FCC/IC - TEST REPORT

Report Number	:	**68.950.15.254.01**	Date of Issue:	October 28, 2015

Model	:	**HB24TX**
Product Type	:	Baby Monitor
Applicant	:	Shenzhen Videotimes Technology Co., Ltd.
Address	:	Jinmeiwei First Industry Park, Xingye West Road, Bao'an District, Shenzhen, China
Production Facility	:	Shenzhen Videotimes Technology Co., Ltd.
Address	:	Jinmeiwei First Industry Park, Xingye West Road, Bao'an District, Shenzhen, China
Test Result	:	■ **Positive** ☐ **Negative**
Total pages including Appendices	:	37

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1 Table of Contents

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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. Shenzhen Branch Building 12&13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District, Shenzhen City, 518052, P. R. China
FCC Registration No.:	502708
IC Registration No:	10320A-1
Telephone:	86 755 8828 6998
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3 Description of the Equipment Under Test

Product:	Baby Monitor
Model no.:	HB24TX
FCC ID:	2AF2R-HB24TX
IC ID:	20674-HB24TX
Rating:	DC 3.7V by Li-ion Battery or 6VDC, 600mA Powered by external power supply Adaptor Input: 100-240VAC, 50/60Hz; 150mA Adaptor Output: 6.0V, 600mA
RF Transmission Frequency:	2403.5-2475.5MHz
No. of Operated Channel:	49
Modulation:	GFSK
Antenna Type:	Integral Antenna
Antenna Gain:	1.2dBi
Description of the EUT:	The Equipment Under Test (EUT) is a Baby Monitor operated at 2.4GHz

Channel List:

Channel	Frequency(MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2403.5	13	2421.5	25	2439.5	37	2457.5
2	2405	14	2423	26	2441	38	2459
3	2406.5	15	2424.5	27	2442.5	39	2460.5
4	2408	16	2426	28	2444	40	2462
5	2409.5	17	2427.5	29	2445.5	41	2463.5
6	2411	18	2429	30	2447	42	2465
7	2412.5	19	2430.5	31	2448.5	43	2466.5
8	2414	20	2432	32	2450	44	2468
9	2415.5	21	2433.5	33	2451.5	45	2469.5
10	2417	22	2435	34	2453	46	2471
11	2418.5	23	2436.5	35	2454.5	47	2472.5
12	2420	24	2438	36	2456	48	2474
						49	2475.5

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2014 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators
RSS-Gen Issue 4 November 2014	General Requirements for the Certification of Radio Apparatus
RSS-247 Issue 1 May 2015	RSS-247 —Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

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 (2014).

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5 Summary of Test Results

Technical Requirements							
FCC Part 15 Subpart C, RSS-Gen, RSS-247							
Test Condition			Pages	Test Site	Test Result		
					Pass	Fail	N/A
§15.207	RSS-GEN A8.8	Conducted emission AC power port	10	Site 1	☒	☐	☐
§15.247 (b) (1)	RSS-247 5.4(4)	Conducted peak output power	13	Site 1	☒	☐	☐
§15.247(a)(1)	RSS-247 5.1(2)	20dB bandwidth	15	Site 1	☒	☐	☐
§15.247(a)(1)	RSS-247 5.1(2)	Carrier frequency separation	18	Site 1	☒	☐	☐
§15.247(a)(1)(iii)	RSS-247 5.1(3)	Number of hopping frequencies	20	Site 1	☒	☐	☐
§15.247(a)(1)(iii)	RSS-247 5.1(3)	Dwell Time	22	Site 1	☒	☐	☐
§15.247(a)(2)	RSS-247 5.2 (1)	6dB bandwidth	---	---	☐	☐	☒
§15.247(e)	RSS-247 5.2 (2)	Power spectral density	---	---	☐	☐	☒
§15.247(d)	RSS-247 5.5	Spurious RF conducted emissions	26	Site 1	☒	☐	☐
§15.247(d)	RSS-247 5.5	Band edge	30	Site 1	☒	☐	☐
§15.247(d) & §15.209	RSS-247 5.5 & RSSGEN 6.13	Spurious radiated emissions for transmitter	32	Site 1	☒	☐	☐
§15.203	RSSGEN 8.3	Antenna requirement	See note 2		☒	☐	☐

Note 1: N/A=Not Applicable.
Note 2: The EUT uses an integral antenna, which gain is 1.2dBi. In accordance to §15.203 and § RSSGEN 8.3, 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: 2AF2R-HB24TX, IC: 20674-HB24TX complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules, RSS-Gen and RSS-210.

SUMMARY:

All tests according to the regulations cited on page 5 were

■ - Performed

☐ - **Not** Performed

The Equipment Under Test

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

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

Sample Received Date: September 21, 2015

Testing Start Date: September 21, 2015

Testing End Date: October 19, 2015

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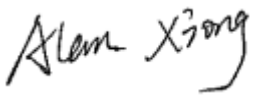
Reviewed by:

John Zhi
EMC Project Manager

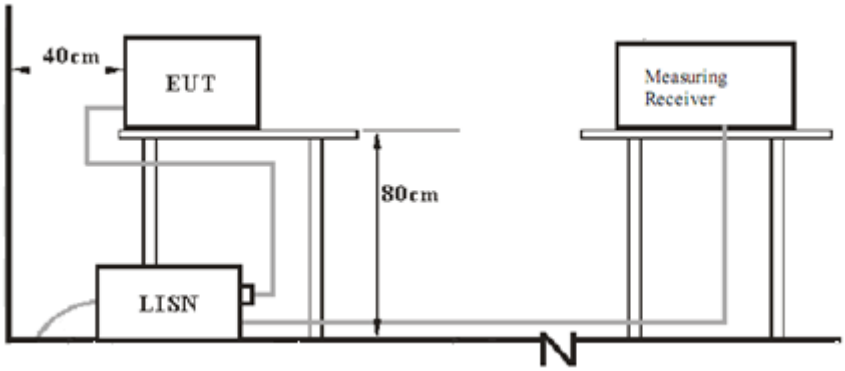
Prepared by:



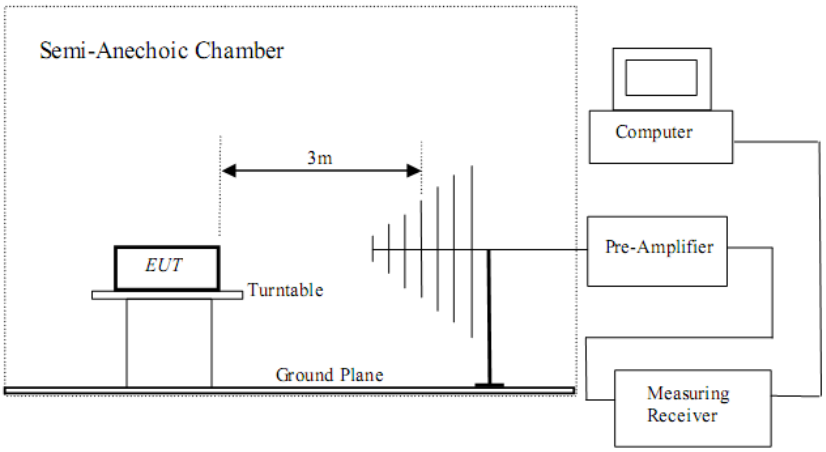
Alan Xiong
EMC Project Engineer

7 Test Setups

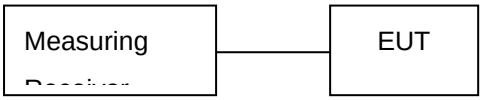
7.1 AC Power Line Conducted Emission test setups



7.2 Radiated test setups



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)
---	---	---	---

Test software 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

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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

According to §15.207 & RSS-GEN A8.8, conducted emissions limit as below:

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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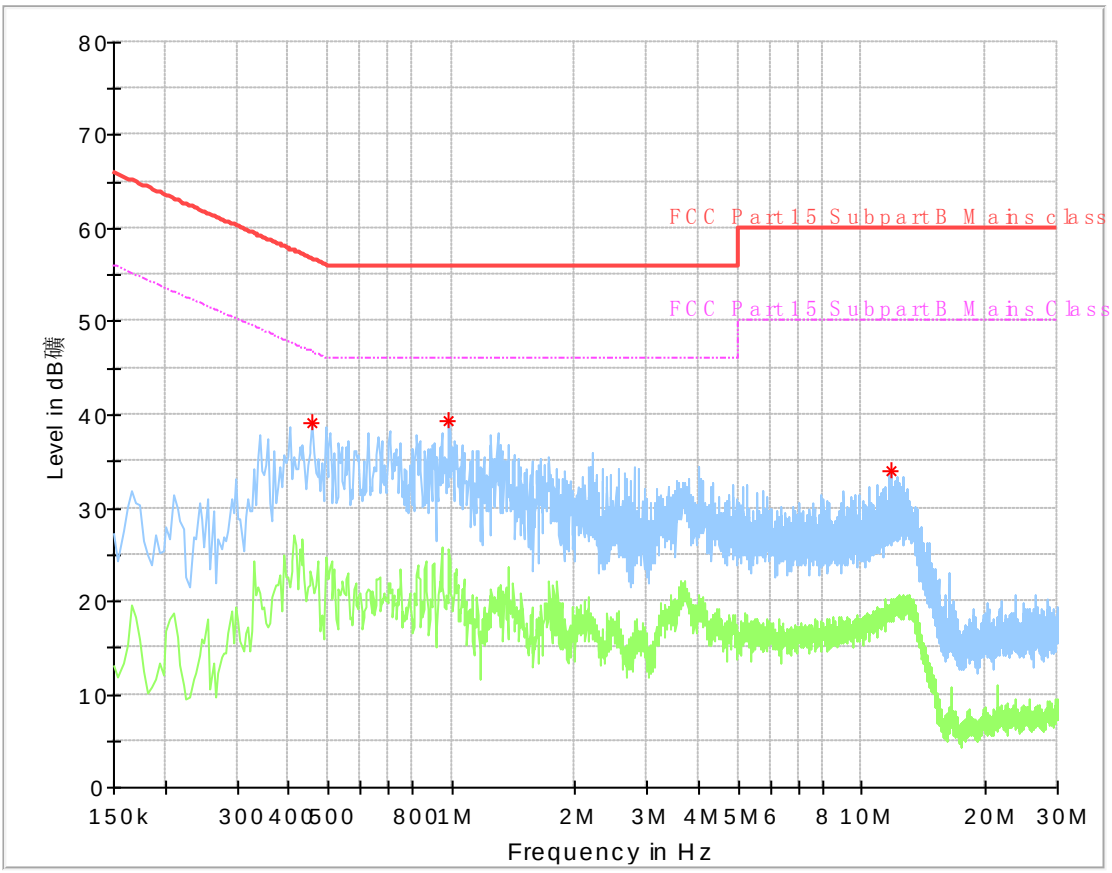
Product Type	:	Baby Monitor
M/N	:	HB24TX
Operating Condition	:	Transmitting
Test Specification	:	Line
Comment	:	AC 120V/60Hz
Remark	:	Model:RJ-AS060600U002



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line
0.458000	39.11	---	56.73	17.62	L1
0.986000	39.45	---	56.00	16.55	L1
11.794000	34.09	---	60.00	25.91	L1

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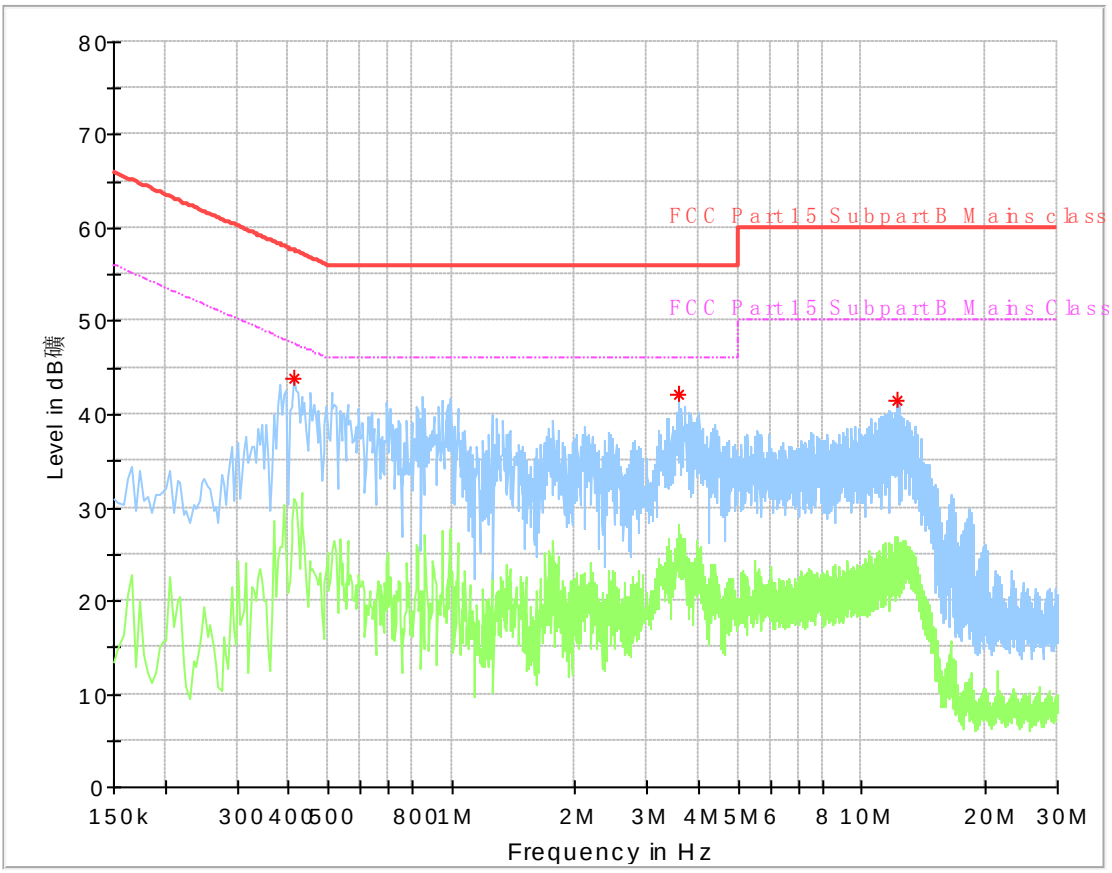
Product Type	:	Baby Monitor
M/N	:	HB24TX
Operating Condition	:	Transmitting
Test Specification	:	Neutral
Comment	:	AC 120V/60Hz
Remark	:	Model:RJ-AS060600U002



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line
0.414000	43.83	---	57.57	13.74	N
3.594000	42.05	---	56.00	13.95	N
12.150000	41.51	---	60.00	18.49	N

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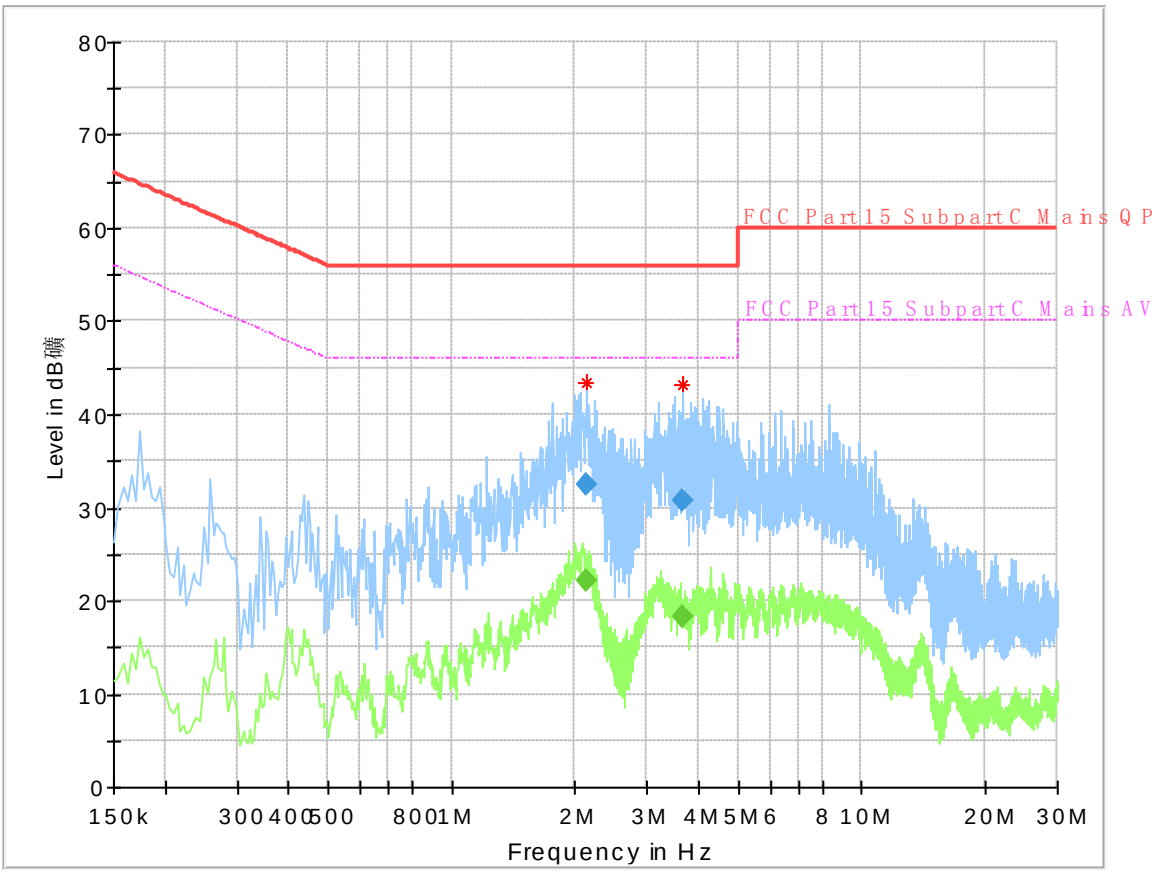
Product Type	:	Baby Monitor
M/N	:	HB24TX
Operating Condition	:	Transmitting
Test Specification	:	Line
Comment	:	AC 120V/60Hz
Remark	:	Model:RJ-AS060600U003



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line
2.129500	---	22.19	46.00	23.81	L1
2.129500	32.53	---	56.00	23.47	L1
3.665500	---	18.38	46.00	27.62	L1
3.665500	30.84	---	56.00	25.16	L1

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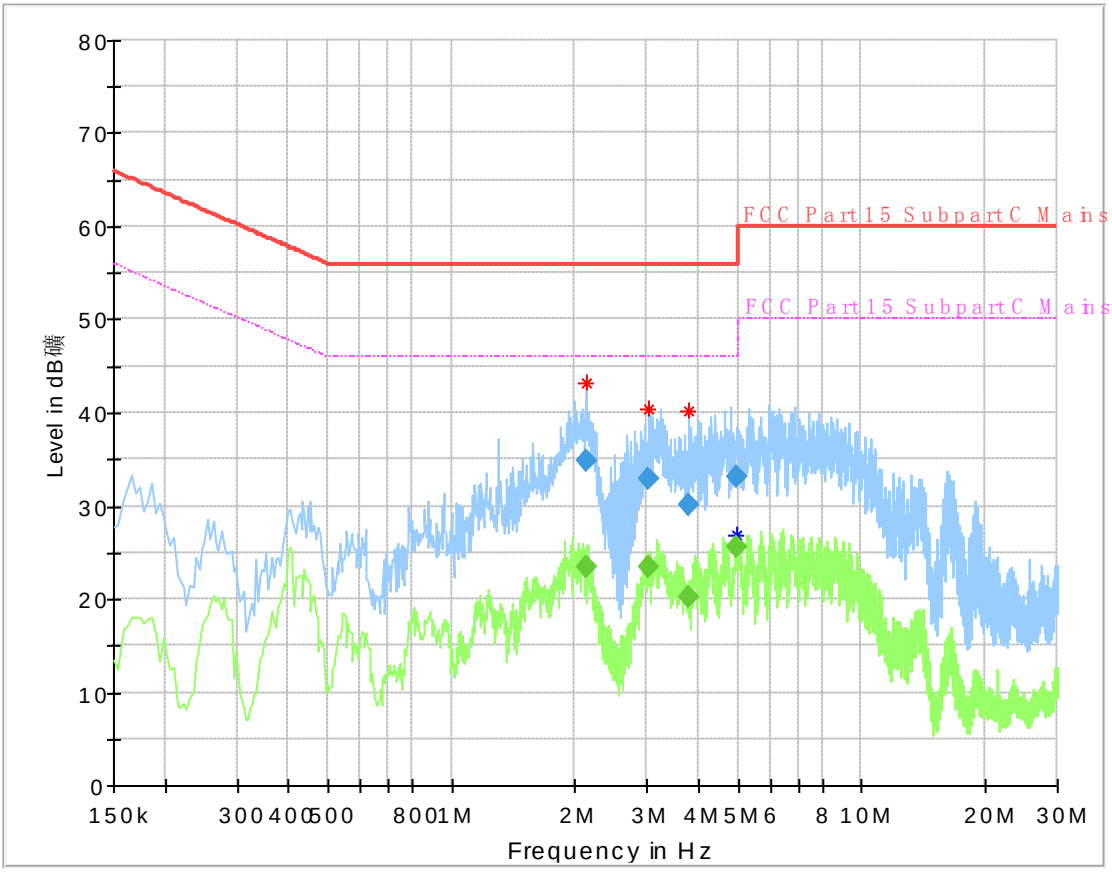
Product Type	:	Baby Monitor
M/N	:	HB24TX
Operating Condition	:	Transmitting
Test Specification	:	Neutral
Comment	:	AC 120V/60Hz
Remark	:	Model:RJ-AS060600U003



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line
2.125500	---	23.37	46.00	22.63	N
2.125500	34.90	---	56.00	21.10	N
3.021500	---	23.37	46.00	22.63	N
3.021500	32.99	---	56.00	23.01	N
3.765500	---	20.24	46.00	25.76	N
3.765500	30.17	---	56.00	25.83	N
4.977500	---	25.54	46.00	20.46	N
4.977500	33.15	---	56.00	22.85	N

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9.2 Conducted peak output power

Test Method

1. Use the following spectrum analyzer settings:
   Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
   RBW > the 20 dB 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

According to §15.247 (b) (1) & RSS-247 5.4(4), conducted peak output power limit as below:

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

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Conducted peak output power

GFSK modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2403.5MHz	15.92	Pass
Middle channel 2462MHz	16.35	Pass
High channel 2475.5MHz	16.30	Pass

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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

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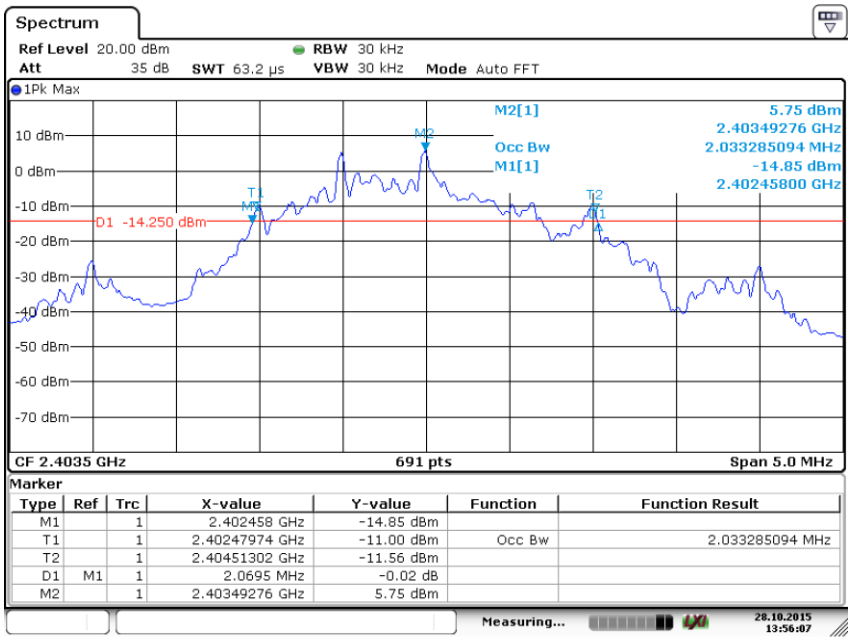
20 dB bandwidth

GFSK Modulation test result

Frequency MHz	20 dB Bandwidth kHz	Limit kHz	Result
2403.5	2069.5	--	Pass
2462	2083.9	--	Pass
2475.5	2076.7	--	Pass



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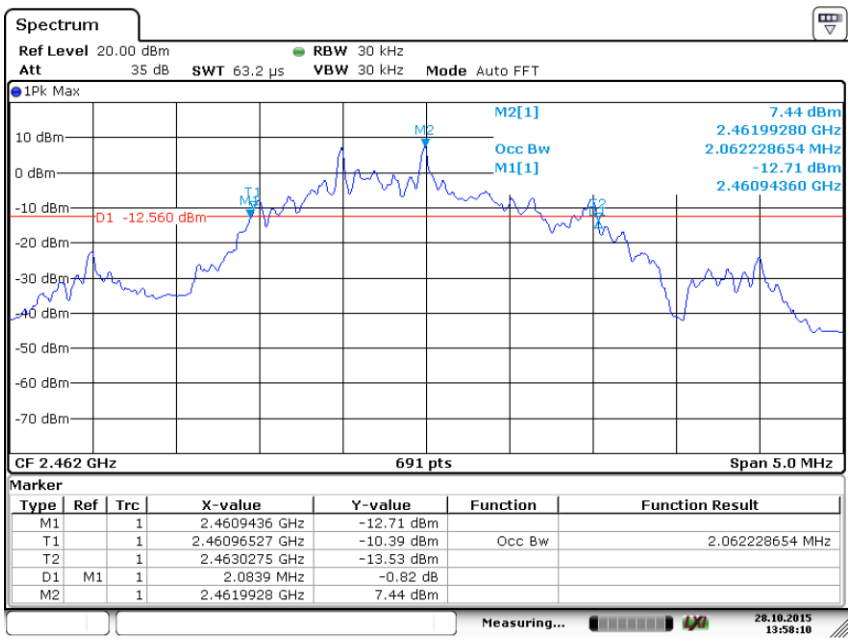

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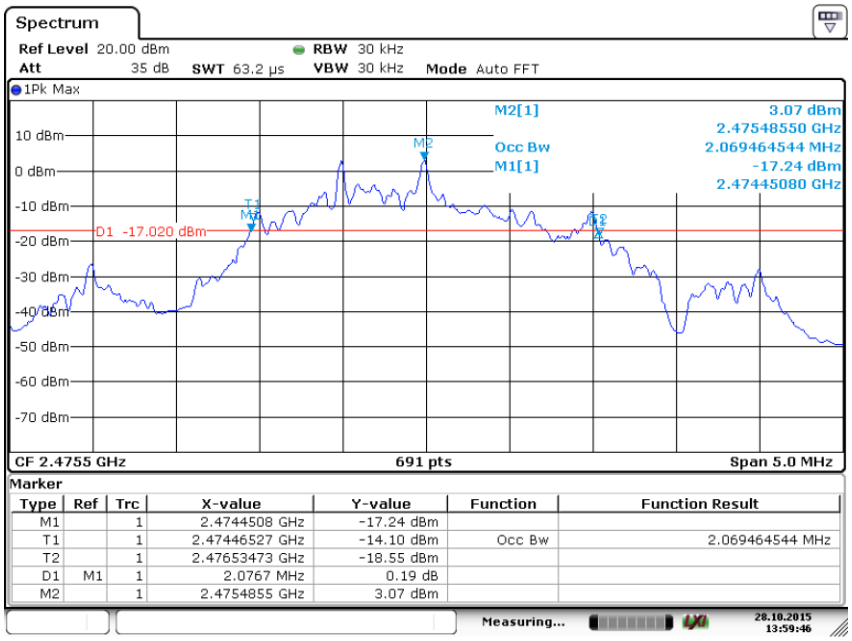
20 dB bandwidth



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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

GFSK Modulation Limit

Frequency MHz	2/3 of 20 dB Bandwidth kHz
2403.5	1379.7
2462	1389.3
2475.5	1384.5

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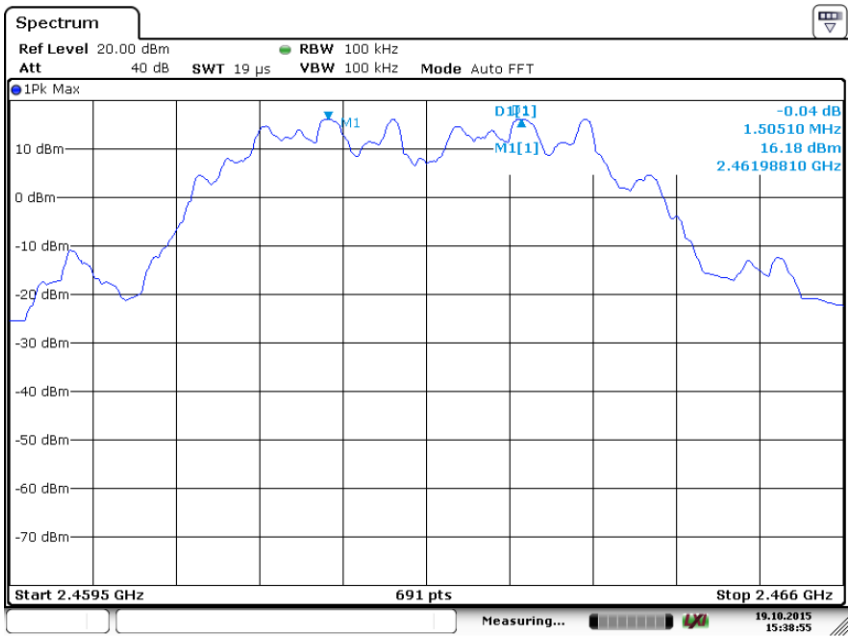
Carrier Frequency Separation

Test result: The measurement was performed with the typical configuration (normal hopping status), here GFSK modulation mode was used to show compliance.

GFSK Modulation test result

Frequency MHz	Carrier Frequency Separation kHz	Result
2462	1505.1	Pass



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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

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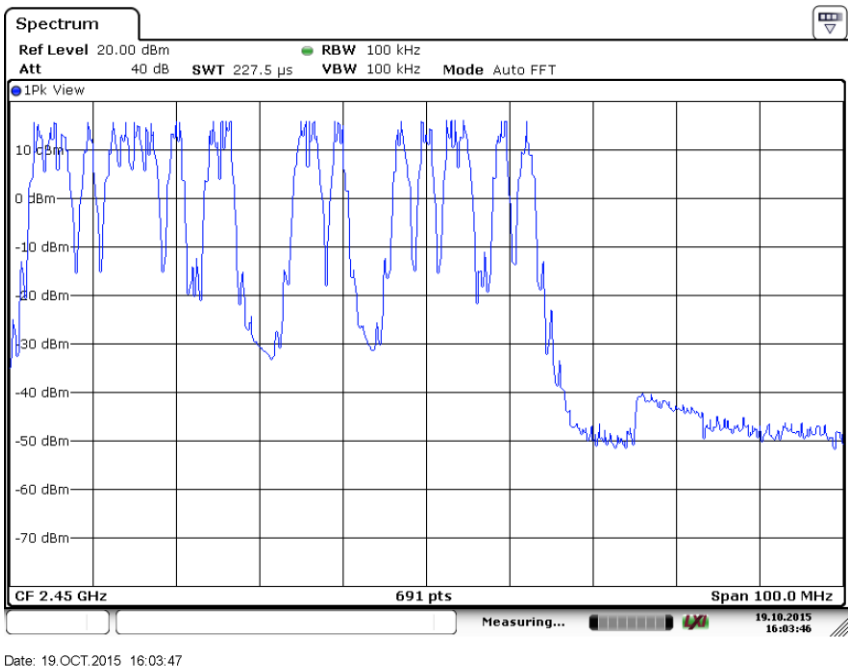
Number of hopping frequencies

Test result: The measurement was performed with the typical configuration (normal hopping status), Here GFSK modulation mode was used to show compliance.

Number of hopping frequencies	Result
20	Pass



Remark: The number of total hopping frequencies up to 49 and only 20 channels will hopping at the same time.

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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

According to §15.247(a)(1)(iii) & RSS-210 A8.1(c) 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.
We test all mode and worse case recorded in the report.

The Dwell Time = Burst Width * Total Hops. The detailed calculations are showed as follows:
The duration for dwell time calculation: 0.4 [s] * hopping number = 0.4 [s] * 20 [ch] = 8.0 [s*ch];

The burst width, which is directly measured, refers to the duration on one channel hop.

The maximum number of hopping channels in 8.0s =9*(8.0/0.8) =90

Test Result

Modulation	Frequency	Reading (ms)	Total Hops	Test Result (ms)	Limit (ms)	Result
GFSK	2403.5MHz	3.7681	90	339.129	< 400	Pass
GFSK	2462MHz	3.7681	90	339.129	< 400	Pass
GFSK	2475.5MHz	3.7681	90	339.129	< 400	Pass

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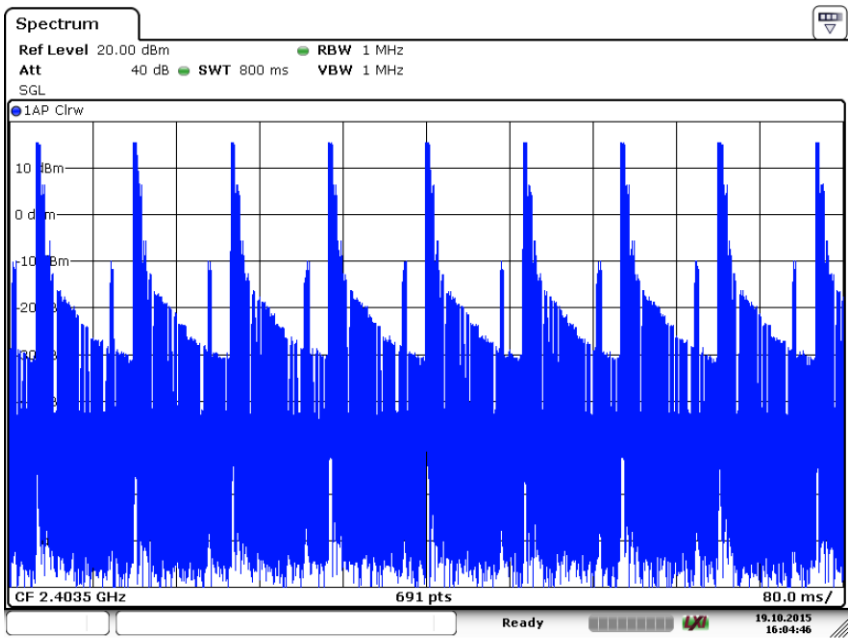
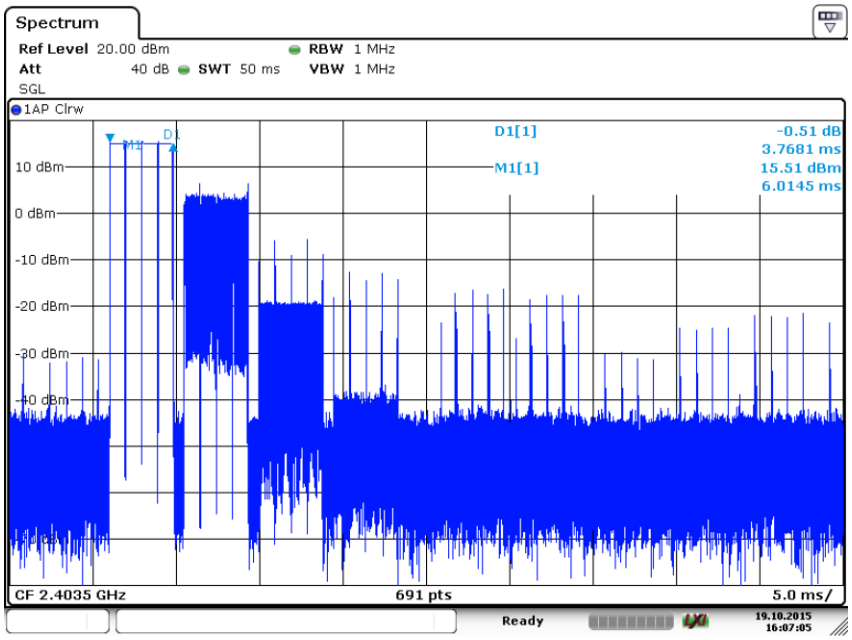
GFSK Modulation-2403.5MHz



Date: 19.OCT.2015 16:04:47



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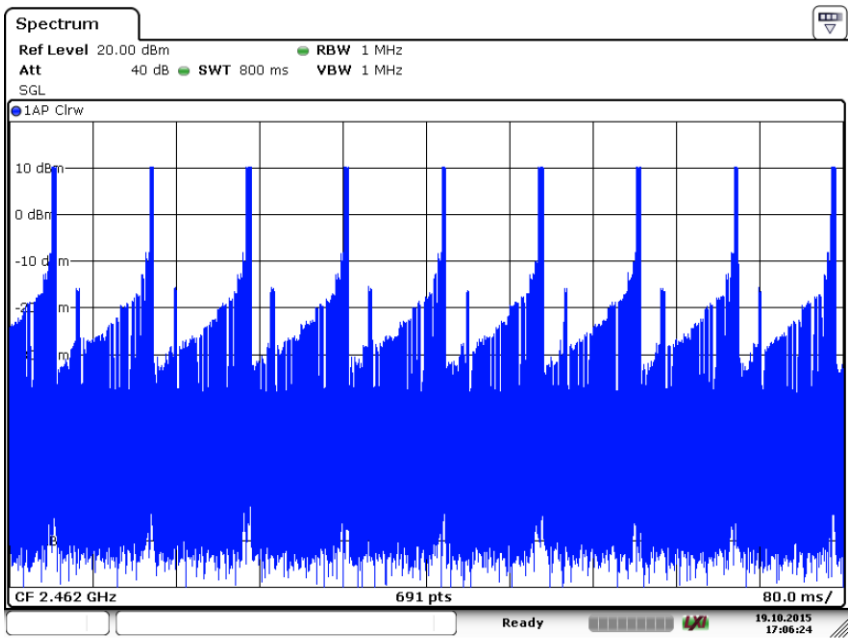
GFSK Modulation-2462MHz



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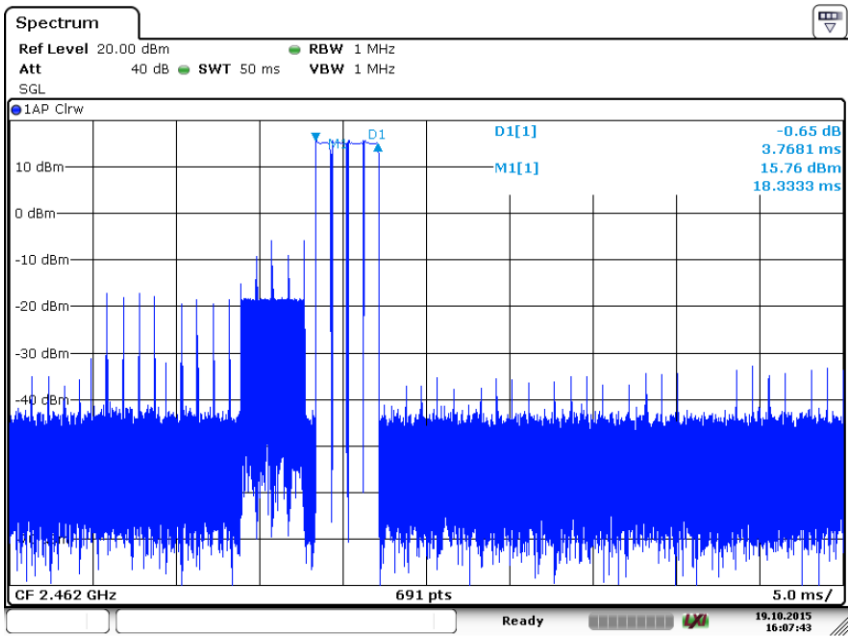

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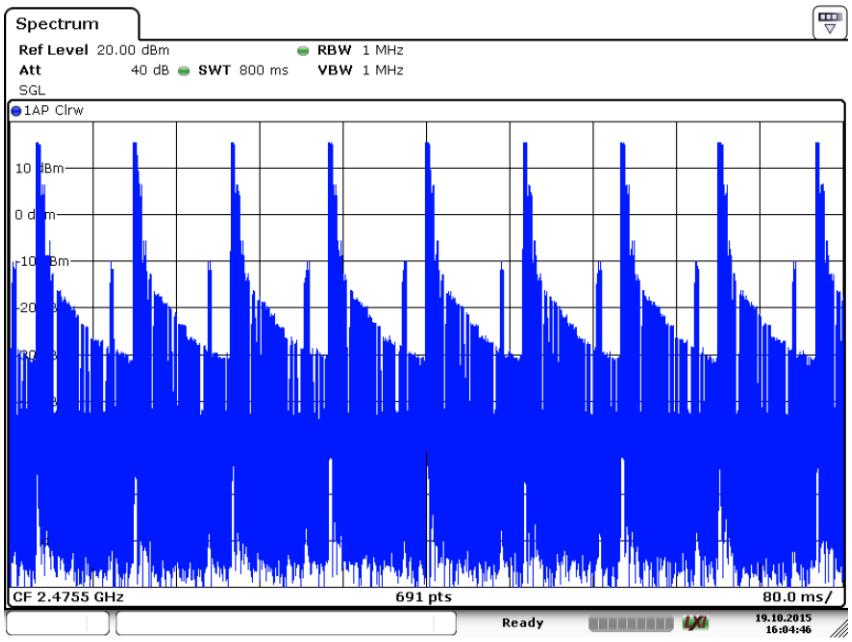
GFSK Modulation-2475.5MHz



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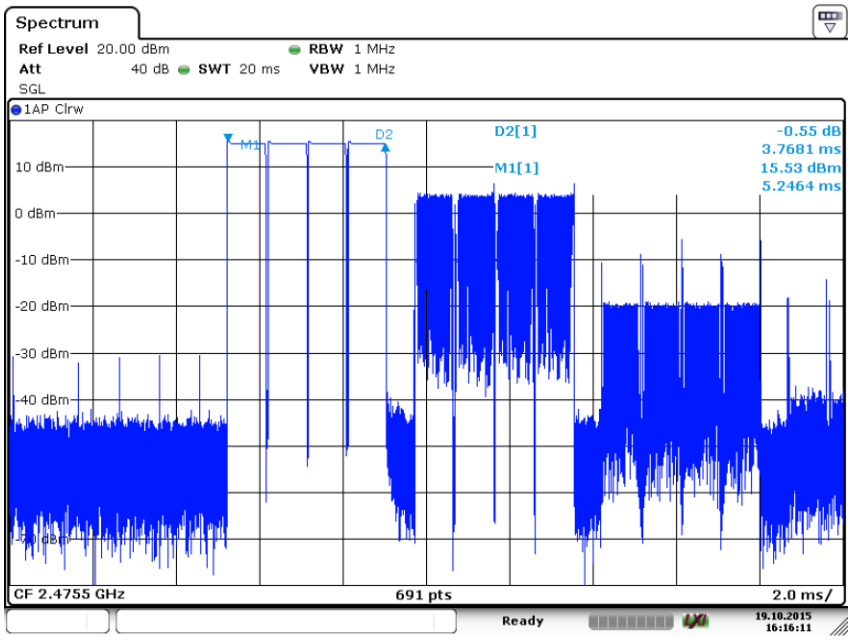

Date: 19.OCT.2015 16:16:11

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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

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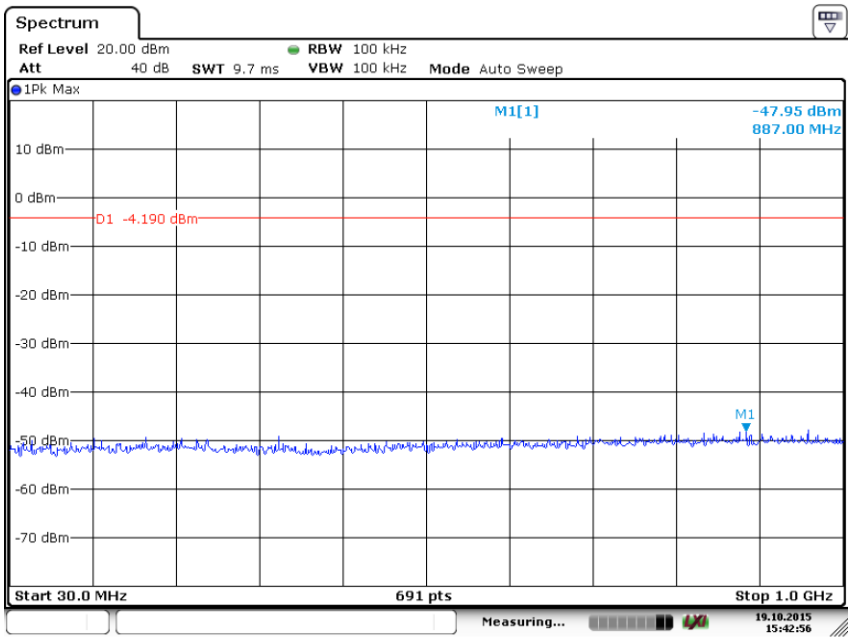
Spurious RF conducted emissions

2403.5MHz



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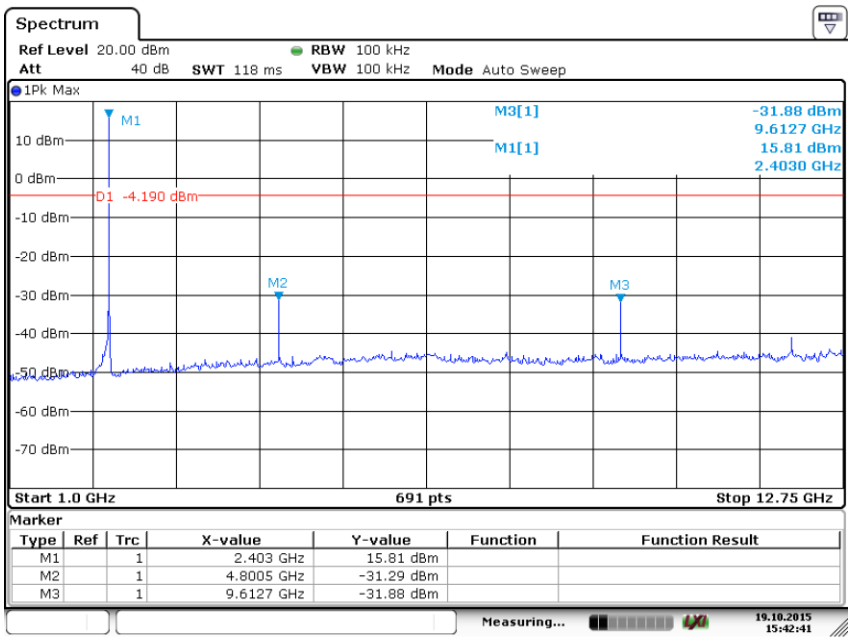

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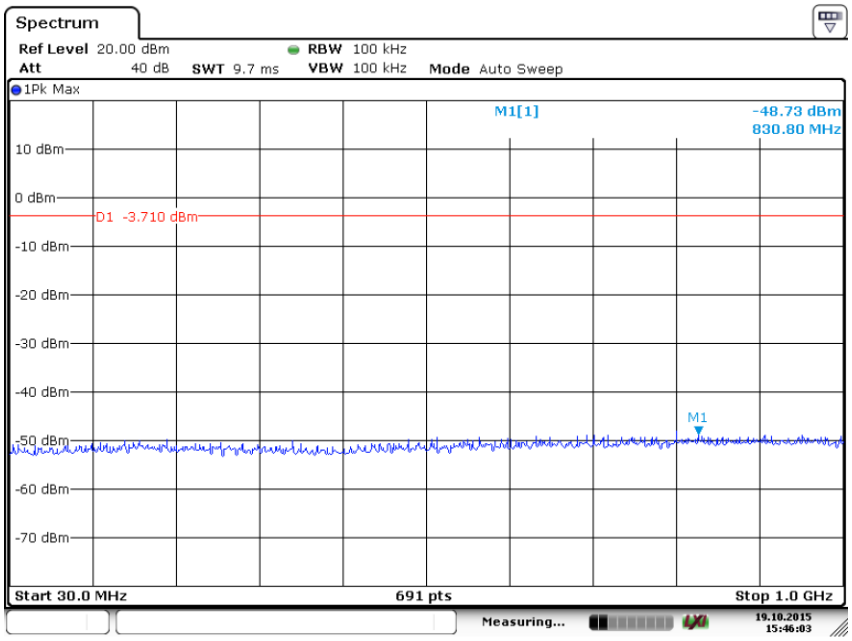
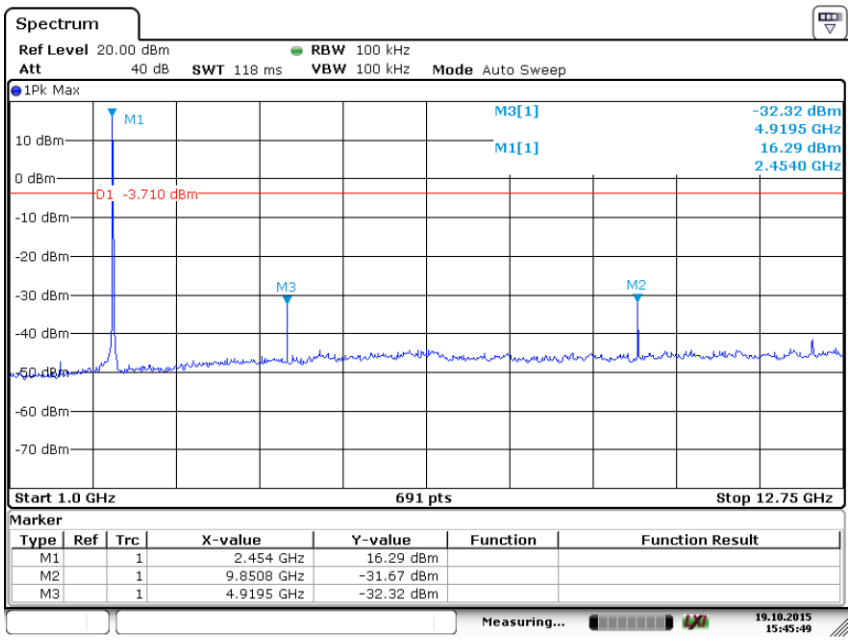
Spurious RF conducted emissions

2462MHz



Date: 19.OCT.2015 15:46:03



Date: 19.OCT.2015 15:45:50

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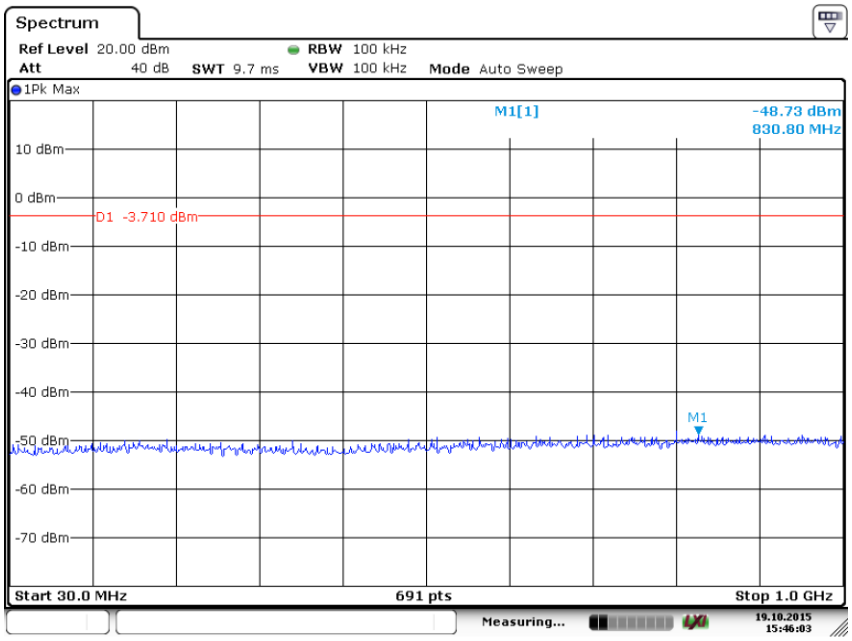
Spurious RF conducted emissions

2475.5MHz



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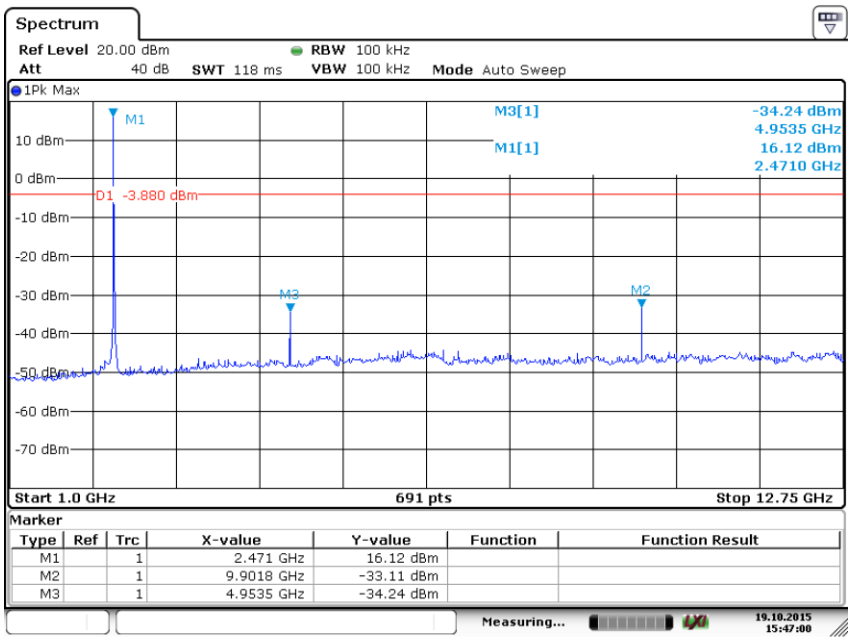

Date: 19.OCT.2015 15:47:00

Remark: Testing is carried out with frequency rang 30MHz to 25GHz, which above 12.75GHz are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

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:

According to §15.247(d) & RSS-210 A8.5, 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) and RSS-Gen7.2.2, must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)) and RSS-Gen.

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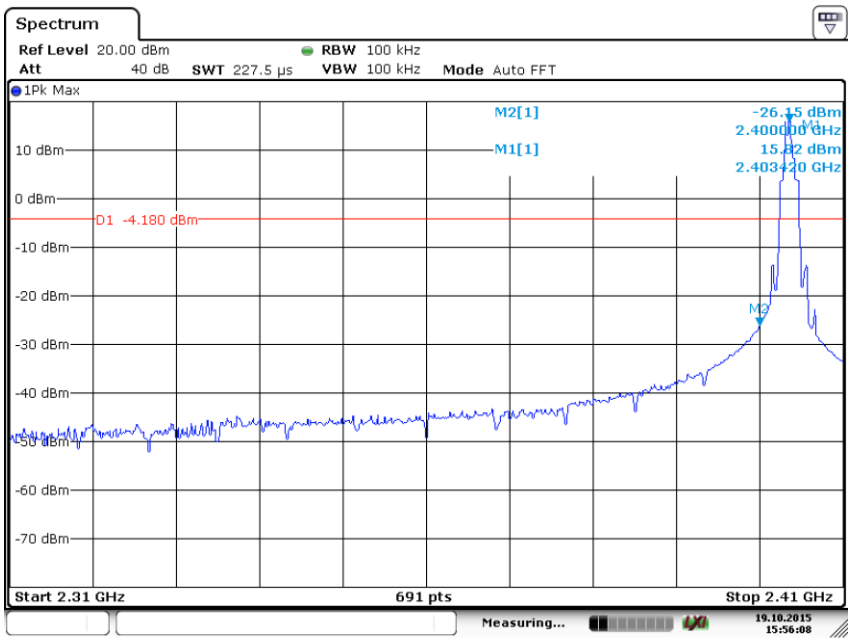
Band edge testing

GFSK Modulation Test Result:



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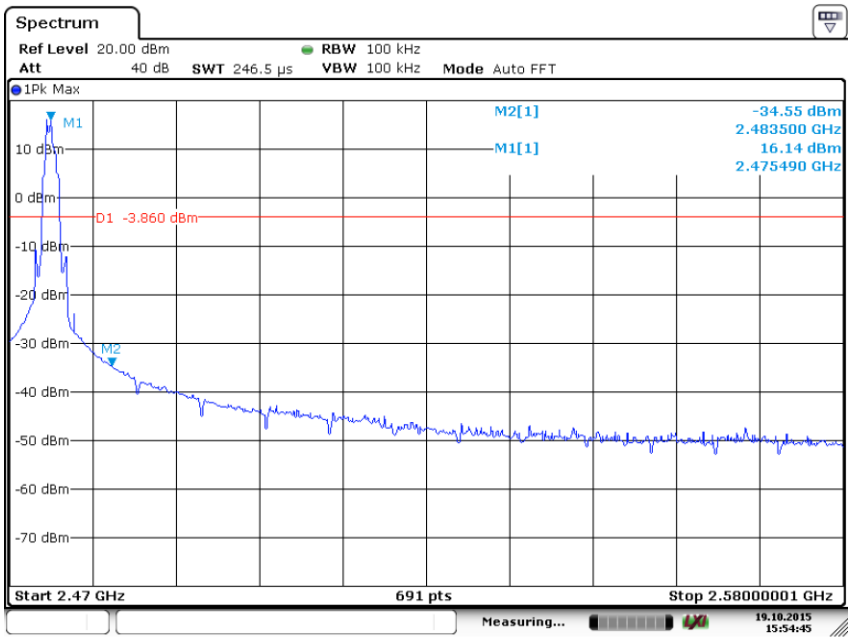

Date: 19.OCT.2015 15:54:45

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9.9 Spurious radiated emissions for transmitter

Test Method

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
3. Use the following spectrum analyzer settings:
   Span = wide enough to fully capture the emission being measured, RBW = 1 MHz for f ≥ 1GHz, 100 kHz for f < 1 GHz, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Follow the guidelines in ANSI C63.4-2009 with respect to maximizing the emission by rotating the EUT, adjusting the measurement antenna height and polarization, etc.
   The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, submit this data. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
5. Set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the duty cycle per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”, derived from 20log(duty cycle/100 ms), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Limit

According to part 15.247(d) & RSS-247 5.5, 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 & RSSGEN 6.13.

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

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Spurious radiated emissions for transmitter

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, GFSK mode) test result is listed in the report.

Transmitting spurious emission test result as below:

GFSK Modulation 2403.5MHz Test Result:

Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
MHz	dBuV/m		dBμV/m		dBuV/m	
143.978	32.84	Horizontal	43.50	QP	10.66	Pass
149.31	32.45	Horizontal	43.50	QP	11.05	Pass
208.00	25.86	Horizontal	43.50	QP	17.64	Pass
53.28	29.19	Vertical	40.00	QP	10.81	Pass
149.31	35.62	Vertical	43.50	QP	7.88	Pass
197.33	29.11	Vertical	43.50	QP	14.39	Pass
*4807	48.69	Horizontal	74	PK	25.31	Pass
*4807	34.02	Horizontal	54	AV	19.98	Pass
7210.5	55.24	Horizontal	74	PK	18.76	Pass
7210.5	39.40	Horizontal	54	AV	14.6	Pass
9614	57.96	Horizontal	74	PK	16.04	Pass
9614	42.82	Horizontal	54	AV	11.18	Pass
*12017.5	53.75	Horizontal	74	PK	20.25	Pass
*12017.5	50.20	Horizontal	54	AV	3.80	Pass
*4807	52.18	Vertical	74	PK	21.82	Pass
*4807	37.27	Vertical	54	AV	16.73	Pass
7210.5	51.22	Vertical	74	PK	22.78	Pass
7210.5	36.84	Vertical	54	AV	17.16	Pass
9614	58.87	Vertical	74	PK	15.13	Pass
9614	43.92	Vertical	54	AV	10.08	Pass
*12017.5	50.90	Vertical	74	PK	23.10	Pass
*12017.5	36.27	Vertical	54	AV	17.73	Pass

Remark:

(1) AV Emission Level= PK Emission Level+20log(dutycycle)
(2) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
(3) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.

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10 Test Equipment List

List of Test Instruments

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2016-7-24
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2016-8-14
Horn Antenna	Rohde & Schwarz	HF907	102294	2016-7-24
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2016-7-24
3m Semi-anechoic chamber	TDK	9X6X6	----	2019-5-29

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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:

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Radiated Spurious Emission 25MHz-3000MHz	Horizontal: 4.95dB; Vertical: 5.02dB;
Uncertainty for Radiated Spurious Emission 3000MHz-18000MHz	Horizontal: 4.89dB; Vertical: 4.88dB;
Uncertainty for Radiated Spurious Emission 18000MHz-40000MHz	Horizontal: 4.93dB; Vertical: 4.92dB;
Uncertainty for Conducted RF test	Power level test involved: 2.04dB Frequency test involved:1.1×10^{-7}

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