FCC/IC - TEST REPORT

Report Number	:	**68.950.16.624.02**	Date of Issue:	**May 22, 2017**
Model	:	**MBP49BU**		
Product Type	:	Digital Video Baby monitor		
Applicant	:	Binatone Electronics International Limited		
Address	:	Floor 23A, 9 Des Voeux Road West, Sheung Wan, Hong Kong		
Manufacturer	:	Binatone Electronics International Limited		
Address	:	Floor 23A, 9 Des Voeux Road West, Sheung Wan, Hong Kong		
Test Result	:	■ **Positive** ☐ **Negative**		
Total pages including Appendices	:	**36**		

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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:	Digital Video Baby monitor
Model no.:	MBP49BU
Brand Name:	motorola
FCC ID:	VLJ-MBP49BU
IC ID:	4522A-MBP49BU
Options and accessories:	NIL
Rating:	5VDC, 1A Powered by external power supply Adapter Model: S006AKU0500100 Adaptor Input: 100-240VAC, 50/60Hz; 200mA Adaptor Output: 5.0VDC, 1000mA
RF Transmission Frequency:	2402-2479MHz
No. of Operated Channel:	23
Modulation:	GFSK
Antenna Type:	Integral Antenna
Antenna Gain:	0dBi
Description of the EUT:	The Equipment Under Test (EUT) is a baby monitor operated at 2.4GHz

Channel List:

CH1=2402MHz	CH2=2404MHz	CH3=2406MHz
CH4=2408MHz	CH5=2410MHz	CH6=2415MHz
CH7=2420MHz	CH8=2425MHz	CH9=2430MHz
CH10=2435MHz	CH11=2440MHz	CH12=2445MHz
CH13=2450MHz	CH14=2455MHz	CH15=2460MHz
CH16=2465MHz	CH17=2467MHz	CH18=2469MHz
CH19=2471MHz	CH20=2473MHz	CH21=2475MHz
CH22=2477MHz	CH23=2479MHz	

Remark: The product will only use 22 Channels (from Channel 1 to Channel 22) under normal operating condition. The last one Channel (Channel 23) is only used in matching mode.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2016 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 2 May 2017	RSS-247 —Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-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					
Test Condition			Pages	Test Site	Test Result
§15.207	RSS-GEN A8.8	Conducted emission AC power port	10	Site 1	Pass
§15.247 (b) (1)	RSS-247 5.4(b)	Conducted peak output power	13	Site 1	Pass
§15.247(a)(1)	RSS-247 5.1(a)	20dB bandwidth&99% bandwidth	15	Site 1	Pass
§15.247(a)(1)	RSS-247 5.1(b)	Carrier frequency separation	18	Site 1	Pass
§15.247(a)(1)(iii)	RSS-247 5.1(d)	Number of hopping frequencies	20	Site 1	Pass
§15.247(a)(1)(iii)	RSS-247 5.1(d)	Dwell Time	22	Site 1	Pass
§15.247(a)(2)	RSS-247 5.2 (a)	6dB bandwidth	---	---	N/A
§15.247(e)	RSS-247 5.2 (b)	Power spectral density	---	---	N/A
§15.247(d)	RSS-247 5.5	Spurious RF conducted emissions	26	Site 1	Pass
§15.247(d)	RSS-247 5.5	Band edge	30	Site 1	Pass
§15.247(d) & §15.209	RSS-247 5.5 & RSSGEN 6.13	Spurious radiated emissions for transmitter	35	Site 1	Pass
§15.203	RSSGEN 8.3	Antenna requirement	See note 2		Pass

Note 1: N/A=Not Applicable.
Note 2: The EUT uses an integral antenna, which gain is 0dBi. 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 update base on report 68.950.16.624.01, For MBP49 BU update it Change the PCB and bottom plastic, but he PCB & plastic material are totally same as before, and the RF module including it's antenna gain, output power, hardware and software is totally same as before, so only Spurious radiated emissions for transmitter update in this report, and this report is intended for FCC ID: VLJ-MBP49BU and IC: 4522A-MBP49BU complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules and RSS-Gen and RSS-247.

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: January 21, 2017

Testing Start Date: January 21, 2017

Testing End Date: May 18, 2017

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Reviewed by:

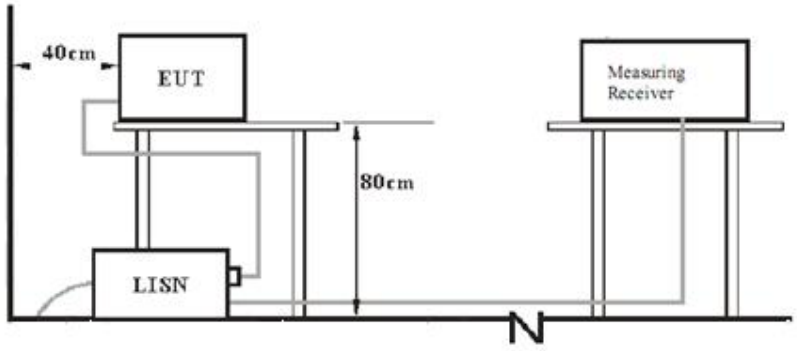
John Zhi
EMC Project Manager

Prepared by:

Leon Zhang
EMC Project Engineer

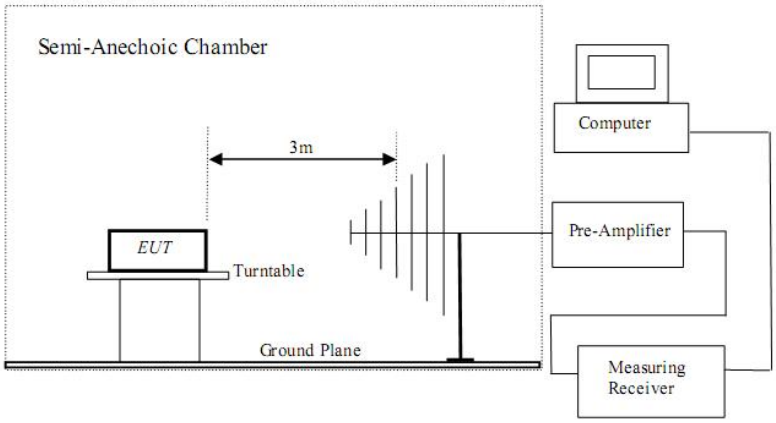
7 Test Setups

7.1 AC Power Line Conducted Emission test setups

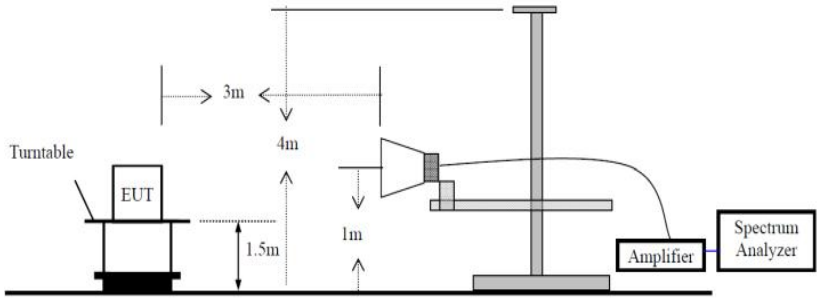


7.2 Radiated test setups

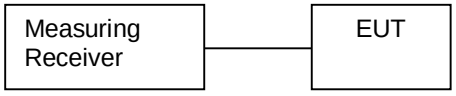
Below 1GHz:



Above 1GHz:



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)
Notebook	Lenovo	X240	---

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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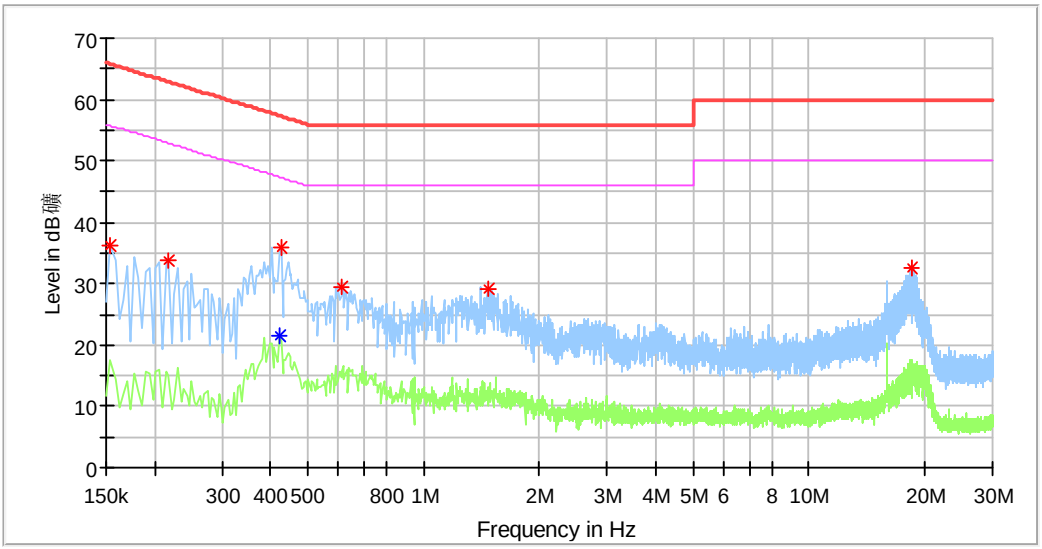
Product Type	:	Digital Video Baby monitor
M/N	:	MBP49 BU
Operating Condition	:	Normal Working
Test Specification	:	Line
Comment	:	AC 120V/60Hz



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.154000	36.08	---	65.78	29.70	L1	9.7
0.218000	33.88	---	62.89	29.01	L1	9.7
0.422000	---	21.53	47.41	25.87	L1	9.7
0.426000	36.00	---	57.33	21.33	L1	9.7
0.614000	29.59	---	56.00	26.41	L1	9.7
1.466000	29.27	---	56.00	26.73	L1	9.7
18.558000	32.47	---	60.00	27.53	L1	10.1

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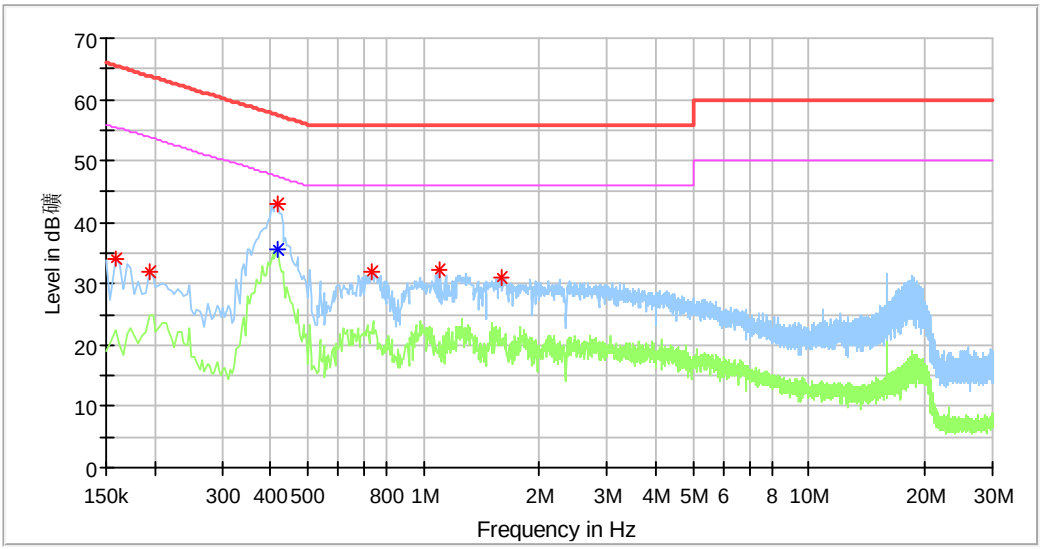
Product Type	:	Digital Video Baby monitor
M/N	:	MBP49 BU
Operating Condition	:	Normal Working
Test Specification	:	Neutral
Comment	:	AC 120V/60Hz



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.158000	34.09	---	65.57	31.48	N	9.6
0.194000	31.86	---	63.86	32.01	N	9.6
0.418000	---	35.66	47.49	11.83	N	9.7
0.418000	42.88	---	57.49	14.61	N	9.7
0.730000	32.02	---	56.00	23.98	N	9.7
1.102000	32.12	---	56.00	23.88	N	9.7
1.586000	31.16	---	56.00	24.84	N	9.7

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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(b), 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 2402MHz	15.23	Pass
Middle channel 2440MHz	16.03	Pass
High channel 2477MHz	16.08	Pass

Remark: The RF module of MBP49BU and MBP50BU are same, only the peripheral circuit is different. And the conducted peak output power of MBP49BU is less than MBP50BU. So we use the MBP50BU's conductive date directly. Radiated Emission test is necessary and indispensable for MBP49BU.

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9.3 20 dB bandwidth and 99% 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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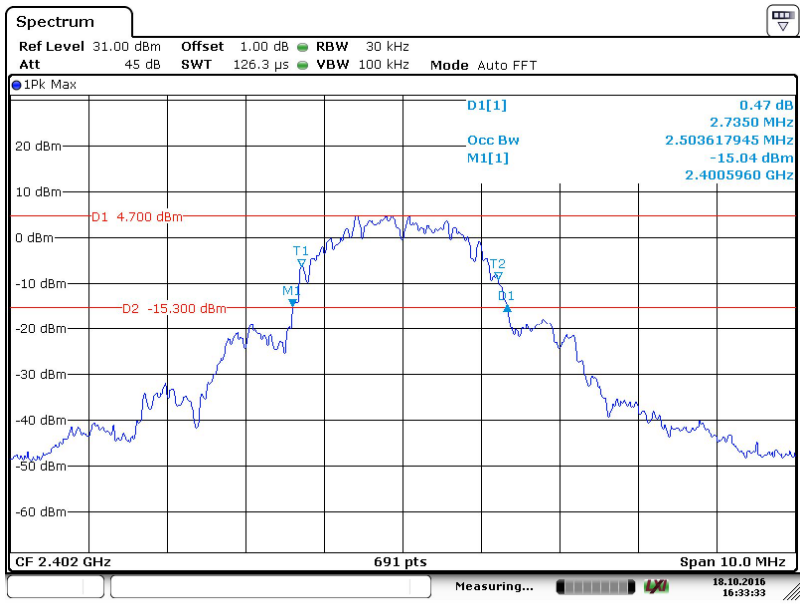
20 dB bandwidth and 99% bandwidth

GFSK Modulation test result

Frequency MHz	20 dB Bandwidth kHz	99% bandwidth kHz	Limit kHz	Result
2402	2735.0	2503.6	--	Pass
2440	2706.0	2547.0	--	Pass
2477	2706.0	2604.9	--	Pass



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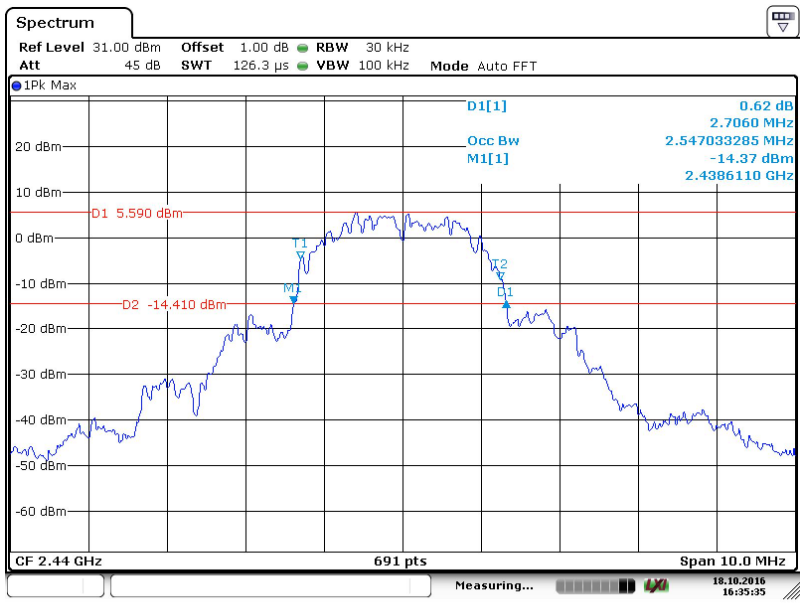

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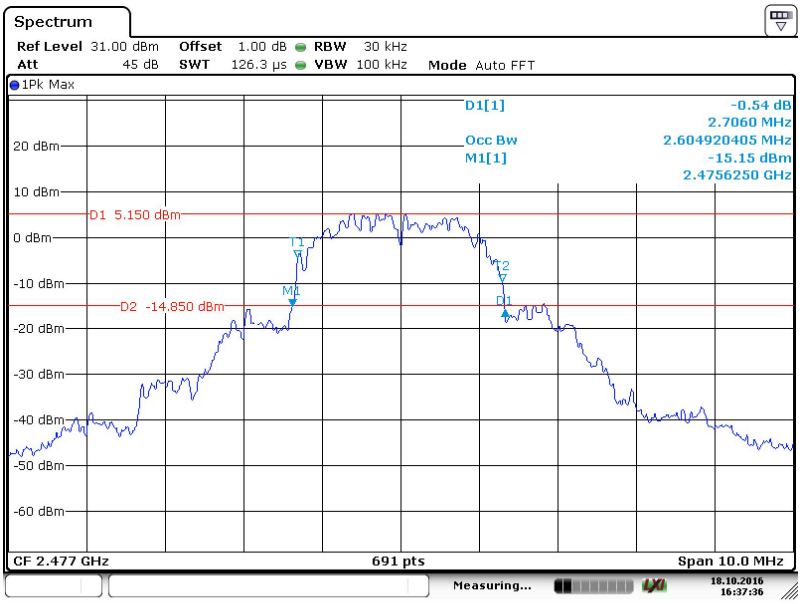
20 dB bandwidth and 99% bandwidth



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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
2402	1823.3
2440	1804.0
2477	1804.0

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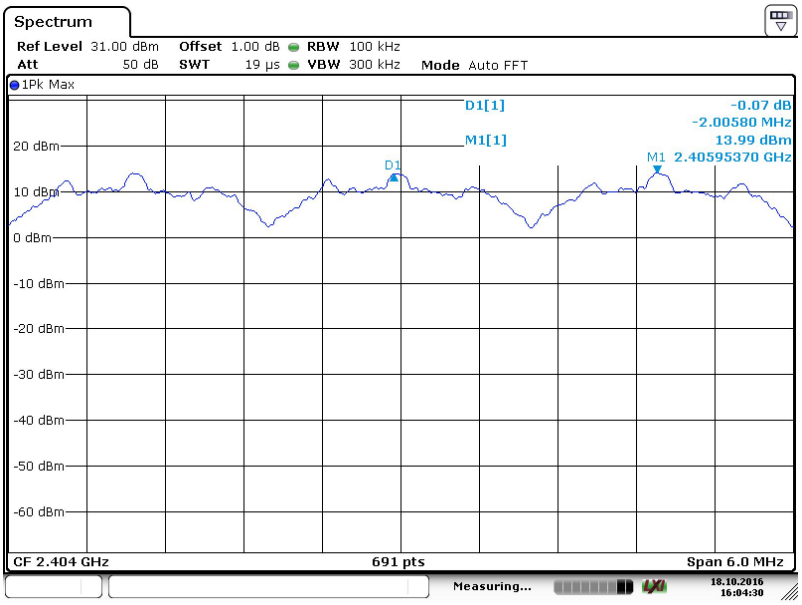
Carrier Frequency Separation

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
2402	2005.8	Pass
2440	5014.0	



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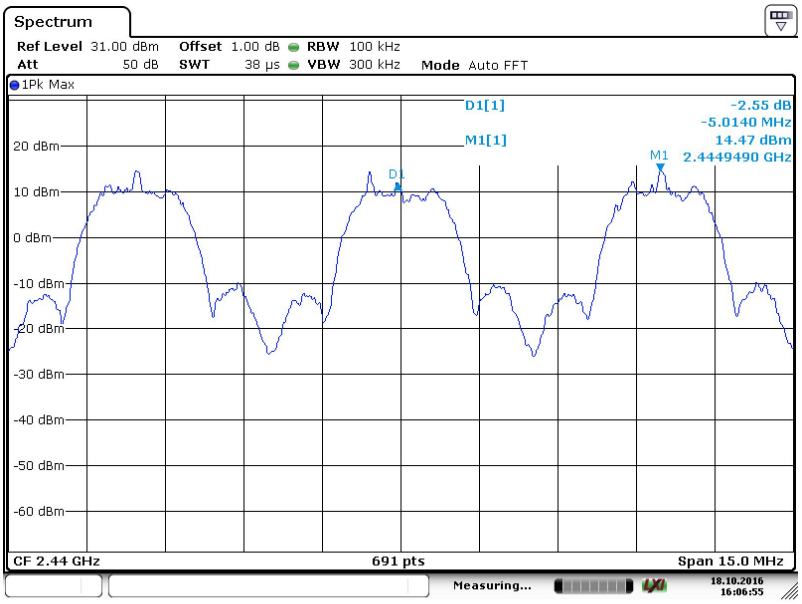

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9.5 Number of hopping frequencies

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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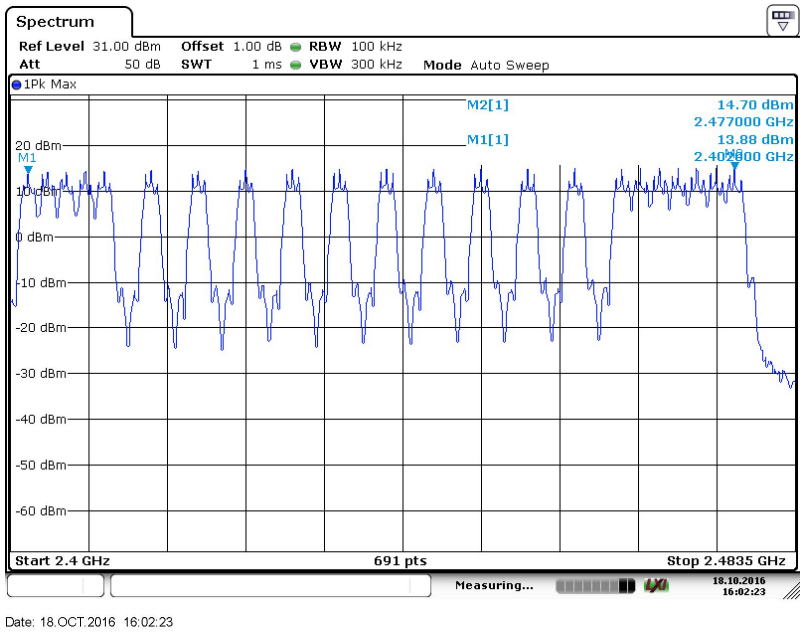
Number of hopping frequencies

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
23	Pass



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Remark: The product will only use 22 Channels (from Channel 1 to Channel 22) under normal operating condition. The last one Channel (Channel 23) is only used in matching mode.

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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 Low frequency, middle frequency and high frequency, only 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] * 22 [ch] = 8.8 [s*ch];

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

The maximum number of hopping channels in 8.8s =28*(8.8/2) =123.2

Test Result

Modulation	Frequency	Reading (ms)	Total Hops	Test Result (ms)	Limit (ms)	Result
GFSK	2440MHz	2.225	123.2	274.12	< 400	Pass

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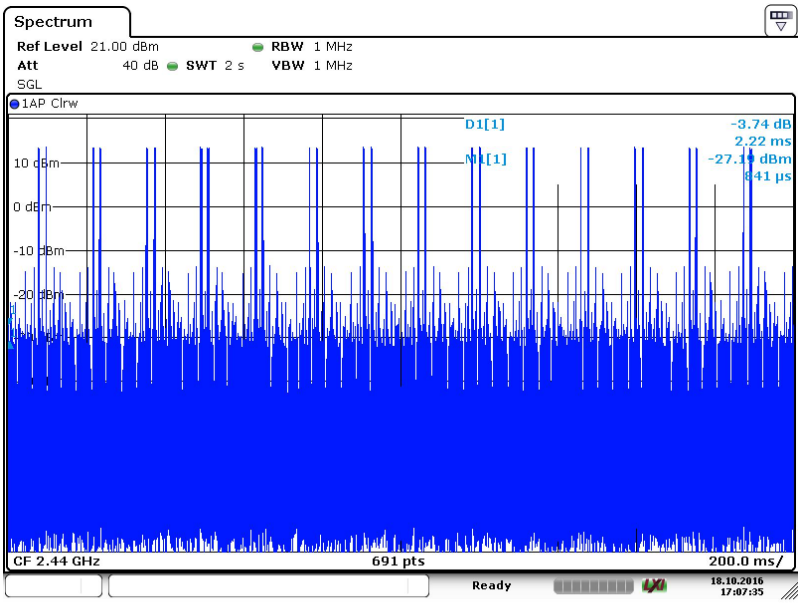
GFSK Modulation-2440MHz



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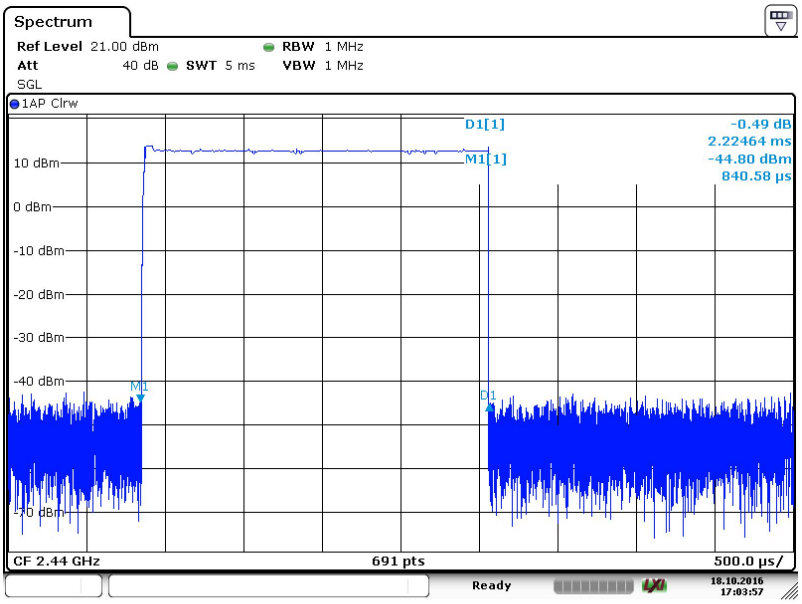

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9.7 Spurious RF conducted emissions

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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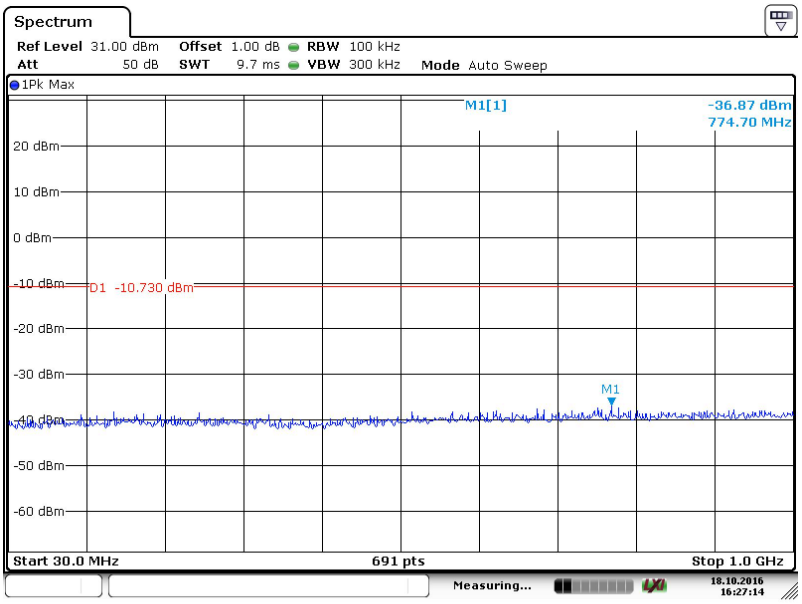
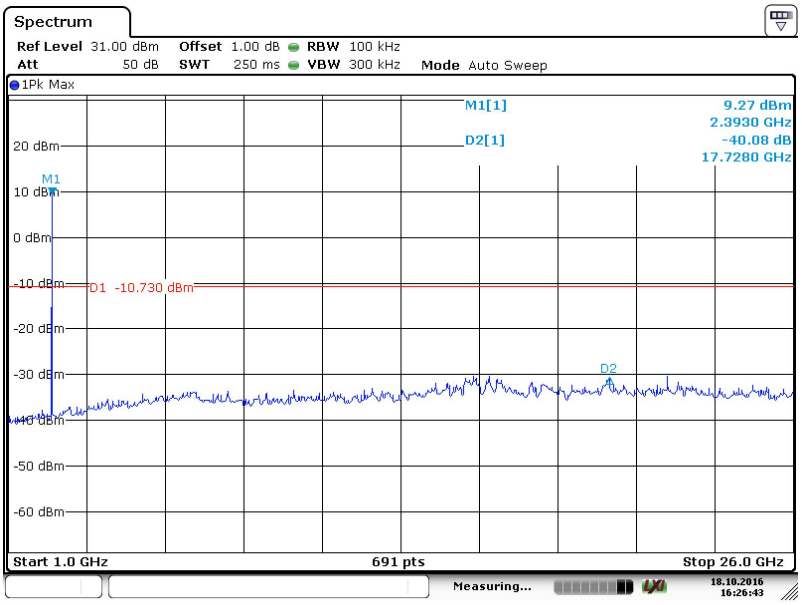
Spurious RF conducted emissions

2402MHz



Date: 18.OCT.2016 16:27:14



Date: 18.OCT.2016 16:26:43

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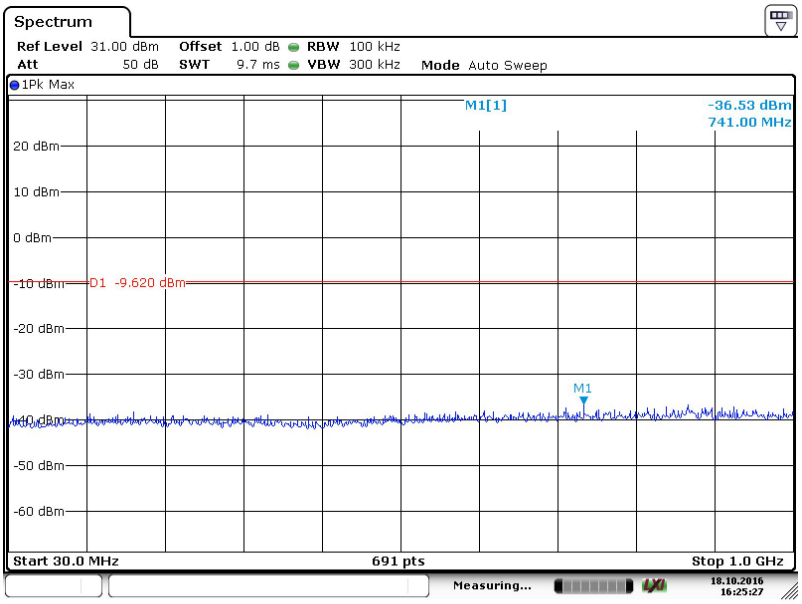
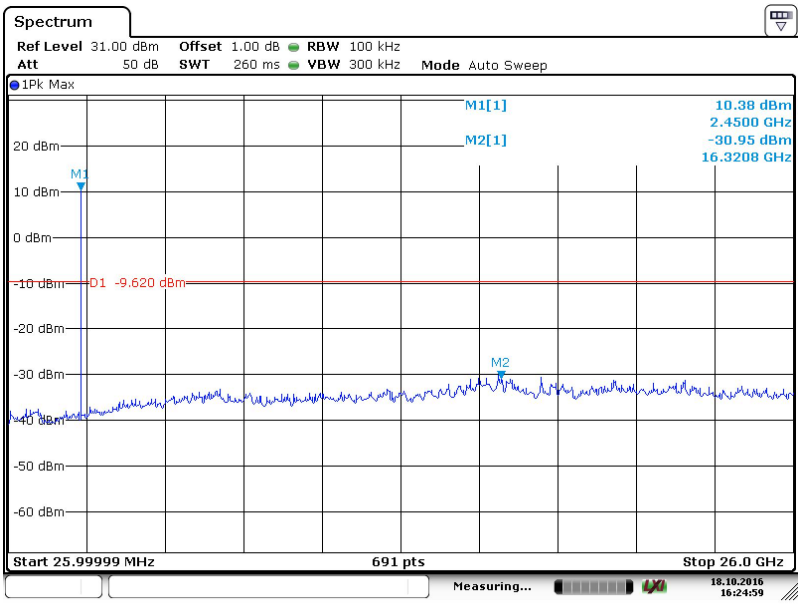
Spurious RF conducted emissions

2440MHz



Date: 18.OCT.2016 16:25:27



Date: 18.OCT.2016 16:25:00

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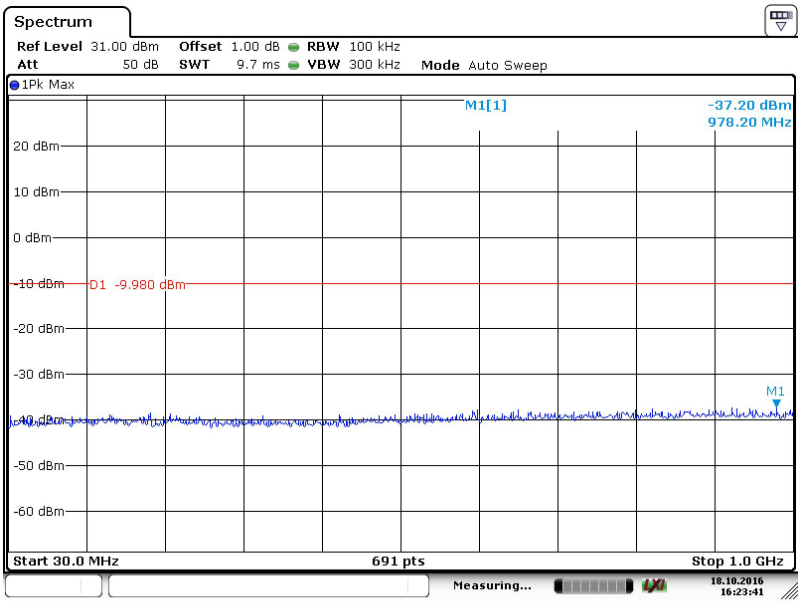
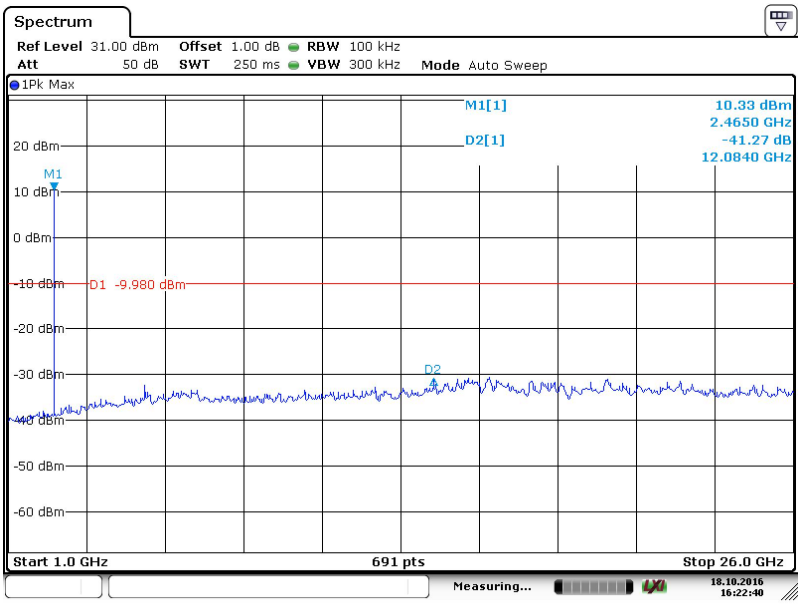
Spurious RF conducted emissions

2477MHz



Date: 18.OCT.2016 16:23:42



Date: 18.OCT.2016 16:22:39

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9.8 Band edge testing

Test Method

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

Limit:

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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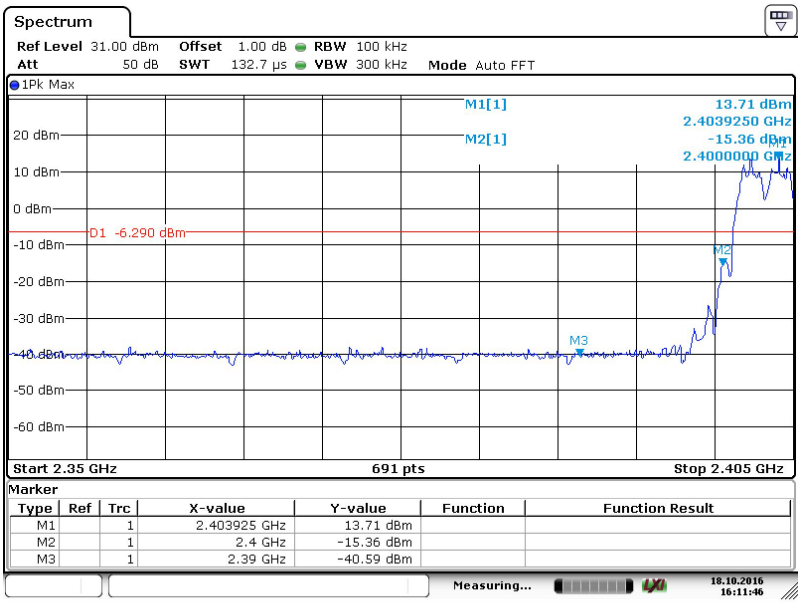
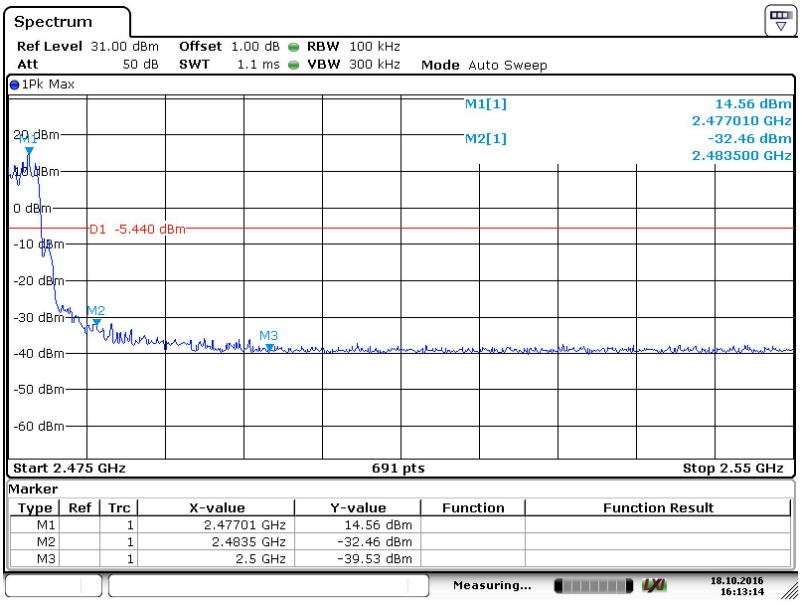
Band edge testing

GFSK Modulation Test Result:

Hopping On:

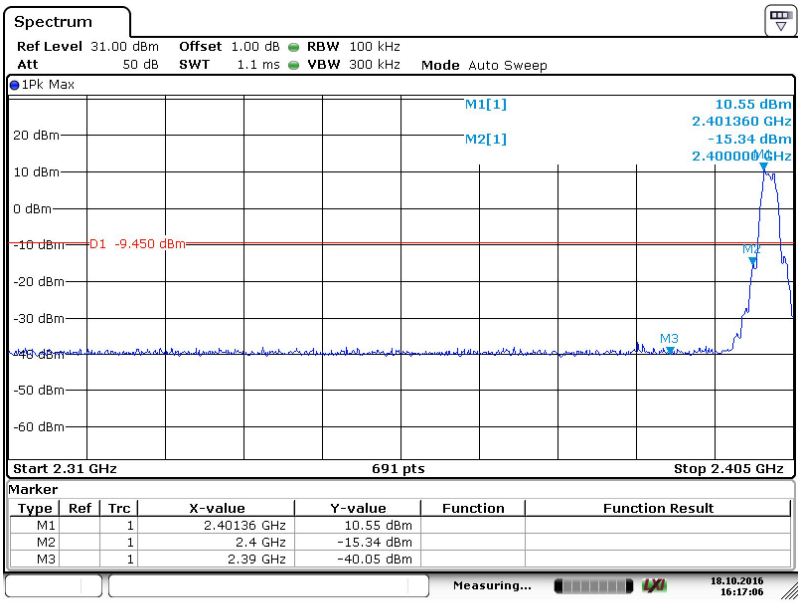


Date: 18.OCT.2016 16:11:46

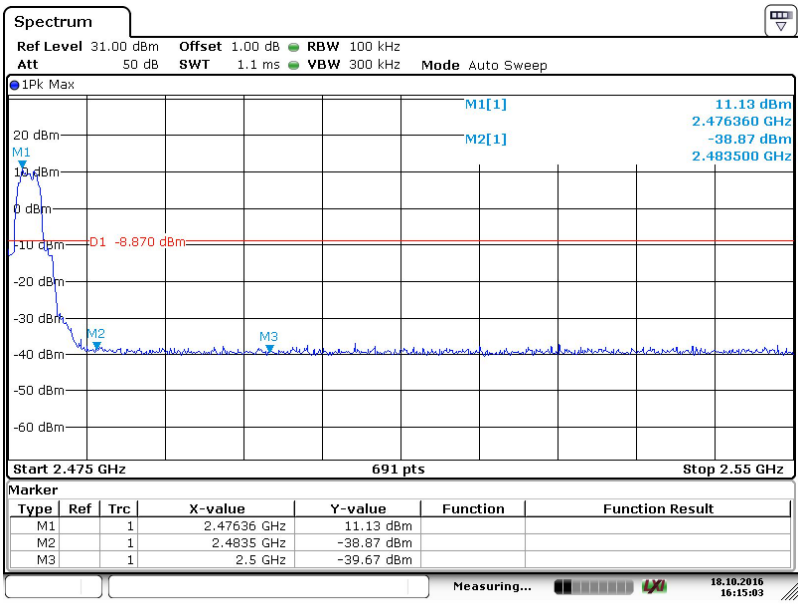


Date: 18.OCT.2016 16:13:14

Hopping Off:



Date: 18.OCT.2016 16:17:06



Date: 18.OCT.2016 16:15:03

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9.9 Spurious radiated emissions for transmitter

Test Method

1. The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned
5. Use the following spectrum analyzer settings According to C63.10:
   For Above 1GHz
   Span = wide enough to capture the peak level of the in-band emission and all spurious
   RBW = 1MHz, VBW≥RBW for peak measurement and VBW = 10Hz for average measurement, Sweep = auto, Detector function = peak, Trace = max hold.
   For Below 1GHz
   Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the in-band emission and all spurious
   RBW = 100 KHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (20log(1/duty cycle)).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.

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Limit

According to part 15.247(d), the radio emission outside the operating frequency band shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Radiated emissions which fall in the restricted bands, as defined in section15.205, must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	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:

FHSS Mode GFSK Modulation 2402MHz Test Result

Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
MHz	dBuV/m		dBµV/m		dBuV/m	
38.676111	29.43	Horizontal	40.00	QP	10.57	Pass
168.063333	39.15	Horizontal	43.50	QP	4.35	Pass
180.026667	41.51	Horizontal	43.50	QP	1.99	Pass
480.133889	31.50	Horizontal	46.00	QP	14.50	Pass
38.945556	27.18	Vertical	40.00	QP	12.82	Pass
168.063333	29.77	Vertical	43.50	QP	13.73	Pass
180.026667	31.64	Vertical	43.50	QP	11.86	Pass
326.388889	34.11	Vertical	46.00	QP	11.89	Pass
576.163889	27.94	Vertical	46.00	QP	18.06	Pass
8756.718750	41.71	Horizontal	74.00	PK	32.29	Pass
14412.187500	49.97	Horizontal	74.00	PK	24.03	Pass
4803.750000	48.26	Vertical	74.00	PK	25.74	Pass
8808.750000	40.53	Vertical	74.00	PK	33.47	Pass

FHSS Mode GFSK Modulation 2440MHz Test Result

Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
MHz	dBuV/m		dBµV/m		dBuV/m	
12200.15625	52.00	Horizontal	74.00	PK	22.00	Pass
14637.18750	49.90	Horizontal	74.00	PK	24.10	Pass
12200.156250	52.17	Vertical	74.00	PK	21.83	Pass
14640.000000	50.32	Vertical	74.00	PK	23.68	Pass

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FHSS Mode GFSK Modulation 2477MHz Test Result

Frequency	Emission Level	Polarization	Limit	Detector	Margin	Result
MHz	dBuV/m		dBµV/m		dBuV/m	
7486.40625	39.80	Horizontal	74.00	PK	34.20	Pass
12388.12500	49.56	Horizontal	74.00	PK	24.44	Pass
8795.625000	40.80	Vertical	74.00	PK	33.20	Pass
12381.562500	52.46	Vertical	74.00	PK	21.54	Pass

Remark: Testing is carried out with frequency rang 30MHz to 18GHz, the detected values which are noise floor or below the limit 35dB will not be recorded.

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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	2017-7-15
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2017-8-3
Horn Antenna	Rohde & Schwarz	HF907	102294	2017-7-15
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2017-7-15
3m Semi-anechoic chamber	TDK	9X6X6	----	2019-5-29
Test software	Rohde & Schwarz	EMC32	Version 9.15.00	N/A

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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 Emission in 3m chamber 30MHz-1000MHz	Horizontal: 4.99dB; Vertical: 4.97dB;
Uncertainty for Radiated Emission in 3m chamber 1000MHz-18000MHz	Horizontal: 4.96dB; Vertical: 4.95dB;
Uncertainty for Conducted RF test with TS 8997	Power level test involved: 2.04dB Frequency test involved:1.1×10^{-7}

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