 dB	0.50 dB

Measurement 2

Setting	Instrument Value	Target Value
Start Frequency	2.48350 GHz	2.48350 GHz
Stop Frequency	2.50000 GHz	2.50000 GHz
Span	16.500 MHz	16.500 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz

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SweepPoints	330	~ 330
SweepTime	37.969 μ s	AUTO
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	8 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.50 dB

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TEST REPORT

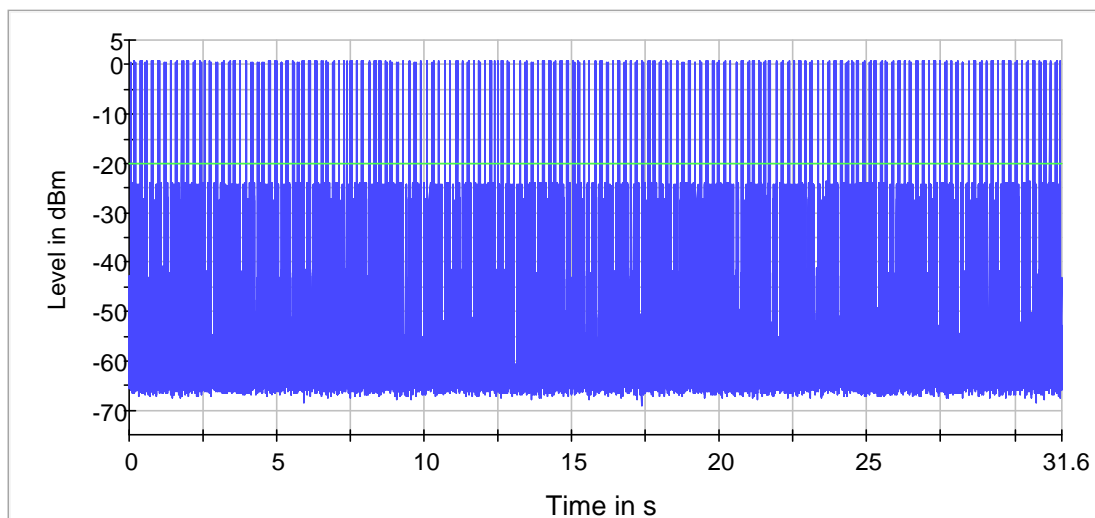
Report No. : AW0069050(9)

Date : Dec 12, 2018

Time of Channel Occupancy (2441 MHz; GFSK, DH1)

Result

DUT Frequency (MHz)	Time (ms)	Limit Max (ms)	Limit Min (ms)	Threshold (dBm)	Result
2441.000000	129.020	400.000	0.000	-20.0	PASS



— Trace — Threshold

Measurement

Setting	Instrument Value	Target Value
Center Frequency	2.44100 GHz	2.44100 GHz
Span	ZeroSpan	ZeroSpan
RBW	500.000 kHz	~ 500.000 kHz
VBW	1.000 MHz	~ 1.500 MHz
SweepPoints	30001	~ 30001
Sweeptime	31.600 s	31.600 s
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	0.000 dB	0.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	1	1
Filter	Channel	Channel
Trace Mode	Clear Write	Clear Write
SweepType	Sweep	AUTO
Preamp	off	off
Trigger	External	External
Trigger Offset	0.000 ms	0.000 ms

FCC ID: 2ADFF-KSFRPL
IC: 23562-KSFRPL



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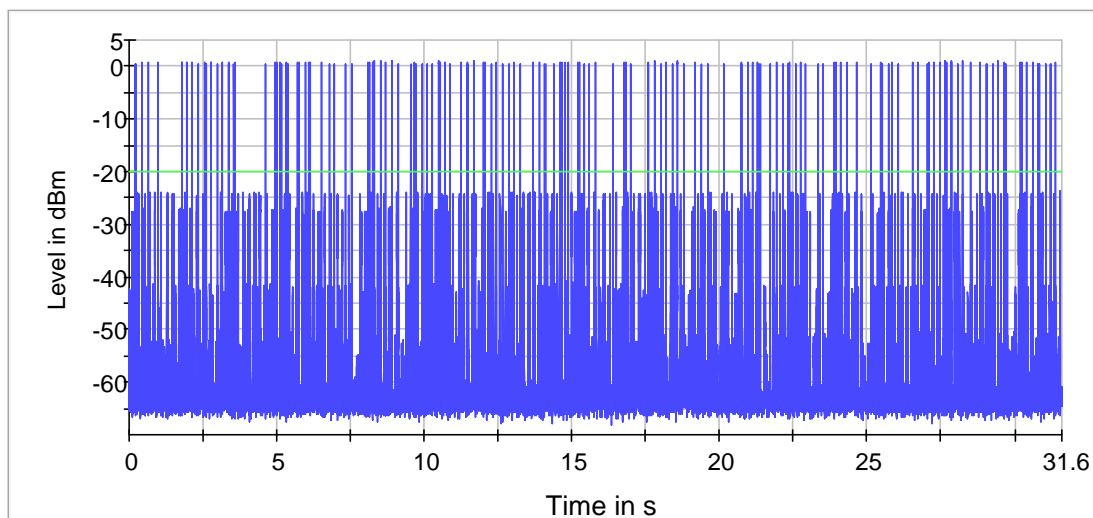
Report No. : AW0069050(9)

Date : Dec 12, 2018

Time of Channel Occupancy(2) (2441 MHz; GFSK; DH3)

Result

DUT Frequency (MHz)	Time (ms)	Limit Max (ms)	Limit Min (ms)	Threshold (dBm)	Result
2441.000000	260.510	400.000	0.000	-20.0	PASS



— Trace — Threshold

Measurement

Setting	Instrument Value	Target Value
Center Frequency	2.44100 GHz	2.44100 GHz
Span	ZeroSpan	ZeroSpan
RBW	500.000 kHz	~ 500.000 kHz
VBW	1.000 MHz	~ 1.500 MHz
SweepPoints	30001	~ 30001
SweepTime	31.600 s	31.600 s
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	0.000 dB	0.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	1	1
Filter	Channel	Channel
Trace Mode	Clear Write	Clear Write
SweepType	Sweep	AUTO
Preamp	off	off
Trigger	External	External
Trigger Offset	0.000 ms	0.000 ms

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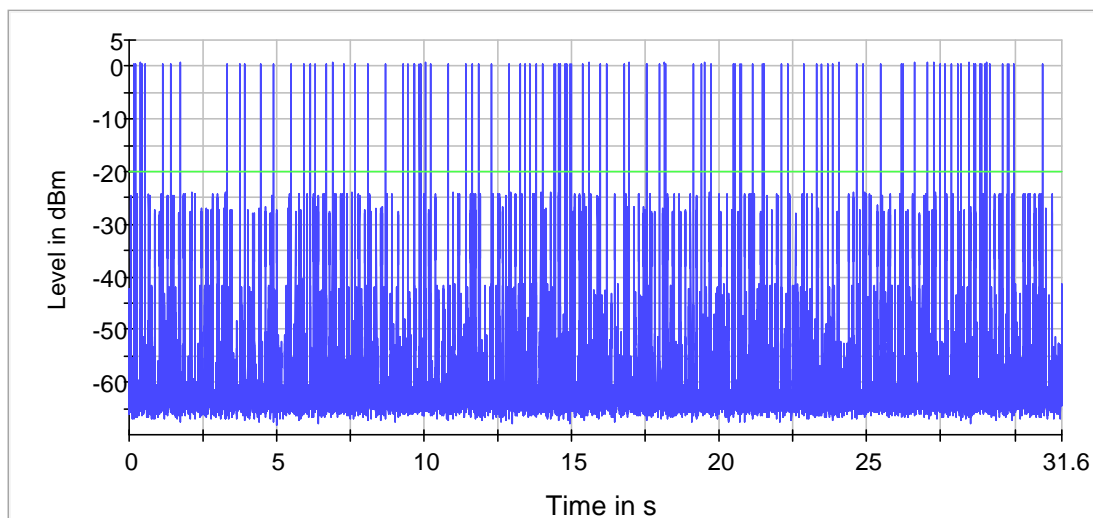
Report No. : AW0069050(9)

Date : Dec 12, 2018

Time of Channel Occupancy(3) (2441 MHz; GFSK;DH5)

Result

DUT Frequency (MHz)	Time (ms)	Limit Max (ms)	Limit Min (ms)	Threshold (dBm)	Result
2441.000000	296.550	400.000	0.000	-20.0	PASS



— Trace — Threshold

Measurement

Setting	Instrument Value	Target Value
Center Frequency	2.44100 GHz	2.44100 GHz
Span	ZeroSpan	ZeroSpan
RBW	500.000 kHz	~ 500.000 kHz
VBW	1.000 MHz	~ 1.500 MHz
SweepPoints	30001	~ 30001
SweepTime	31.600 s	31.600 s
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	0.000 dB	0.000 dB
Detector	MaxPeak	MaxPeak
SweepCount	1	1
Filter	Channel	Channel
Trace Mode	Clear Write	Clear Write
SweepType	Sweep	AUTO
Preamp	off	off
Trigger	External	External
Trigger Offset	0.000 ms	0.000 ms

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TEST REPORT

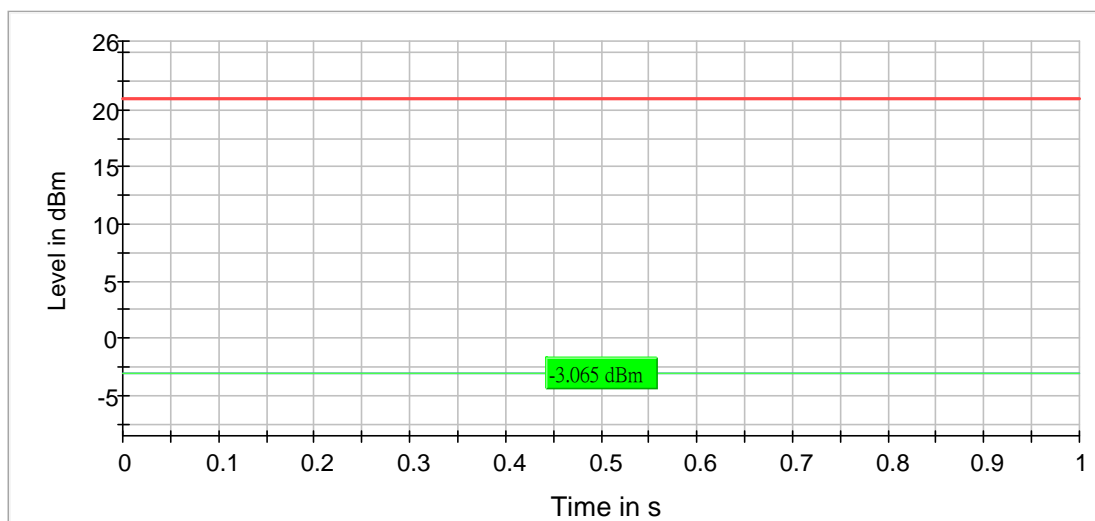
Report No. : AW0069050(9)

Date : Dec 12, 2018

RF output power (2402 MHz; GFSK;DH5)

Result

DUT Frequency (MHz)	Gated RMS (dBm)	Limit Max (dBm)	Gated EIRP (dBm)	DutyCycle (%)	Result
2402.000000	-3.1	21.0	-2.1	100.000	PASS



— Gated Trace
 — Overall
 — Limit

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TEST REPORT

Report No. : AW0069050(9)

Date : Dec 12, 2018

Band Edge low (2402 MHz; GFSK;DH5)

Result

DUT Frequency (MHz)	Result
2402.000000	PASS

Inband Peak

Frequency (MHz)	Level (dBm)
2402.225000	-6.2

Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.725000	-50.1	13.9	-36.2	PASS
2399.525000	-50.2	14.0	-36.2	PASS
2399.775000	-50.3	14.1	-36.2	PASS
2399.825000	-50.6	14.4	-36.2	PASS
2399.575000	-50.7	14.5	-36.2	PASS
2399.475000	-50.9	14.7	-36.2	PASS
2399.025000	-51.2	15.0	-36.2	PASS
2398.975000	-51.3	15.0	-36.2	PASS
2399.675000	-51.5	15.3	-36.2	PASS
2399.875000	-51.7	15.5	-36.2	PASS
2399.625000	-51.8	15.6	-36.2	PASS
2399.075000	-51.9	15.6	-36.2	PASS
2399.425000	-52.0	15.8	-36.2	PASS
2399.375000	-52.5	16.3	-36.2	PASS
2399.125000	-52.7	16.5	-36.2	PASS

FCC ID: 2ADFF-KSFRPL
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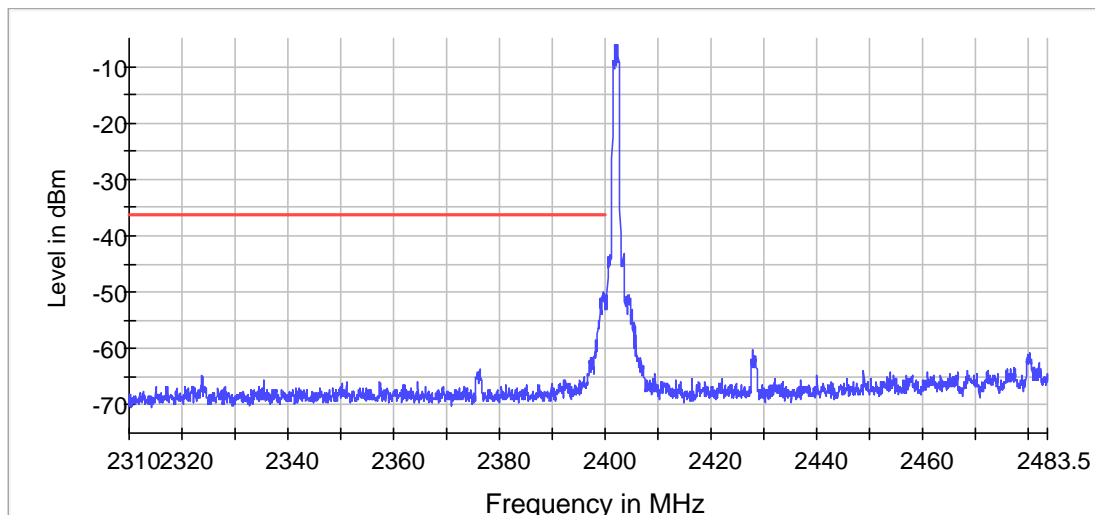
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TEST REPORT

Report No. : AW0069050(9)

Date : Dec 12, 2018



— Limit — Sum Level × Fail

Measurement 1

Setting	Instrument Value	Target Value
Start Frequency	2.31000 GHz	2.31000 GHz
Stop Frequency	2.40000 GHz	2.40000 GHz
Span	90.000 MHz	90.000 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	1800	~ 1800
SweepTime	1.800 ms	AUTO
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	15 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.50 dB

Measurement 2

Setting	Instrument Value	Target Value
Start Frequency	2.40000 GHz	2.40000 GHz
Stop Frequency	2.48350 GHz	2.48350 GHz
Span	83.500 MHz	83.500 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz

FCC ID: 2ADFF-KSFRPL

IC: 23562-KSFRPL



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Report No. : AW0069050(9)

Date : Dec 12, 2018

SweepPoints	1670	~ 1670
SweepTime	1.670 ms	AUTO
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	5 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.03 dB	0.50 dB

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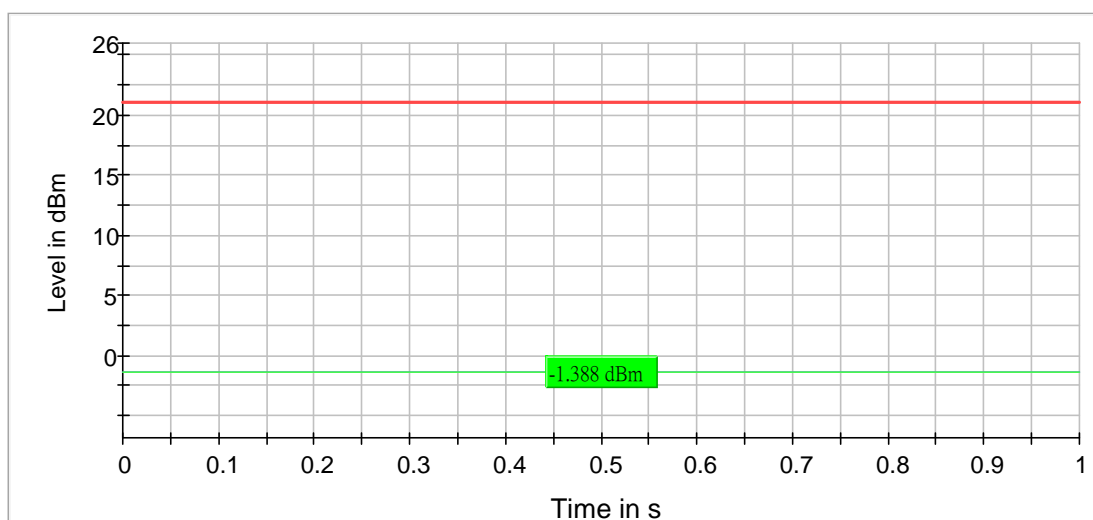
Report No. : AW0069050(9)

Date : Dec 12, 2018

RF output power (2441 MHz; GFSK;DH5)

Result

DUT Frequency (MHz)	Gated RMS (dBm)	Limit Max (dBm)	Gated EIRP (dBm)	DutyCycle (%)	Result
2441.000000	-1.4	21.0	-0.4	100.000	PASS



— Gated Trace
 — Overall
 — Limit

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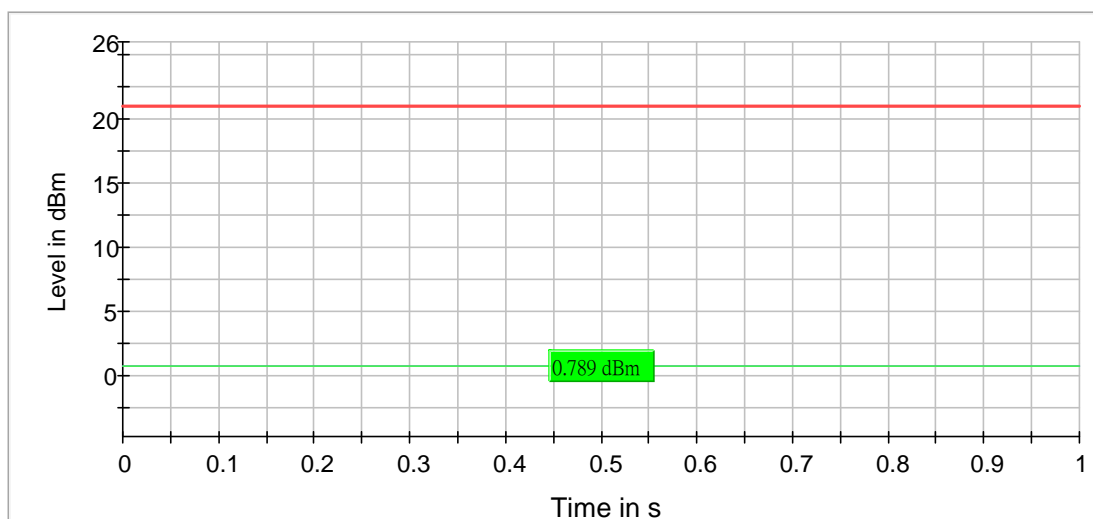
Date : Dec 12, 2018

Emission Bandwidth 20 dB (2480 MHz; 0.000 dBm; 1 MHz; Test Mode)

RF output power (2480 MHz; GFSK; DH5)

Result

DUT Frequency (MHz)	Gated RMS (dBm)	Limit Max (dBm)	Gated EIRP (dBm)	DutyCycle (%)	Result
2480.000000	0.8	21.0	1.8	100.000	PASS



— Gated Trace
 — Overall
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Report No. : AW0069050(9)

Date : Dec 12, 2018

Band Edge high (2480 MHz; GFSK; DH5)

Result

DUT Frequency (MHz)	Result
2480.000000	PASS

Inband Peak

Frequency (MHz)	Level (dBm)
2480.225000	-2.3

Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2484.575000	-56.6	24.3	-32.3	PASS
2484.625000	-56.8	24.5	-32.3	PASS
2488.925000	-57.0	24.8	-32.3	PASS
2483.525000	-57.2	25.0	-32.3	PASS
2483.725000	-57.2	25.0	-32.3	PASS
2488.875000	-57.3	25.1	-32.3	PASS
2490.575000	-57.4	25.1	-32.3	PASS
2490.825000	-57.5	25.3	-32.3	PASS
2490.775000	-57.7	25.4	-32.3	PASS
2490.625000	-57.7	25.4	-32.3	PASS
2483.675000	-57.7	25.4	-32.3	PASS
2488.975000	-57.7	25.5	-32.3	PASS
2483.575000	-57.7	25.5	-32.3	PASS
2485.075000	-57.8	25.6	-32.3	PASS
2489.425000	-57.8	25.6	-32.3	PASS

FCC ID: 2ADFF-KSFRPL
IC: 23562-KSFRPL



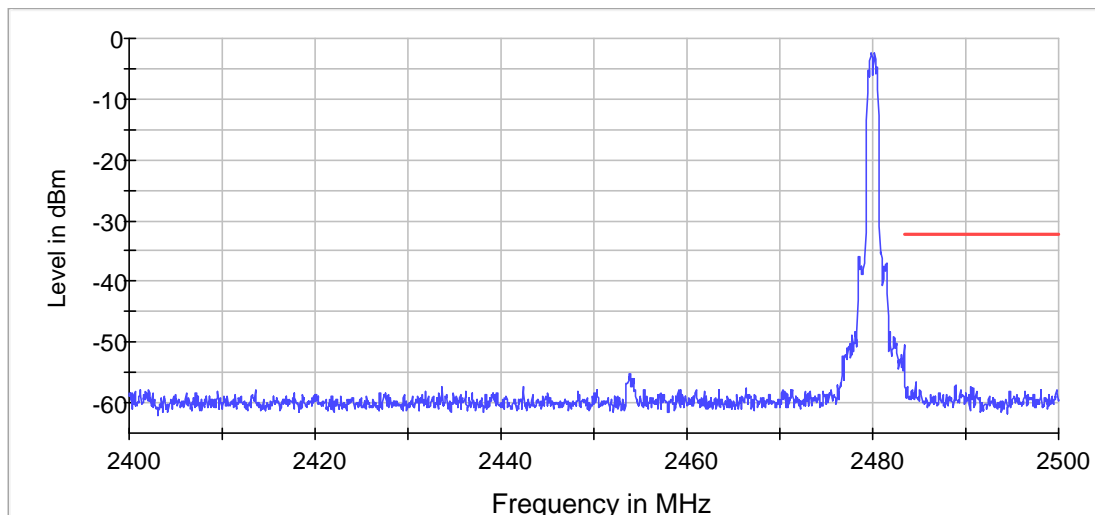
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TEST REPORT

Report No. : AW0069050(9)

Date : Dec 12, 2018



— Limit — Sum Level × Fail

Measurement 1

Setting	Instrument Value	Target Value
Start Frequency	2.40000 GHz	2.40000 GHz
Stop Frequency	2.48350 GHz	2.48350 GHz
Span	83.500 MHz	83.500 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	1670	~ 1670
SweepTime	1.670 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	5 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.13 dB	0.50 dB

Measurement 2

Setting	Instrument Value	Target Value
Start Frequency	2.48350 GHz	2.48350 GHz
Stop Frequency	2.50000 GHz	2.50000 GHz
Span	16.500 MHz	16.500 MHz
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz

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SweepPoints	330	~ 330
SweepTime	37.969 μ s	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	4 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.50 dB

FCC ID: 2ADFF-KSFRPL
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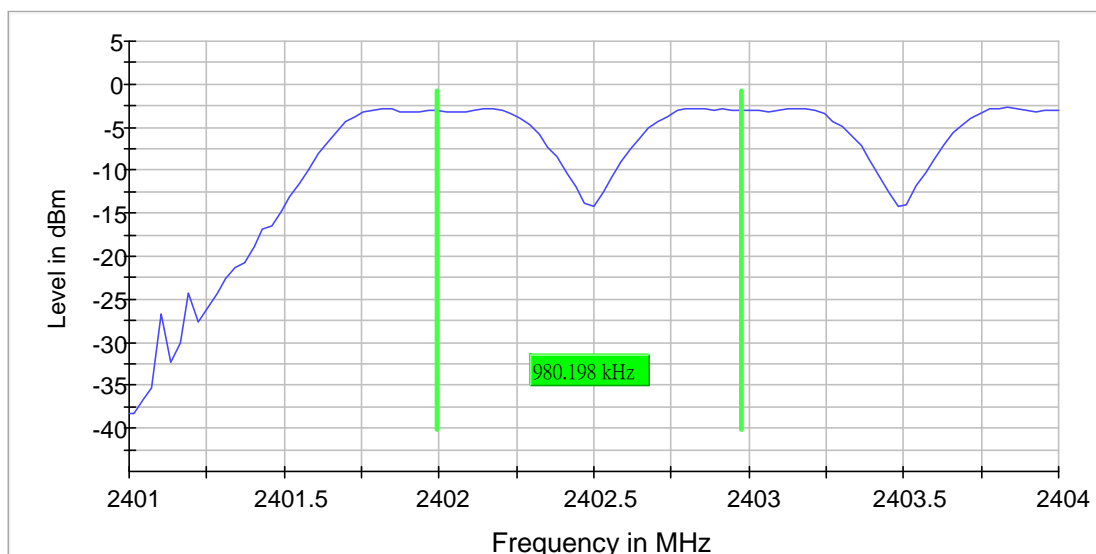
Report No. : AW0069050(9)

Date : Dec 12, 2018

Carrier Frequency Separation (2402 MHz; GFSK; DH5)

Result

DUT Frequency (MHz)	Frequency Separation (MHz)	Limit Min (MHz)	Limit Max (MHz)	Center Frequency low Channel (MHz)	Center Frequency high Channel (MHz)
2402.000000	0.980198	0.906867	---	2401.995050	2402.975248



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.40100 GHz	2.40100 GHz
Stop Frequency	2.40400 GHz	2.40400 GHz
Span	3.000 MHz	3.000 MHz
RBW	300.000 kHz	<= 300.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	101	~ 10
SweepTime	1.000 ms	AUTO
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	19 / max. 150	max. 150

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Report No. : AW0069050(9)

Date : Dec 12, 2018

Stable	10 / 10	10
Max Stable Difference	0.13 dB	0.50 dB

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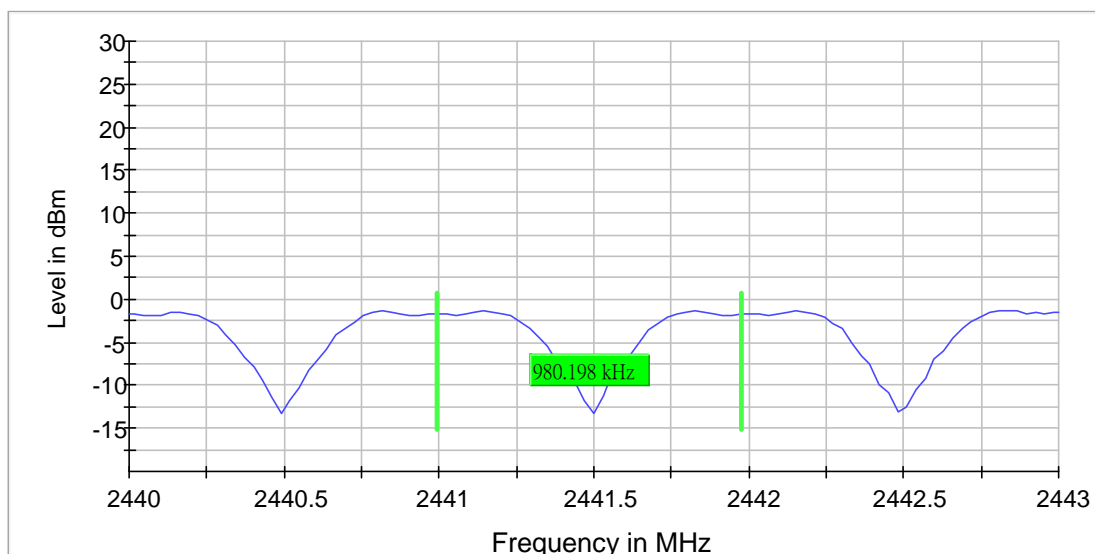
Report No. : AW0069050(9)

Date : Dec 12, 2018

Carrier Frequency Separation (2441 MHz; GFSK; DH5)

Result

DUT Frequency (MHz)	Frequency Separation (MHz)	Limit Min (MHz)	Limit Max (MHz)	Center Frequency low Channel (MHz)	Center Frequency high Channel (MHz)
2441.000000	0.980198	0.906867	---	2440.995050	2441.975248



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.44000 GHz	2.44000 GHz
Stop Frequency	2.44300 GHz	2.44300 GHz
Span	3.000 MHz	3.000 MHz
RBW	300.000 kHz	<= 300.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	101	~ 10
SweepTime	1.000 ms	AUTO
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	12 / max. 150	max. 150

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Stable	10 / 10	10
Max Stable Difference	0.00 dB	0.50 dB

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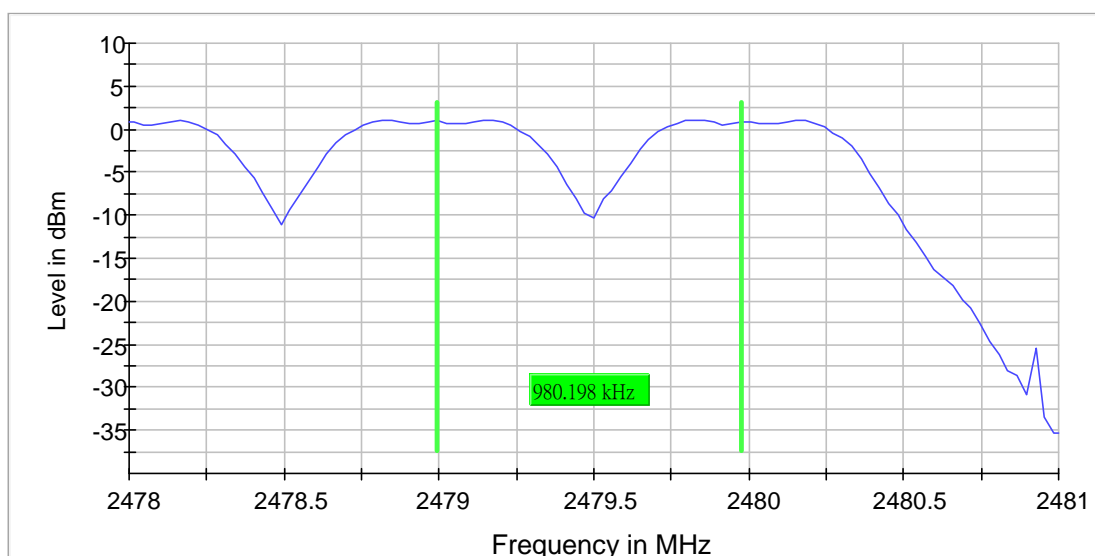
Report No. : AW0069050(9)

Date : Dec 12, 2018

Carrier Frequency Separation (2479 MHz; GFSK; DH5)

Result

DUT Frequency (MHz)	Frequency Separation (MHz)	Limit Min (MHz)	Limit Max (MHz)	Center Frequency low Channel (MHz)	Center Frequency high Channel (MHz)
2479.000000	0.980198	0.906867	---	2478.995050	2479.975248



Measurement

Setting	Instrument Value	Target Value
Start Frequency	2.47800 GHz	2.47800 GHz
Stop Frequency	2.48100 GHz	2.48100 GHz
Span	3.000 MHz	3.000 MHz
RBW	300.000 kHz	<= 300.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	101	~ 10
SweepTime	1.000 ms	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	23 / max. 150	max. 150

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Date : Dec 12, 2018

Stable	10 / 10	10
Max Stable Difference	0.02 dB	0.50 dB

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Date : Dec 12, 2018

Tx Spurious Emission (2402 MHz; GFSK; DH5)

Result

DUT Frequency (MHz)	Result
2402.000000	PASS

Final measurements

Frequency (MHz)	Level Pre Measurement (dBm)	level (dBm)	Limit (dBm)	Margin (dB)	Result
130.025000	-62.2	-65.4	-56.4	9.0	PASS
135.175000	-58.6	-59.6	-56.4	3.2	PASS
258.075000	-56.4	-57.3	-53.9	3.4	PASS
282.675000	-55.3	-57.9	-53.9	4.0	PASS

Pre Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
282.675000	-55.3	1.4	-53.9
282.625000	-55.5	1.6	-53.9
135.175000	-58.6	2.2	-56.4
258.075000	-56.4	2.5	-53.9
135.225000	-59.1	2.7	-56.4
135.125000	-59.6	3.2	-56.4
258.125000	-57.5	3.6	-53.9
258.025000	-58.1	4.2	-53.9
282.575000	-58.7	4.8	-53.9
282.725000	-59.3	5.4	-53.9
130.025000	-62.2	5.8	-56.4
110.625000	-62.7	6.3	-56.4
110.575000	-63.1	6.7	-56.4
130.075000	-63.2	6.8	-56.4
129.975000	-63.2	6.8	-56.4

Measurement Settings

Start Frequency (MHz)	Stop Frequency (MHz)	Pre Measurement	Final Measurement
30.000000	1000.000000	1	1
1000.000000	2400.000000	2	2
2400.000000	2483.500000	2	2
2483.500000	7000.000000	2	2
7000.000000	18000.000000	2	2
18000.000000	26000.000000	2	2

FCC ID: 2ADFF-KSFRPL

IC: 23562-KSFRPL



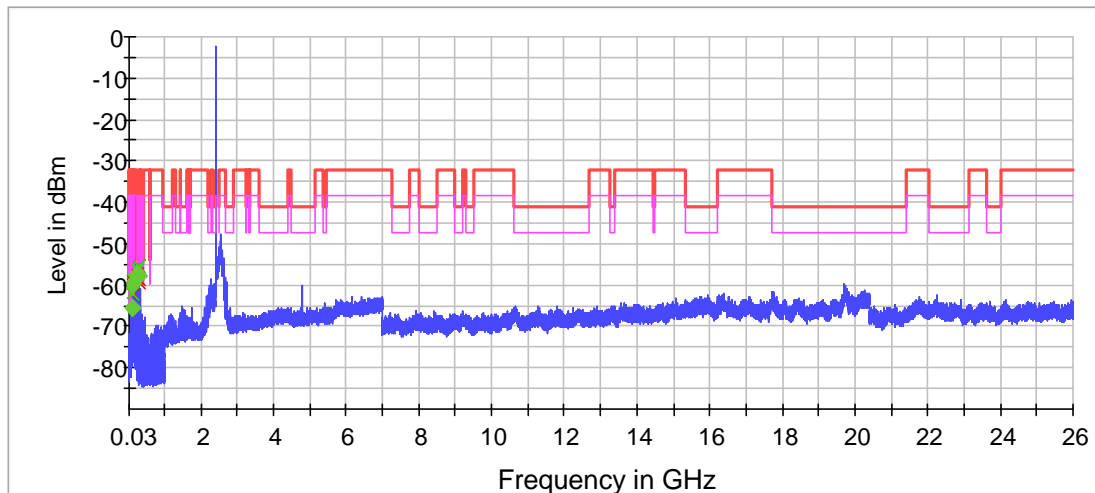
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TEST REPORT

Report No. : AW0069050(9)

Date : Dec 12, 2018



— Limit — Sum Level — Threshold × Critical
◆ Final Critical ◆ Fail ◆ Pass

Pre Measurement 1

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	19400	~ 19400
SweepTime	19.400 ms	AUTO
Reference Level	-30.000 dBm	-30.000 dBm
Attenuation	0.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	6 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.13 dB	0.50 dB

FCC ID: 2ADFF-KSFRPL
IC: 23562-KSFRPL



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廠商會檢定中心

TEST REPORT

Report No. : AW0069050(9)

Date : Dec 12, 2018

Pre Measurement 2

Setting	Instrument Value	Target Value
RBW	1.000 MHz	<= 1.000 MHz
VBW	3.000 MHz	>= 3.000 MHz
SweepPoints	2800	~ 2800
SweepTime	2.800 ms	AUTO
Reference Level	-30.000 dBm	-30.000 dBm
Attenuation	0.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	4 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.50 dB

Final Measurement 1

Setting	Instrument Value	Target Value
Span	ZeroSpan	ZeroSpan
RBW	100.000 kHz	~ 100.000 kHz
VBW	300.000 kHz	~ 300.000 kHz
SweepPoints	10001	~ 10001
SweepTime	1.000 s	1.000 s
Reference Level	-20.000 dBm	-20.000 dBm
Attenuation	0.000 dB	AUTO
Detector	RMS	RMS
SweepCount	1	1
Filter	3 dB	3 dB
Trace Mode	Clear Write	Clear Write
SweepType	Sweep	AUTO
Preamp	off	off

FCC ID: 2ADFF-KSFRPL
IC: 23562-KSFRPL



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TEST REPORT

Report No. : AW0069050(9)

Date : Dec 12, 2018

Tx Spurious Emission (2441 MHz; GFSK; DH5)

Result

DUT Frequency (MHz)	Result
2441.000000	PASS

Final measurements

Frequency (MHz)	Level Pre Measurement (dBm)	level (dBm)	Limit (dBm)	Margin (dB)	Result
135.175000	-58.0	-59.6	-56.4	3.2	PASS
258.075000	-56.4	-57.4	-53.9	3.5	PASS
282.625000	-55.4	-55.9	-53.9	2.0	PASS

Pre Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
282.625000	-55.4	1.5	-53.9
282.675000	-55.4	1.5	-53.9
135.175000	-58.0	1.6	-56.4
135.225000	-58.5	2.1	-56.4
258.075000	-56.4	2.5	-53.9
135.125000	-59.7	3.3	-56.4
258.125000	-57.7	3.8	-53.9
282.575000	-58.0	4.1	-53.9
258.025000	-58.1	4.2	-53.9
282.725000	-59.4	5.5	-53.9
135.275000	-62.4	6.0	-56.4
130.025000	-62.7	6.3	-56.4
110.625000	-62.8	6.4	-56.4
331.775000	-60.5	6.6	-53.9
110.575000	-63.2	6.8	-56.4

Measurement Settings

Start Frequency (MHz)	Stop Frequency (MHz)	Pre Measurement	Final Measurement
30.000000	1000.000000	1	1
1000.000000	2400.000000	2	2
2400.000000	2483.500000	2	2
2483.500000	7000.000000	2	2
7000.000000	18000.000000	2	2
18000.000000	26000.000000	2	2

FCC ID: 2ADFF-KSFRPL

IC: 23562-KSFRPL



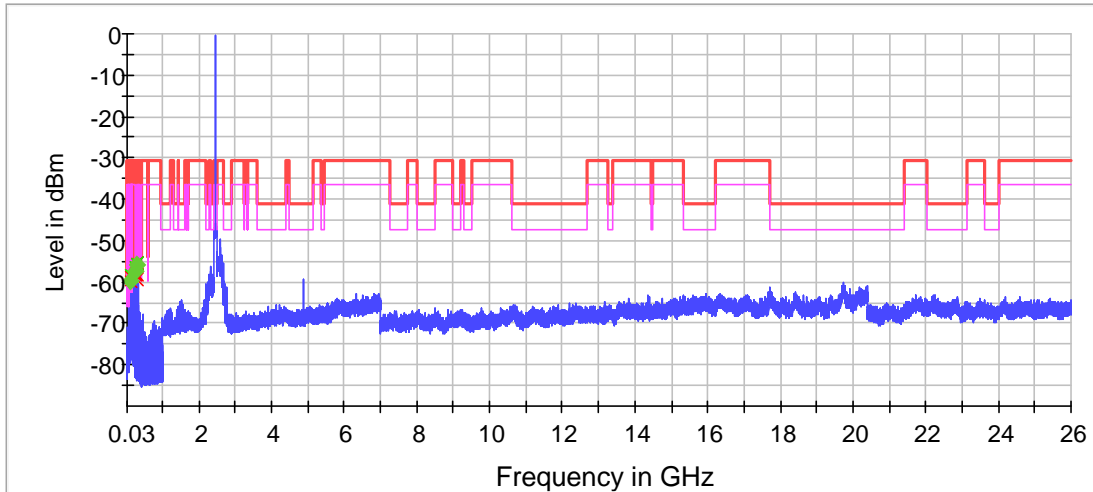
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TEST REPORT

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Date : Dec 12, 2018



— Limit — Sum Level — Threshold × Critical
◆ Final Critical ◆ Fail ◆ Pass

Pre Measurement 1

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	19400	~ 19400
SweepTime	19.400 ms	AUTO
Reference Level	-30.000 dBm	-30.000 dBm
Attenuation	0.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	4 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.33 dB	0.50 dB

FCC ID: 2ADFF-KSFRPL
IC: 23562-KSFRPL



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TEST REPORT

Report No. : AW0069050(9)

Date : Dec 12, 2018

Pre Measurement 2

Setting	Instrument Value	Target Value
RBW	1.000 MHz	<= 1.000 MHz
VBW	3.000 MHz	>= 3.000 MHz
SweepPoints	2800	~ 2800
SweepTime	2.800 ms	AUTO
Reference Level	-30.000 dBm	-30.000 dBm
Attenuation	0.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	27 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.16 dB	0.50 dB

Final Measurement 1

Setting	Instrument Value	Target Value
Span	ZeroSpan	ZeroSpan
RBW	100.000 kHz	~ 100.000 kHz
VBW	300.000 kHz	~ 300.000 kHz
SweepPoints	10001	~ 10001
SweepTime	1.000 s	1.000 s
Reference Level	-20.000 dBm	-20.000 dBm
Attenuation	0.000 dB	AUTO
Detector	RMS	RMS
SweepCount	1	1
Filter	3 dB	3 dB
Trace Mode	Clear Write	Clear Write
SweepType	Sweep	AUTO
Preamp	off	off

FCC ID: 2ADFF-KSFRPL
IC: 23562-KSFRPL



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TEST REPORT

Report No. : AW0069050(9)

Date : Dec 12, 2018

Tx Spurious Emission (2480 MHz; GFSK; DH5)

Result

DUT Frequency (MHz)	Result
2480.000000	PASS

Final measurements

Frequency (MHz)	Level Pre Measurement (dBm)	level (dBm)	Limit (dBm)	Margin (dB)	Result
130.025000	-62.1	-65.4	-56.4	9.0	PASS
135.175000	-58.0	-59.6	-56.4	3.2	PASS
258.075000	-56.3	-57.3	-53.9	3.4	PASS
282.675000	-55.2	-57.9	-53.9	4.0	PASS

Pre Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
282.675000	-55.2	1.3	-53.9
282.625000	-55.3	1.4	-53.9
135.175000	-58.0	1.6	-56.4
135.225000	-58.6	2.2	-56.4
258.075000	-56.3	2.4	-53.9
135.125000	-59.4	3.0	-56.4
258.125000	-57.6	3.7	-53.9
258.025000	-58.0	4.1	-53.9
282.575000	-58.5	4.6	-53.9
282.725000	-59.0	5.1	-53.9
130.025000	-62.1	5.7	-56.4
135.275000	-62.6	6.2	-56.4
2483.750000	-47.5	6.3	-41.2
331.775000	-60.3	6.4	-53.9
110.625000	-63.0	6.6	-56.4

Measurement Settings

Start Frequency (MHz)	Stop Frequency (MHz)	Pre Measurement	Final Measurement
30.000000	1000.000000	1	1
1000.000000	2400.000000	2	2
2400.000000	2483.500000	2	2
2483.500000	7000.000000	2	2
7000.000000	18000.000000	2	2
18000.000000	26000.000000	2	2

FCC ID: 2ADFF-KSFRPL

IC: 23562-KSFRPL



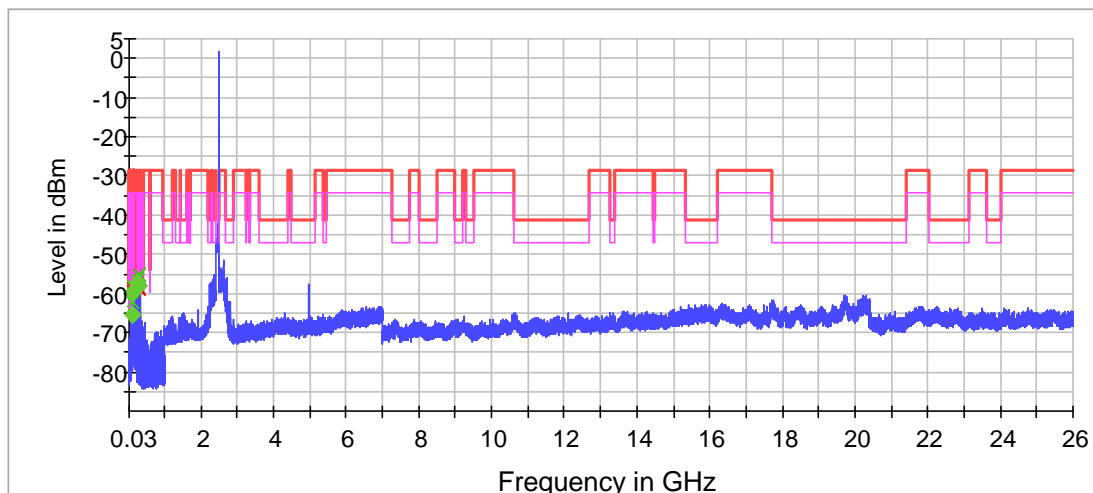
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TEST REPORT

Report No. : AW0069050(9)

Date : Dec 12, 2018



— Limit — Sum Level — Threshold × Critical
◆ Final Critical ◆ Fail ◆ Pass

Pre Measurement 1

Setting	Instrument Value	Target Value
RBW	100.000 kHz	<= 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	19400	~ 19400
SweepTime	19.400 ms	AUTO
Reference Level	-30.000 dBm	-30.000 dBm
Attenuation	0.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	9 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.00 dB	0.50 dB

FCC ID: 2ADFF-KSFRPL
IC: 23562-KSFRPL



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TEST REPORT

Report No. : AW0069050(9)

Date : Dec 12, 2018

Pre Measurement 2

Setting	Instrument Value	Target Value
RBW	1.000 MHz	<= 1.000 MHz
VBW	3.000 MHz	>= 3.000 MHz
SweepPoints	2800	~ 2800
SweepTime	2.800 ms	AUTO
Reference Level	-30.000 dBm	-30.000 dBm
Attenuation	0.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	30	30
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	29 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.31 dB	0.50 dB

Final Measurement 1

Setting	Instrument Value	Target Value
Span	ZeroSpan	ZeroSpan
RBW	100.000 kHz	~ 100.000 kHz
VBW	300.000 kHz	~ 300.000 kHz
SweepPoints	10001	~ 10001
SweepTime	1.000 s	1.000 s
Reference Level	-20.000 dBm	-20.000 dBm
Attenuation	0.000 dB	AUTO
Detector	RMS	RMS
SweepCount	1	1
Filter	3 dB	3 dB
Trace Mode	Clear Write	Clear Write
SweepType	Sweep	AUTO
Preamp	off	off

FCC ID: 2ADFF-KSFRPL
IC: 23562-KSFRPL



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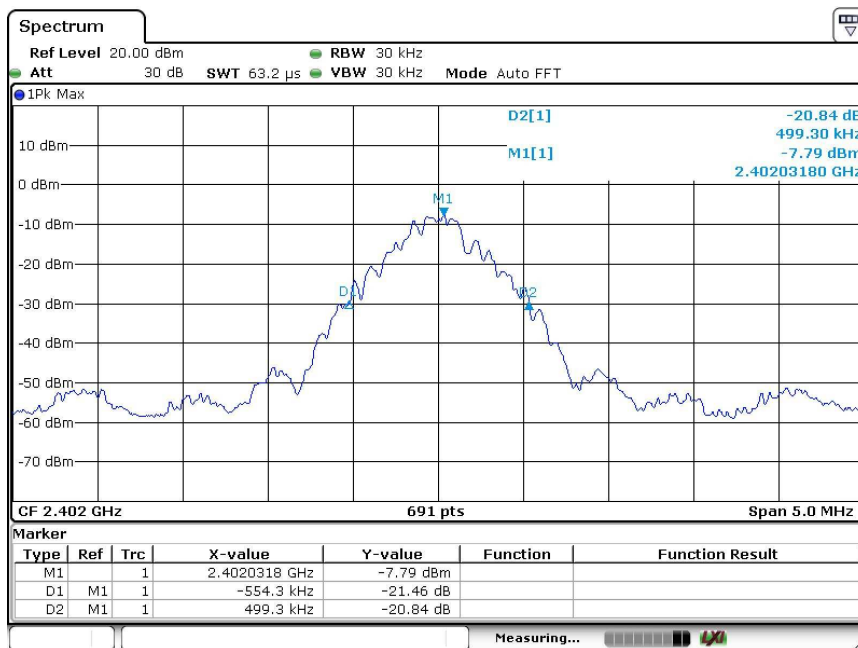
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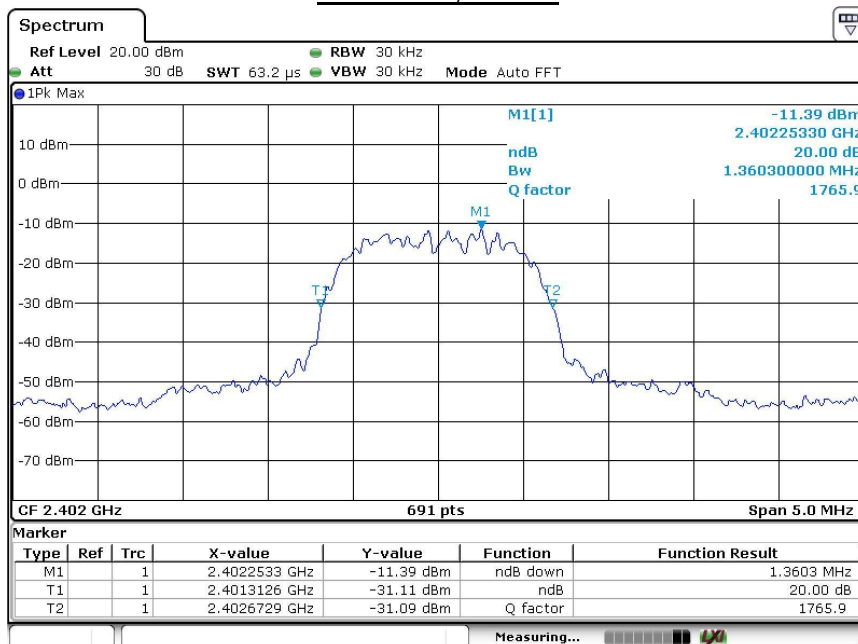
Report No. : AW0069050(9)

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20dB bandwidth



2402MHz, GFSK



2402MHz, $\pi/4$ DQPSK

FCC ID: 2ADFF-KSFRPL
IC: 23562-KSFRPL



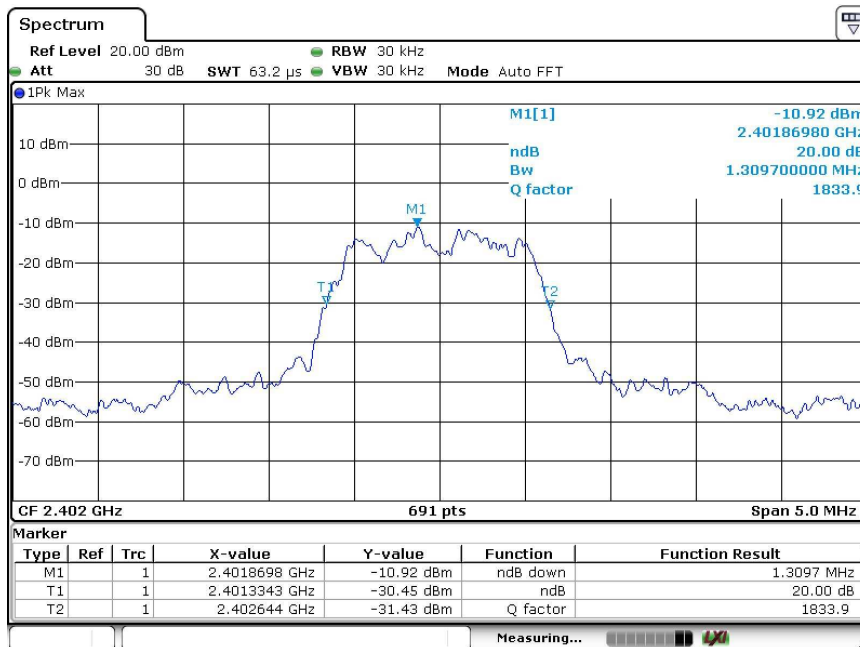
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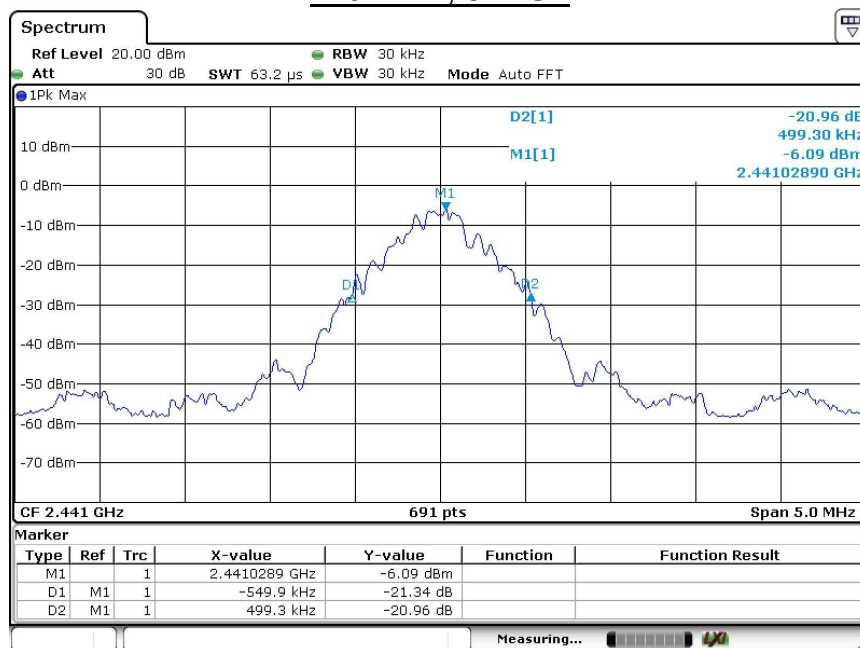
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Date : Dec 12, 2018



2402MHz, 8DPSK



2441MHz, GFSK

FCC ID: 2ADFF-KSFRPL
 IC: 23562-KSFRPL



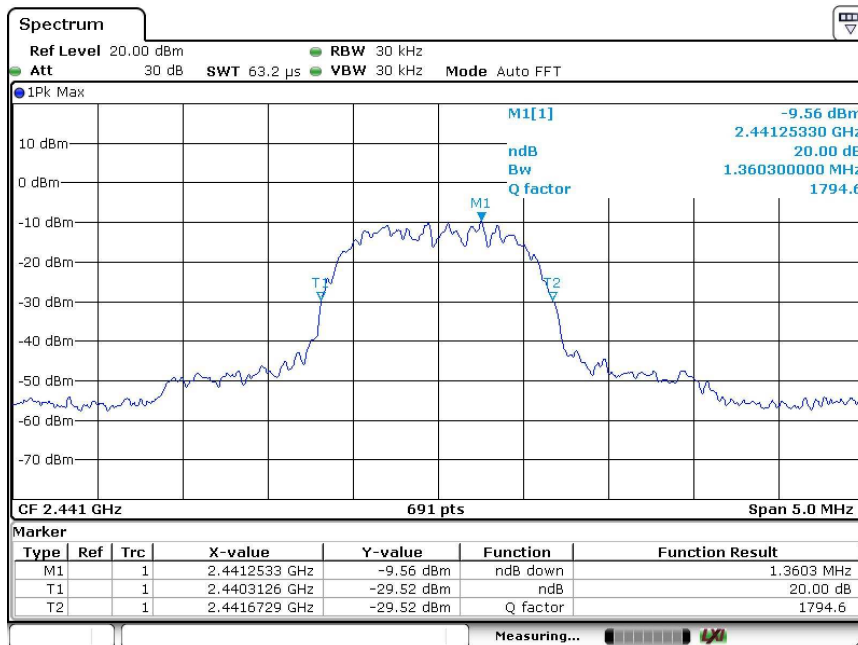
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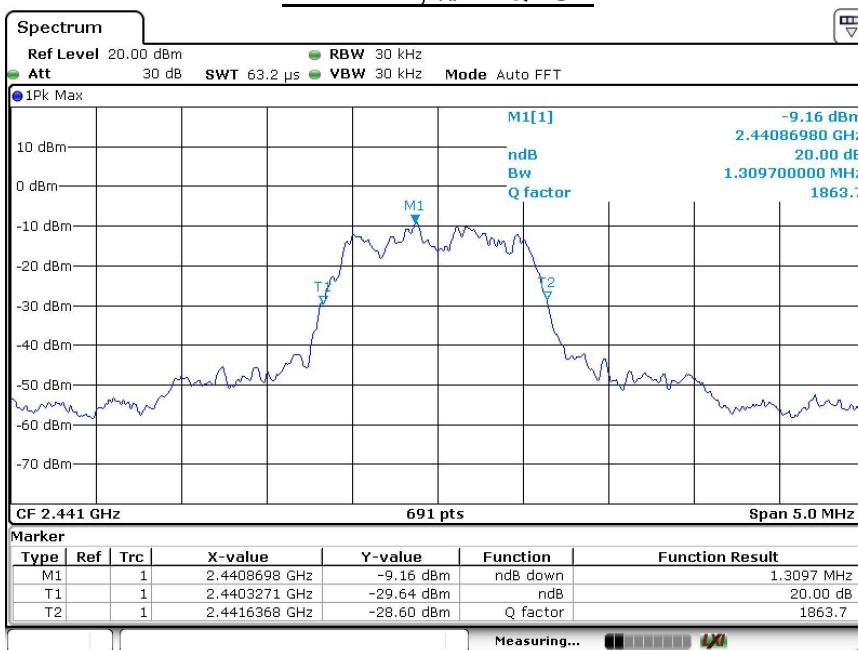
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Date : Dec 12, 2018



2441MHz, $\pi/4$ DQPSK



2441MHz, 8DPSK

FCC ID: 2ADFF-KSFRPL
IC: 23562-KSFRPL



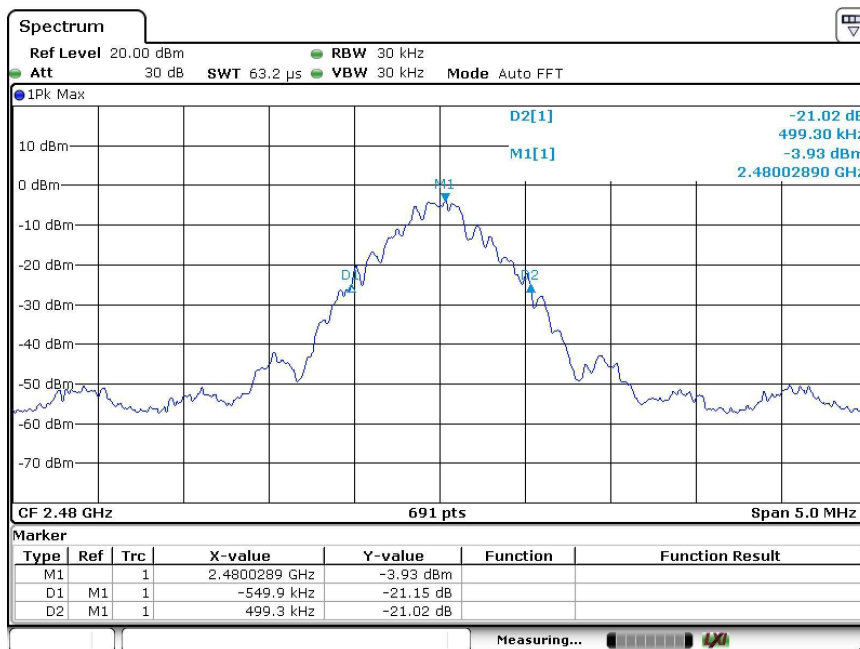
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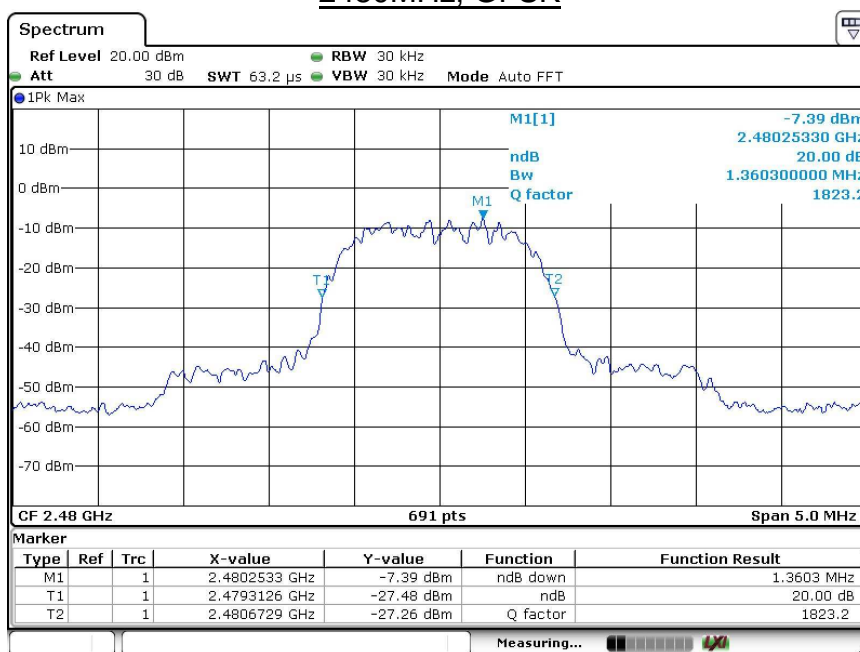
TEST REPORT

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Date : Dec 12, 2018



2480MHz, GFSK



2480MHz, $\pi/4$ DQPSK

FCC ID: 2ADFF-KSFRPL
IC: 23562-KSFRPL



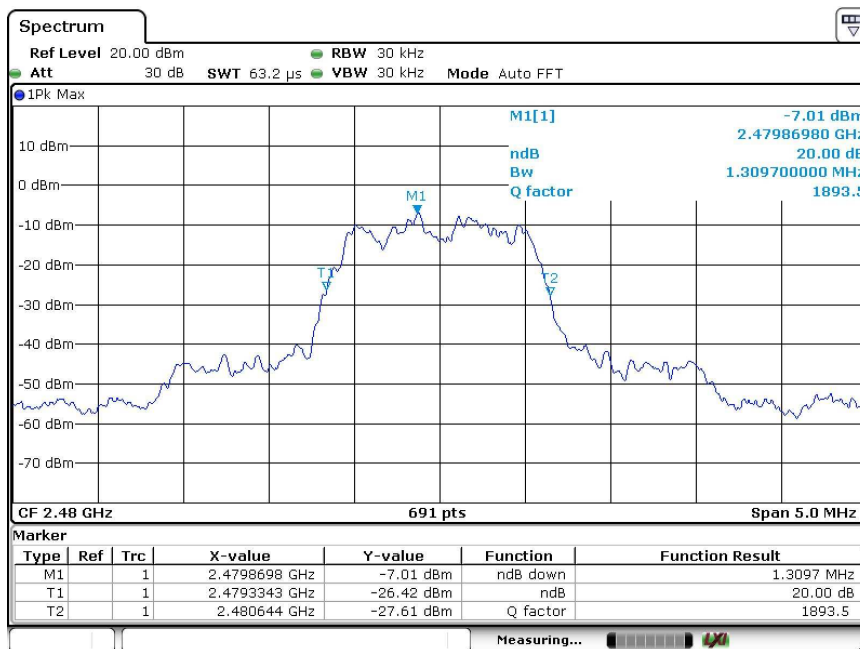
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2480MHz, 8DPSK

FCC ID: 2ADFF-KSFRPL
 IC: 23562-KSFRPL



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TEST REPORT

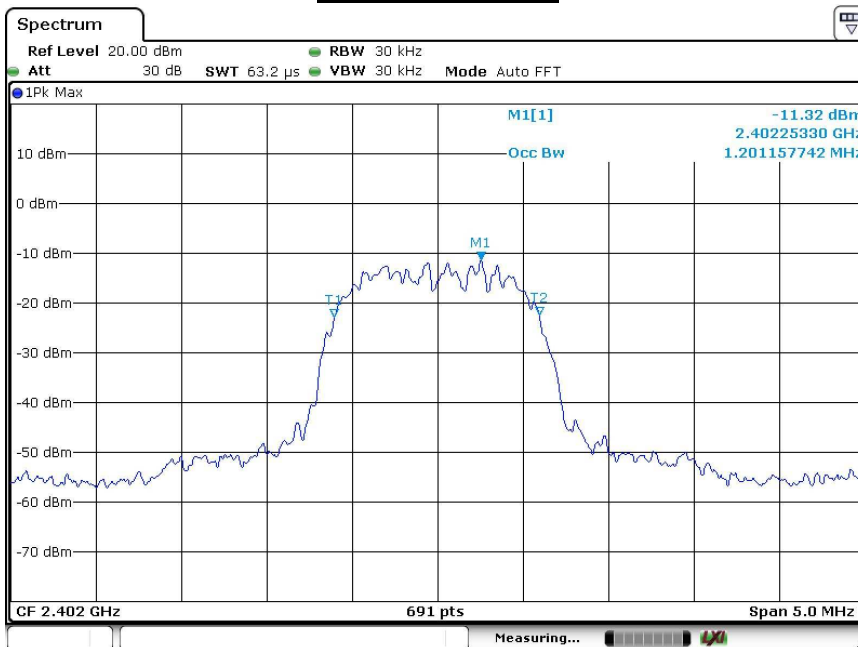
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99% Occupied bandwidth



2402MHz, GFSK



2402MHz, $\pi/4$ DQPSK

FCC ID: 2ADFF-KSFRPL
IC: 23562-KSFRPL



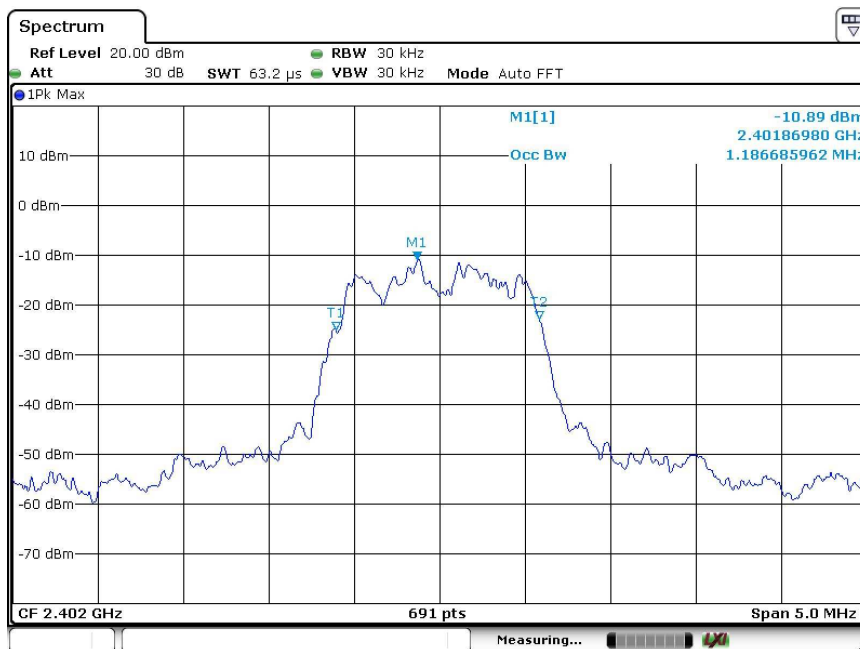
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2402MHz, 8DPSK



2441MHz, GFSK

FCC ID: 2ADFF-KSFRPL
IC: 23562-KSFRPL



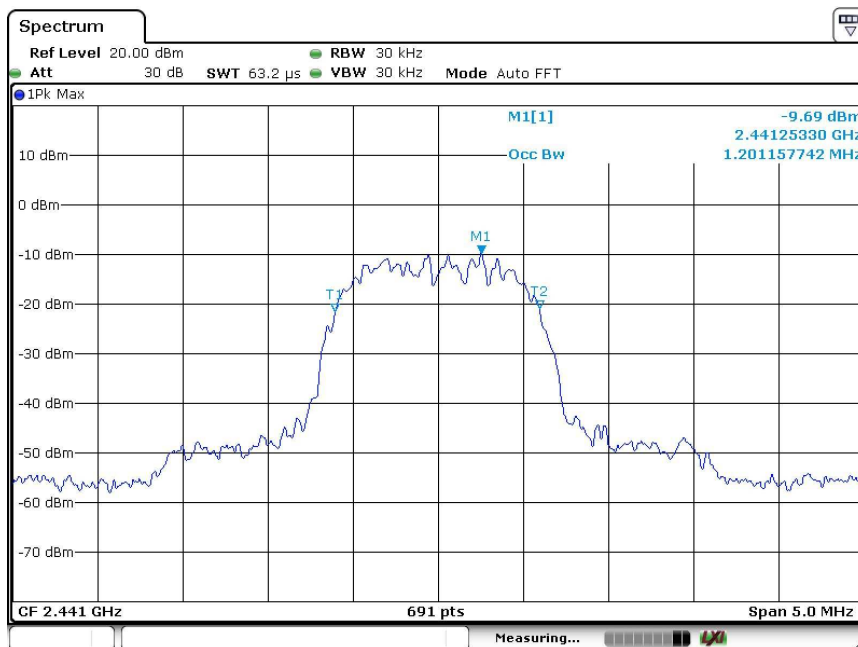
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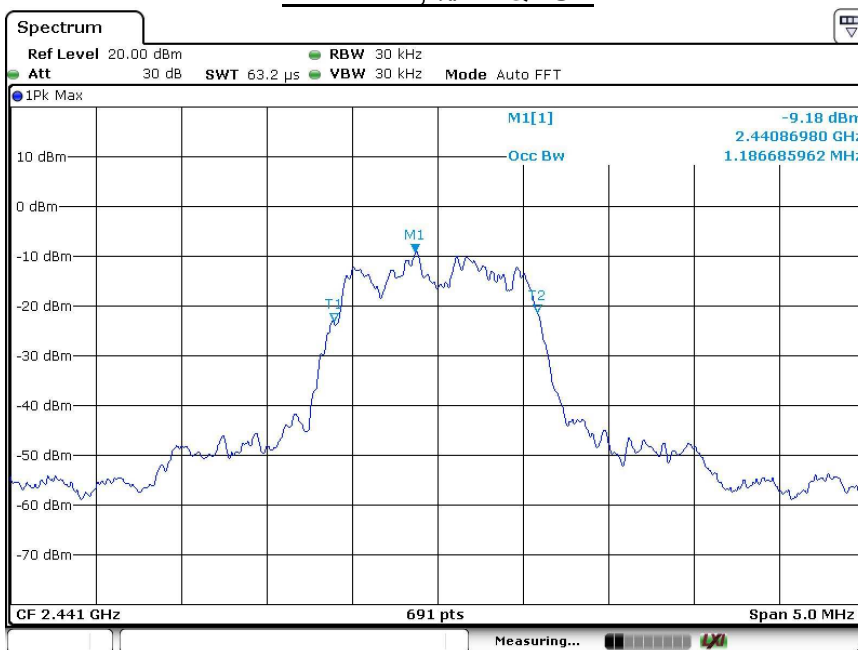
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2441MHz, $\pi/4$ DQPSK



2441MHz, 8DPSK

FCC ID: 2ADFF-KSFRPL
IC: 23562-KSFRPL



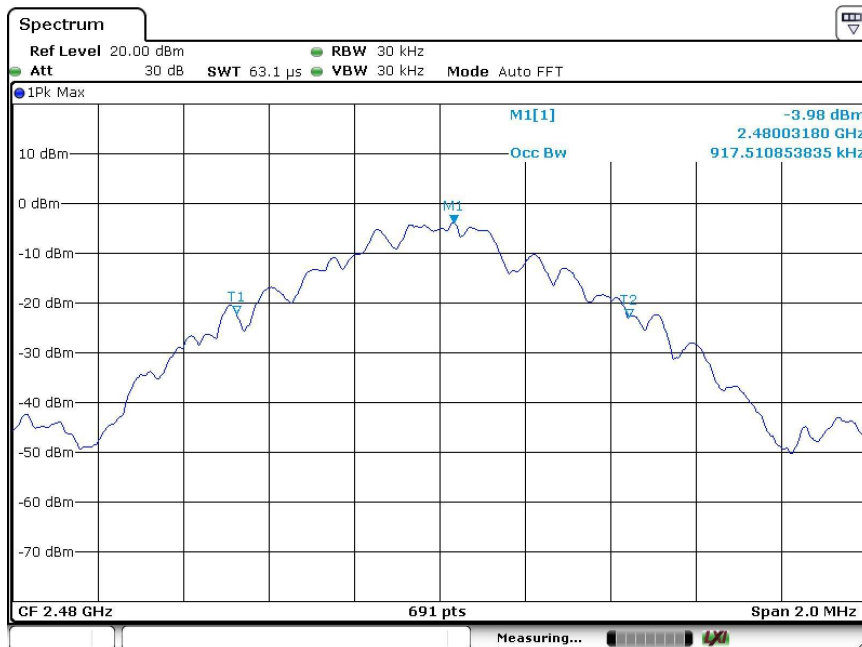
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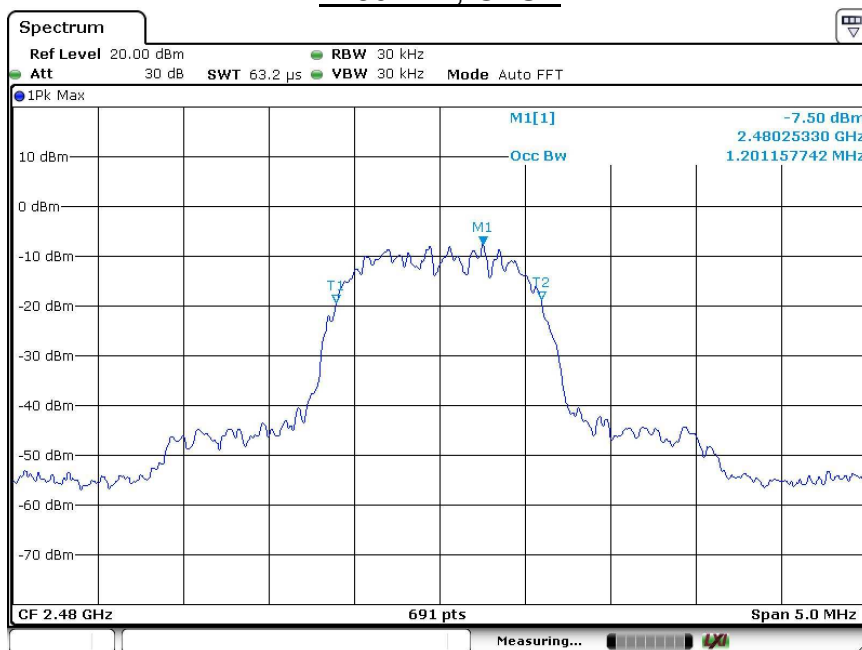
TEST REPORT

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2480MHz, GFSK



2480MHz, $\pi/4$ DQPSK

FCC ID: 2ADFF-KSFRPL
IC: 23562-KSFRPL



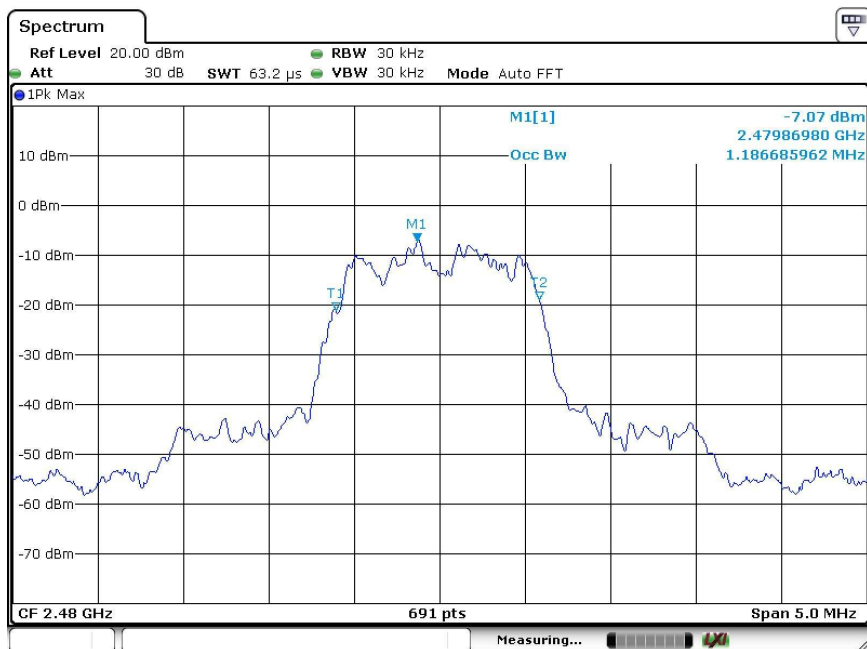
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2480MHz, 8DPSK

***** End of Report *****

FCC ID: 2ADFF-KSFRPL
IC: 23562-KSFRPL