



FCC/IC - TEST REPORT

Report Number : **60.790.15.023.03R** Date of Issue: 2015-09-30

Model : **FOCUS TAG**

Product Type : **WiFi Home Video Camera (TAG)**

Applicant : **Binatone Electronics International Limited**

Address : **Floor 23A, 9 Des Voeux Road West, Sheung Wan, Hong Kong.**

Production Facility : **TATUNG COMPANY**

Address : **22 Chungshan N. Rd. 3rd Sec. Taipei 104 Taiwan.**

Test Result : **Positive** **Negative**

Total pages including Appendices : 34

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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
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Nantou Checkpoint Road 2, Nanshan District,
Shenzhen City, 518052,
P. R. China

Telephone: 86 755 8828 6998

Fax: 86 755 8828 5299

3 Description of the Equipment Under Test

Product:	WiFi Home Video Camera (TAG)
Model no.:	FOCUS TAG
Listed Models:	N/A
FCC ID:	VLJ-FOCUSTAG
IC:	4522A-FOCUSTAG
Options and accessories:	N/A
Rating:	DC3V, CR2032 battery
RF Transmission Frequency:	2402MHz – 2480 MHz
No. of Operated Channel:	40
Modulation:	GFSK
Antenna Type:	Chip antenna
Antenna Gain:	1.5 dBi
Description of the EUT:	The Equipment Under Test (EUT) is a Camera of Wireless Monitoring System, which include of a FHSS Module

Channel list (MHz)							
CH	MHz	CH	MHz	CH	MHz	CH	MHz
1	2402	11	2422	21	2442	31	2462
2	2404	12	2424	22	2444	32	2464
3	2406	13	2426	23	2446	33	2466
4	2408	14	2428	24	2448	34	2468
5	2410	15	2430	25	2450	35	2470
6	2412	16	2432	26	2452	36	2472
7	2414	17	2434	27	2454	37	2474
8	2416	18	2436	28	2456	38	2476
9	2418	19	2438	29	2458	39	2478
10	2420	20	2440	30	2460	40	2480



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 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 (2013).

5 Summary of Test Results

Technical Requirements				
FCC Part 15 Subpart C, RSS-Gen, RSS-247, RSS-102				
Test Condition			Test Site	Test Result
§15.207	RSS-Gen Section 8.8	Conducted emission AC power port	---	Not Applicable
§15.247(b)(1)	RSS-247 Section 5.4(2)	Conducted peak output power	Site 1	Pass
§15.247(a)(2)	RSS-247 Section 5.2(1)	6dB bandwidth	---	Not Applicable
§15.247(a)(1)	RSS-247 Section 5.1(1)	20dB bandwidth	Site 1	Pass
§15.247(a)(1)	RSS-247 Section 5.1(2)	Carrier frequency separation	Site 1	Pass
§15.247(a)(1)(iii)	RSS-247 Section 5.1(4)	Number of hopping frequencies	Site 1	Pass
§15.247(a)(1)(iii)	RSS-247 Section 5.1(4)	Dwell Time	Site 1	Pass
§15.247(e)	RSS-247 Section 5.2(2)	Power spectral density*	---	Not Applicable
§15.247(d)	RSS-247 Section 5.5	Spurious RF conducted emissions	Site 1	Pass
§15.247(d)	RSS-247 Section 5	Band edge	Site 1	Pass
§15.247(d) & §15.209 &	RSS-247 Section 5.5 & RSS-Gen 6.13	Spurious radiated emissions for transmitter	Site 1	Pass
§15.203	RSS-Gen 8.3	Antenna requirement	See note 1	Pass

Note 1: N/A=Not Applicable.

Note 2: The EUT uses a patch antenna, which gain is 0 dBi. In accordance to §15.203 and RSS-Gen 8.3, It is considered sufficiently to comply with the provisions of this section.

Note 3: The data shown on the report are the worst case result.



6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: VLJ-MBP662PU, IC: 4522A-MBP662PU complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules 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: 2015-08-25

Testing Start Date: 2015-08-25

Testing End Date: 2015-09-30

TÜV SÜD HONG KONG LTD.

Prepared by:

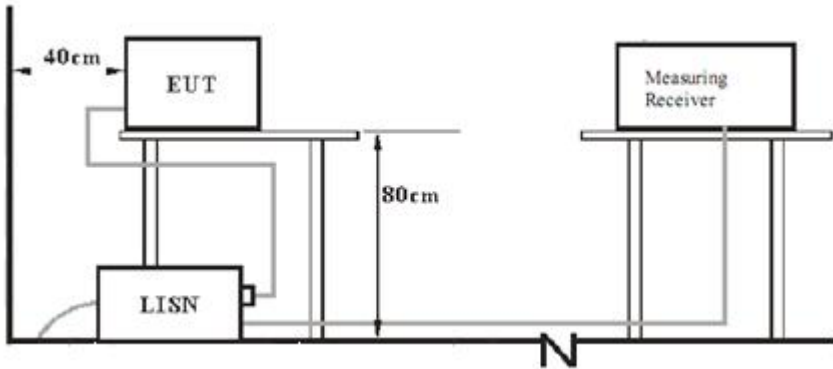
Reviewed by:

Alan Xiong
Project Engineer

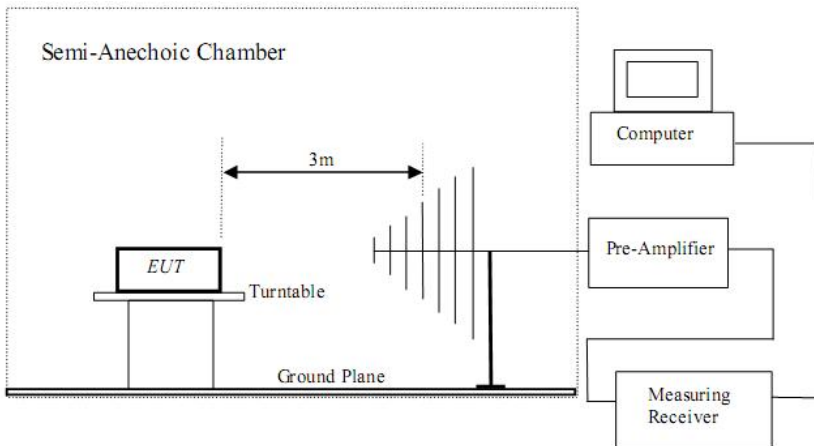
John Zhi
Project Manager

7 Test Setups

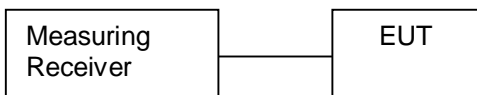
7.1 AC Power Line Conducted Emission test setups



7.2 Radiated test setups



7.3 Conducted RF test setups



8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
WiFi Home Video Camera (TAG)	TATUNG COMPANY	FOCUS TAG	---

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

9 Technical Requirement

9.1 Conducted Emission

Test Method

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

Limit

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

Decreasing linearly with logarithm of the frequency

Remark: This test NOT applicable for the Battery Operated Device.



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

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤0.125	≤21

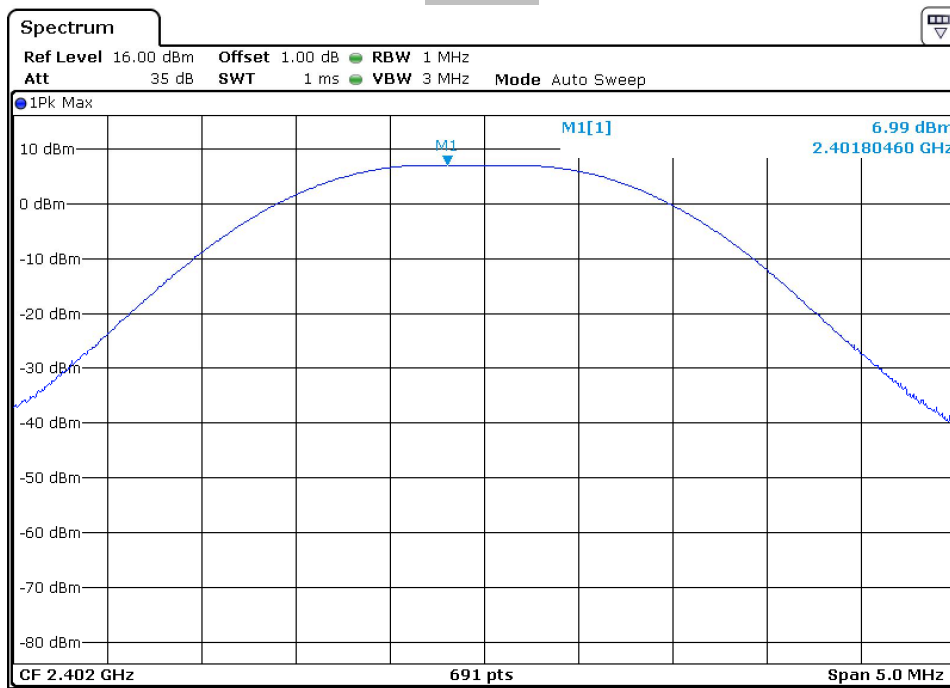


Conducted peak output power

Test Result

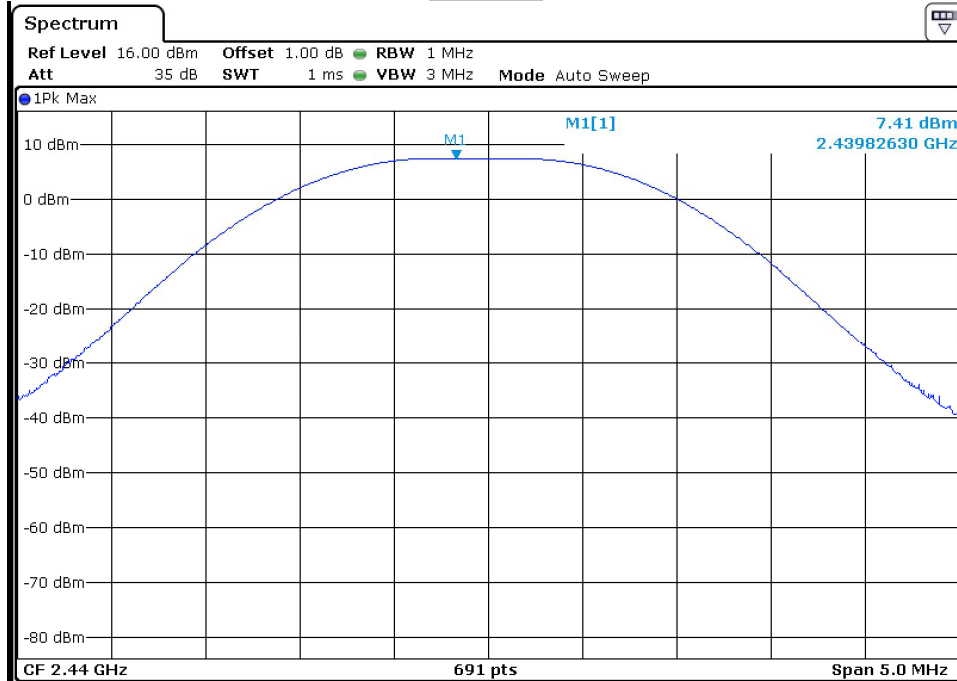
Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	6.99	Pass
Middle channel 2440MHz	7.41	Pass
High channel 2480MHz	8.68	Pass

2402MHz

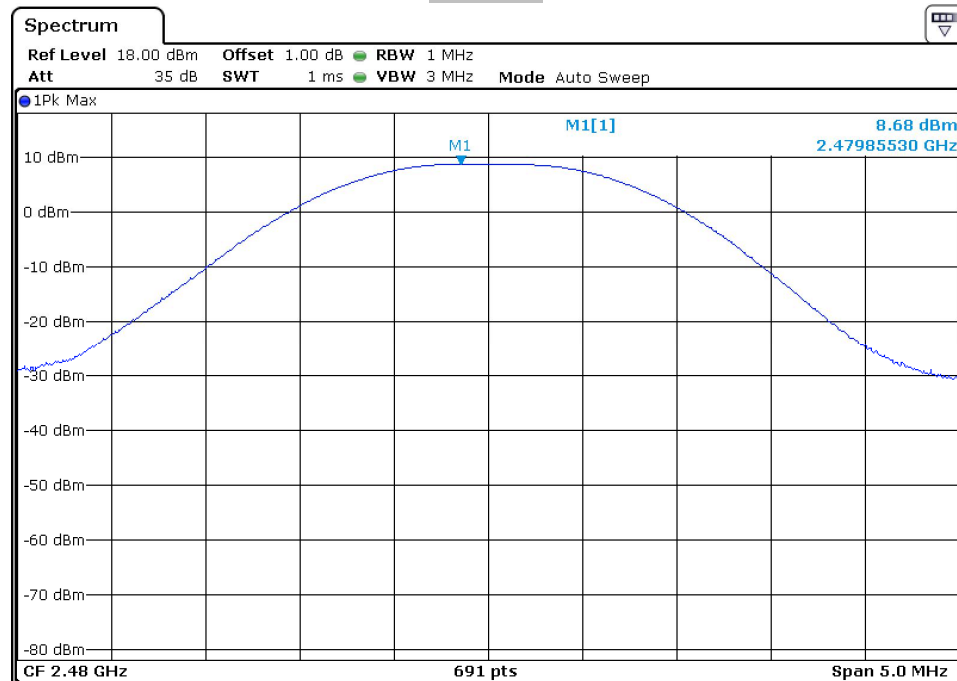




2440MHz



2480MHz





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.

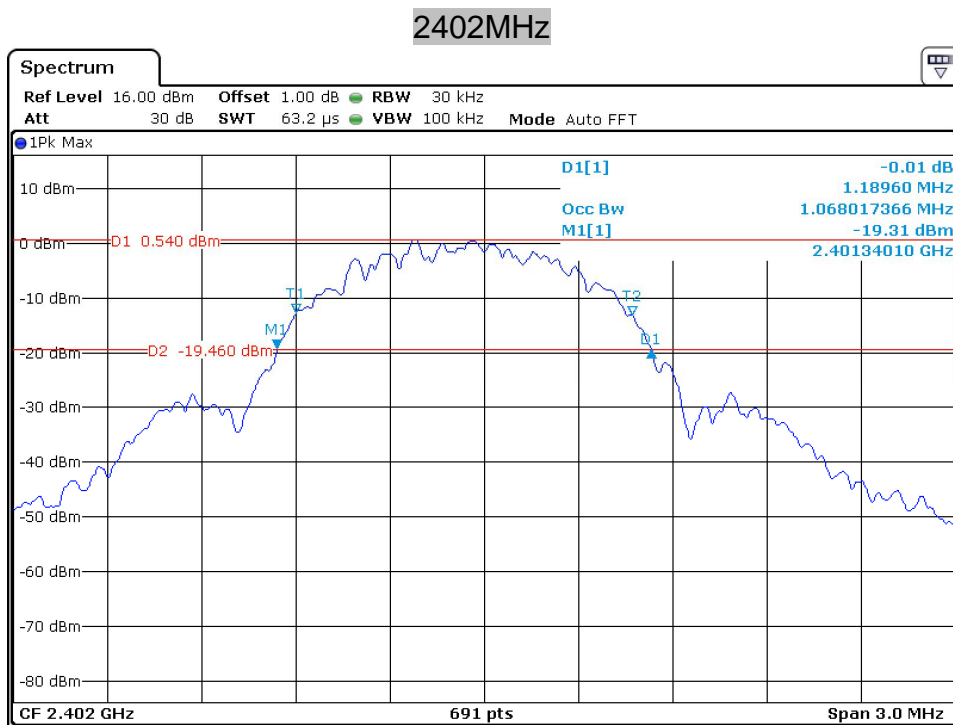
Limit

Limit [kHz]

N/A

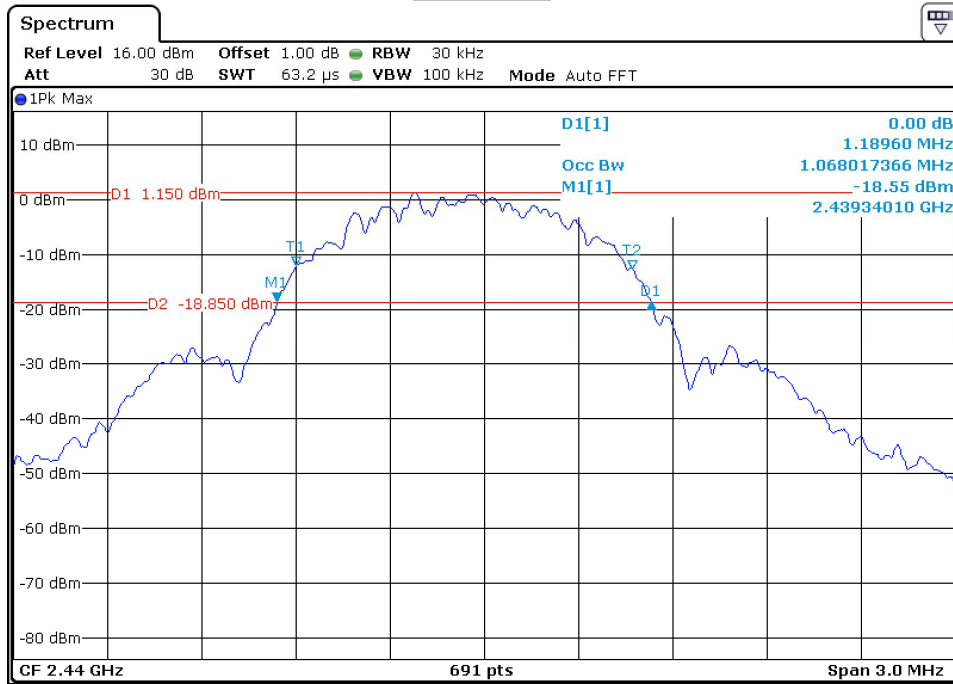
20 dB bandwidth and 99% Occupied Bandwidth

Frequency MHz	20 dB Bandwidth MHz	Result
2402	1.190	Pass
2440	1.190	Pass
2480	1.010	Pass

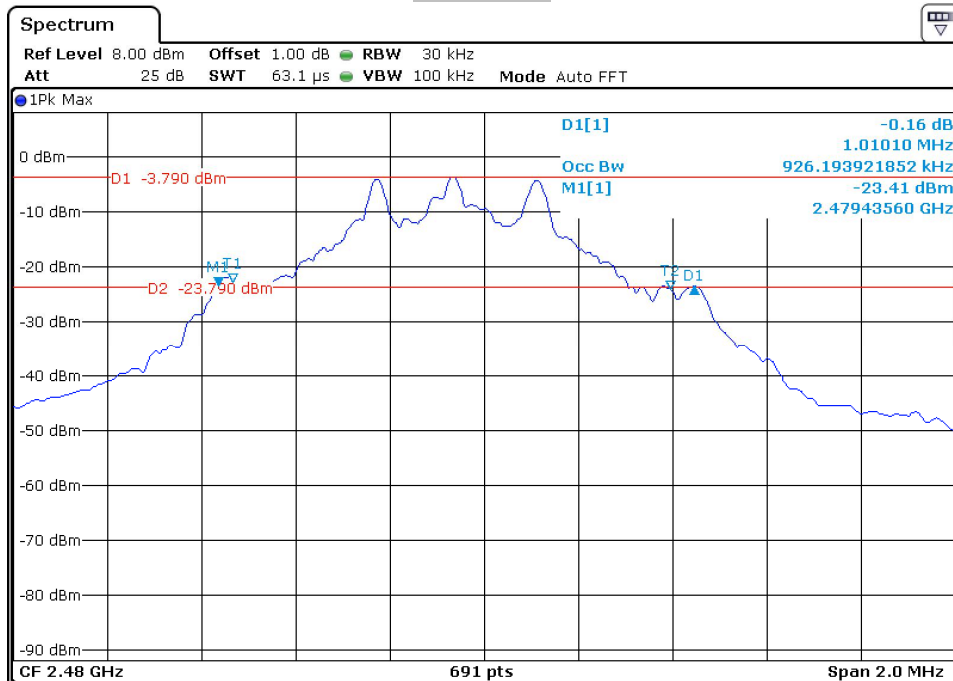




2440MHz



2480MHz



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, $RBW \geq 1\%$ of the span, $VBW \geq RBW$, 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

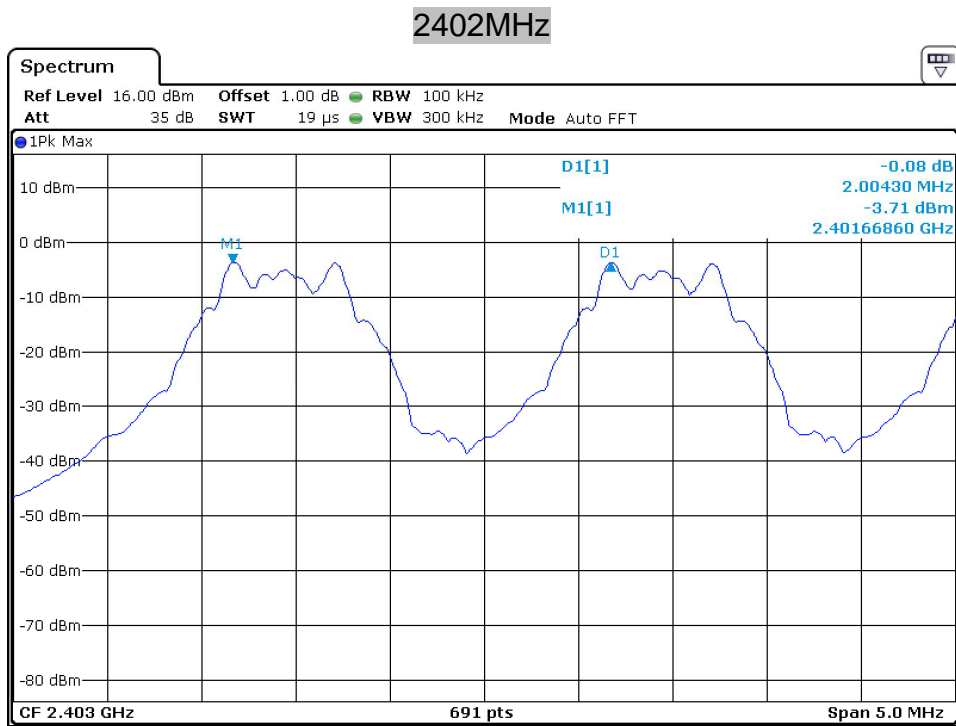
$\geq 25\text{kHz}$ or $2/3$ of the 20 dB bandwidth which is greater

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.

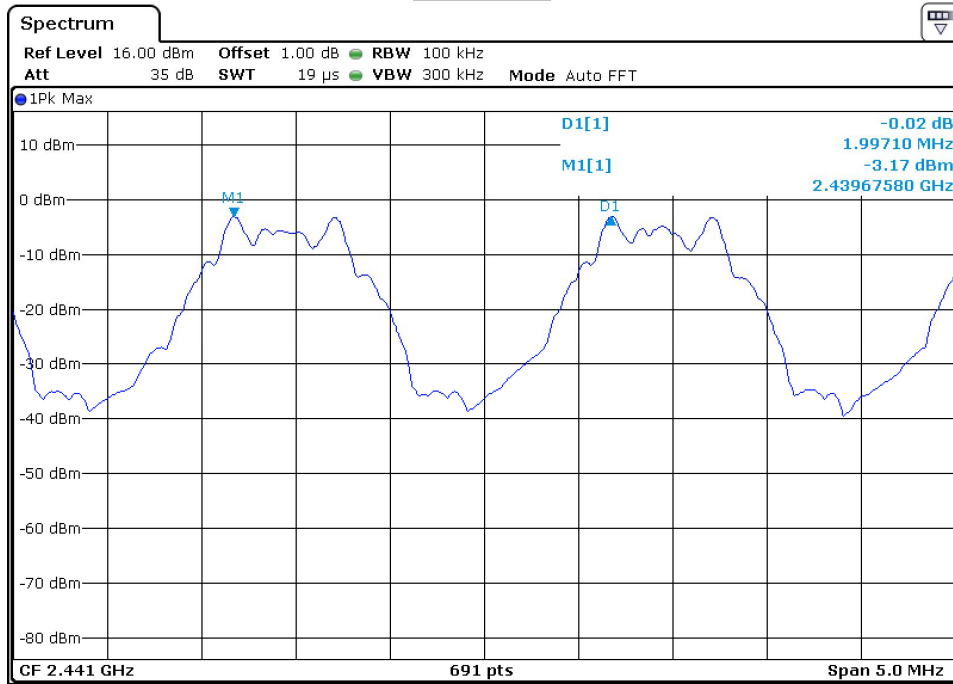
GFSK Modulation test result

Frequency MHz	Carrier Frequency Separation MHz	Result
2402	2.00	Pass
2440	2.00	Pass
2479	2.01	Pass

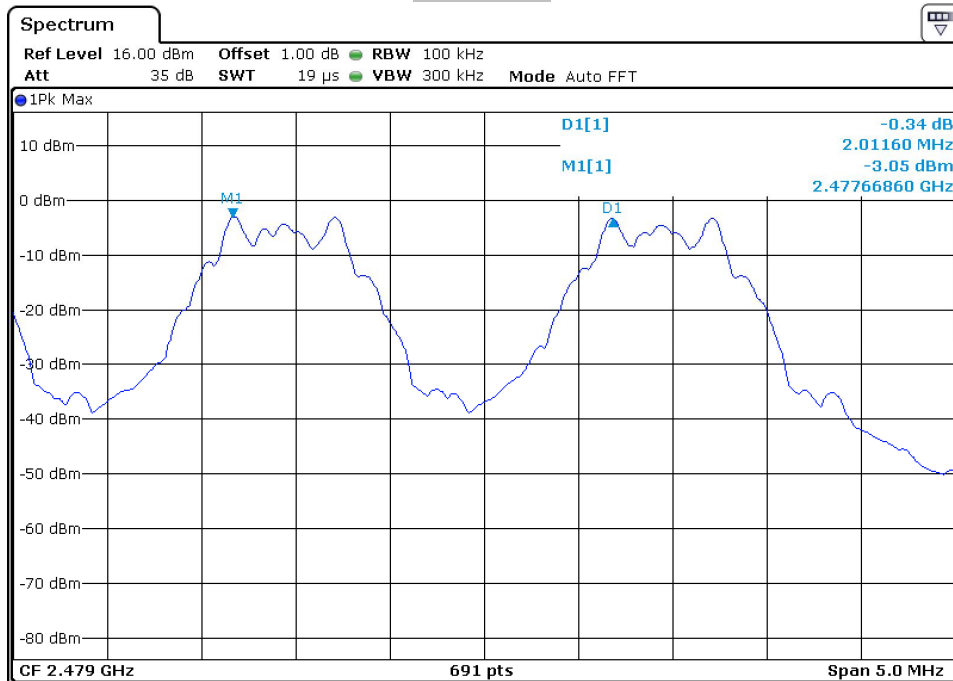




2440MHz



2480MHz



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, $RBW \geq 1\%$ of the span, $VBW \geq RBW$, Sweep = auto, Detector function = peak
2. Set the spectrum analyzer on Max-Hold Mode, and then keep the EUT in hopping mode.
3. Record all the signals from each channel until each one has been recorded.
4. Repeat above procedures until all frequencies measured were complete.

Limit

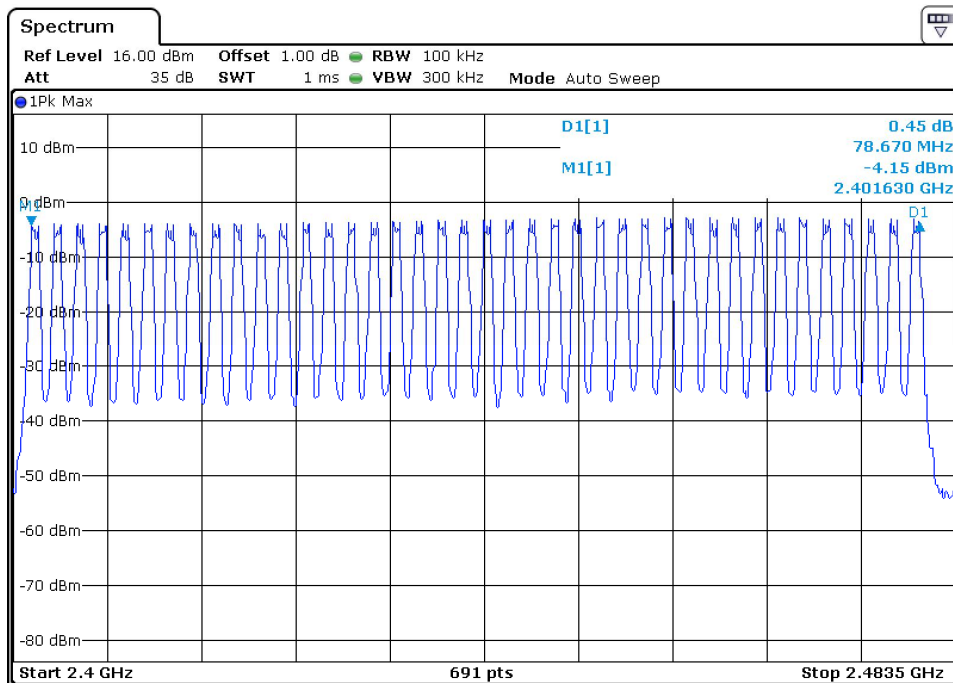
**Limit
number**

≥ 15

Number of hopping frequencies

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

Number of hopping frequencies	Result
40	Pass



9.6 Dwell Time

Test Method

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

Limit

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

Dwell Time

Dwell time

Each transmission only 40 channels will be used.

Observe time = 40 channels × 0.4s = 16s

There are 20 pulses within 1s

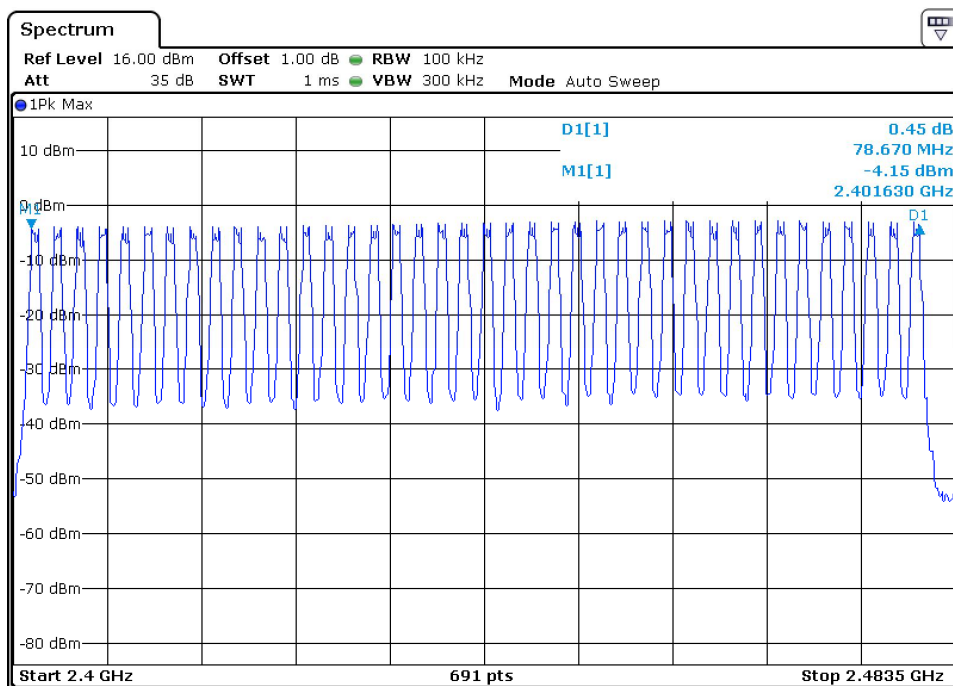
And one set of pulses = 171us

Therefore, the average channel occupancy times (ms)

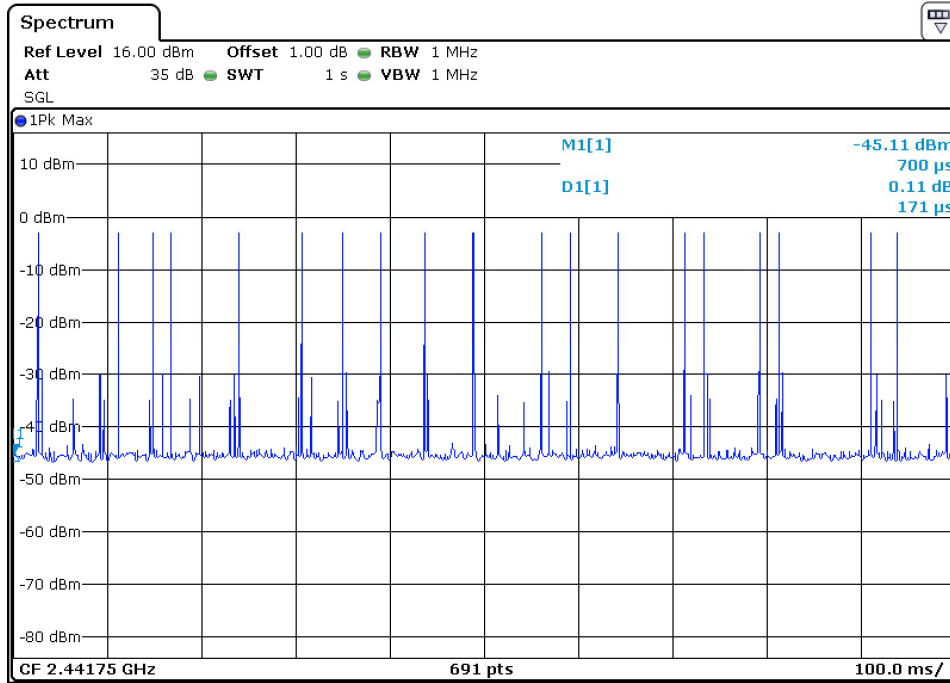
= 171us × 20 × 16

So, total transmitting time is 0.055s. (<0.4s).

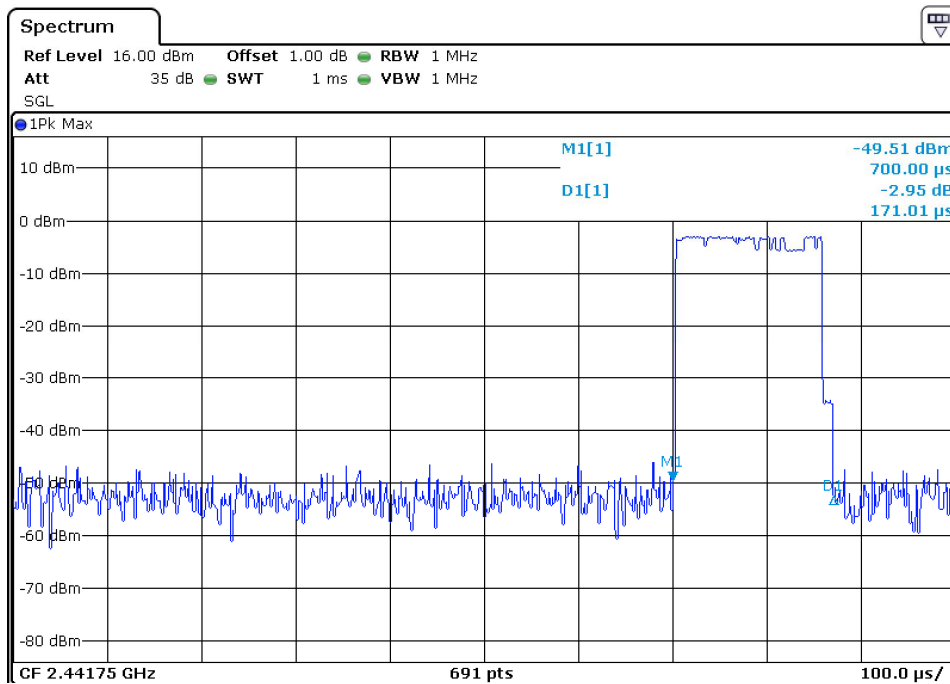
Result data graph shows total 23 channels are used.



Result data graph shows total 20 pulses with 1s.



Result data graph zooms into detail, one pulse period is 171us.





9.7 Spurious RF conducted emissions

Test Method

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

Limit

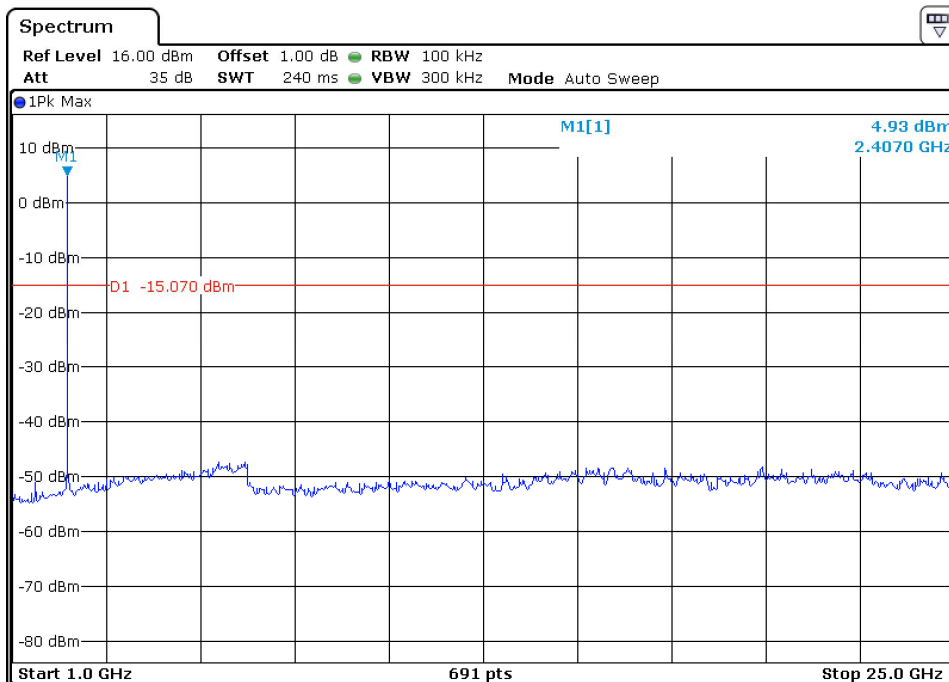
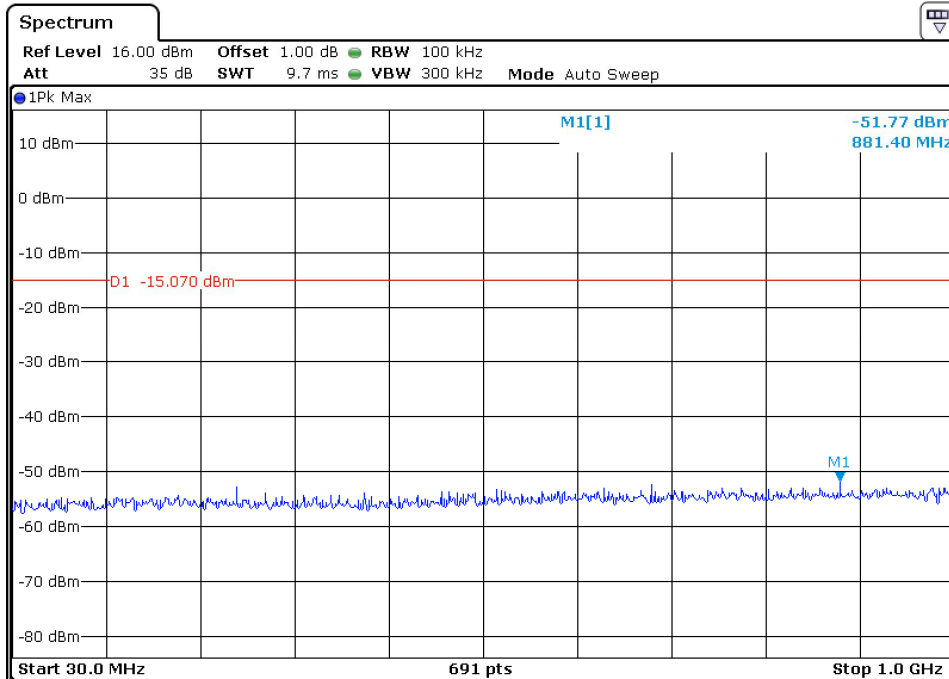
Frequency Range MHz	Limit (dBc)
30-25000	-20



Spurious RF conducted emissions

Only the worse case test result is listed in the report.

2402MHz





9.8 Band edge testing

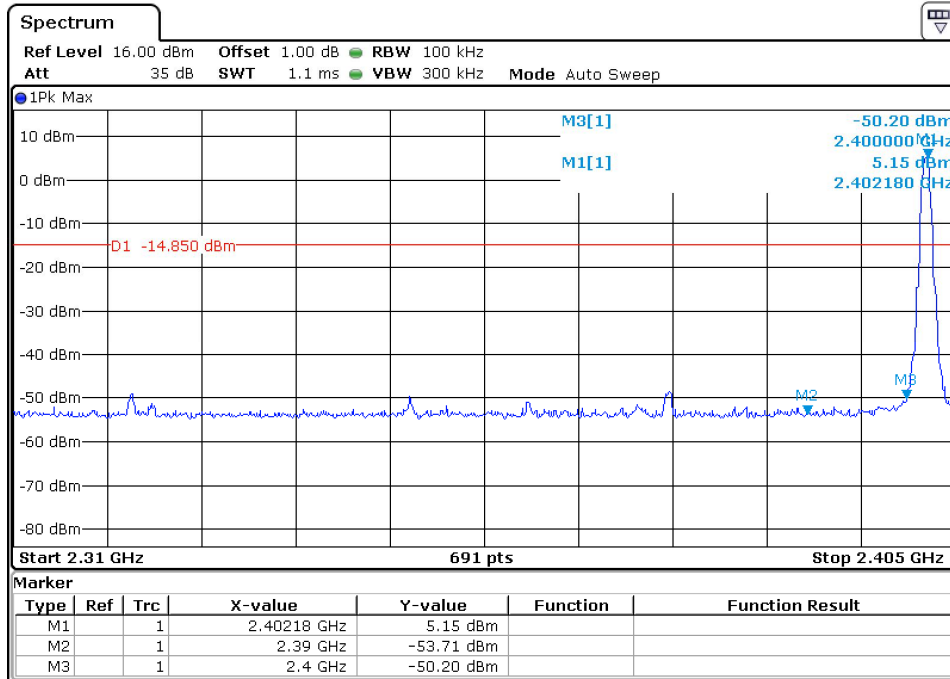
Test Method

- 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 \geq 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.

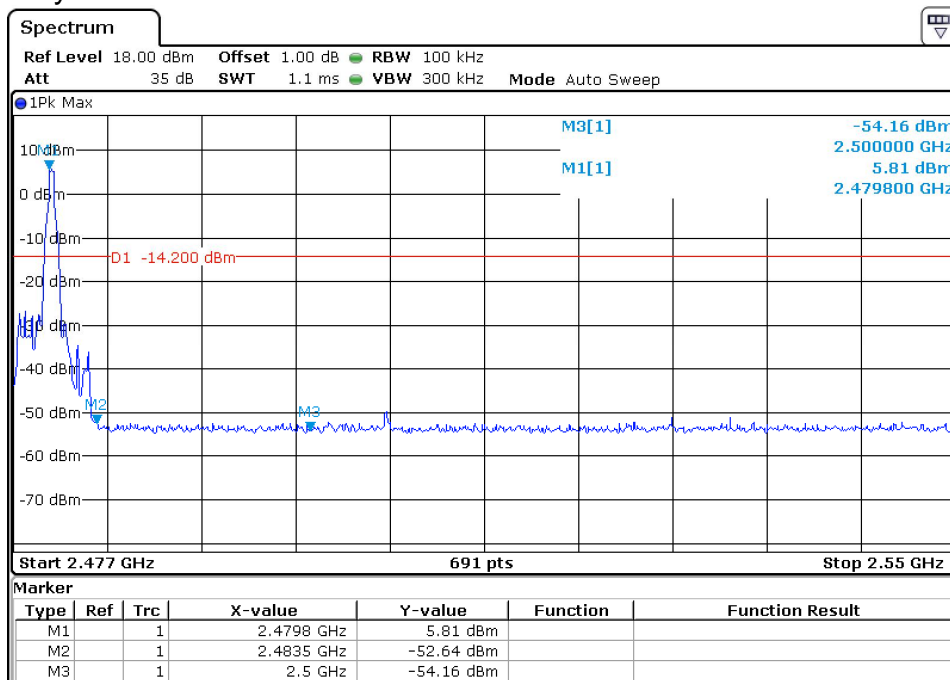
Band edge testing

Test Result:

Lowest Frequency:



Highest Frequency:





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 $f \geq 1\text{GHz}$, 100 kHz for $f < 1\text{GHz}$, VBW \geq 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 $20\log(\text{duty cycle}/100\text{ ms})$, in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Limit

The radio emission outside the operating frequency band shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Radiated emissions which fall in the restricted bands, as defined in section 15.205, 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



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:

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.

Frequency (30MHz to 3GHz)

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Corr. (dB)
1194.416667	45.08	74.00	28.92	V	-14.4
1332.000000	41.07	74.00	32.93	V	-13.8
1500.000000	39.02	74.00	34.98	V	-13.0
2402.000000	85.40	---	---	---	-8.5

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Corr. (dB)
1501.666667	37.50	74.00	36.50	H	-13.0
2945.833333	40.41	74.00	33.59	H	-6.7

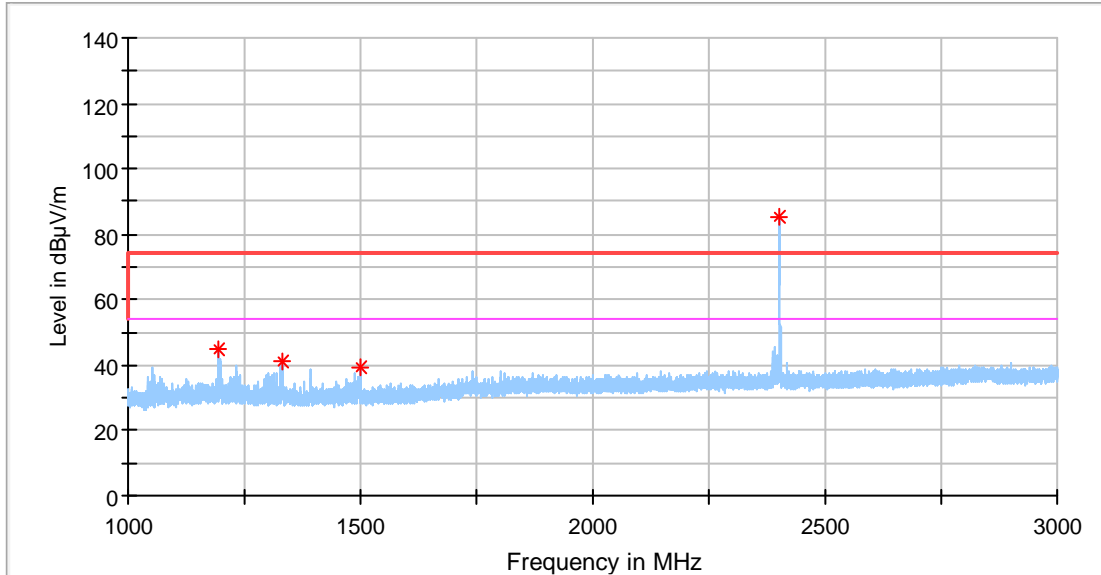
Frequency (above 3GHz)

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Corr. (dB)
4803.750000	46.97	74.00	27.03	V	-0.3
14721.875000	47.80	74.00	26.20	V	13.9
17722.500000	50.44	74.00	23.56	V	18.0
2402.000000	86.52	---	---	V	-8.5

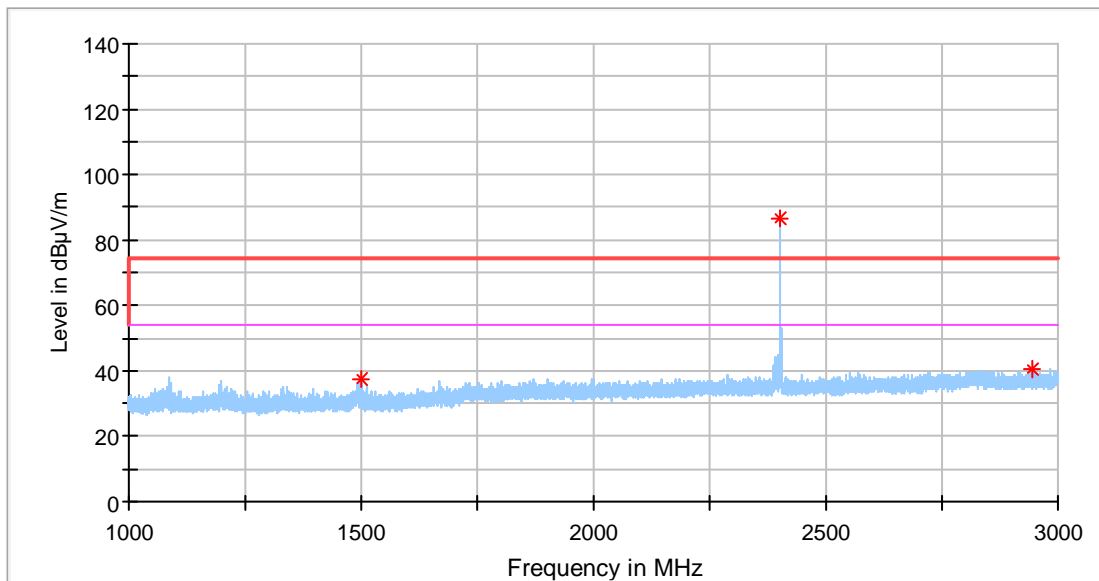
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Corr. (dB)
4835.000000	40.62	74.00	33.38	H	-0.3
7000.625000	42.12	74.00	31.88	H	2.4
14636.250000	47.36	74.00	26.64	H	13.7
17845.000000	50.72	74.00	23.28	H	18.5

Spurious radiated emissions for transmitter

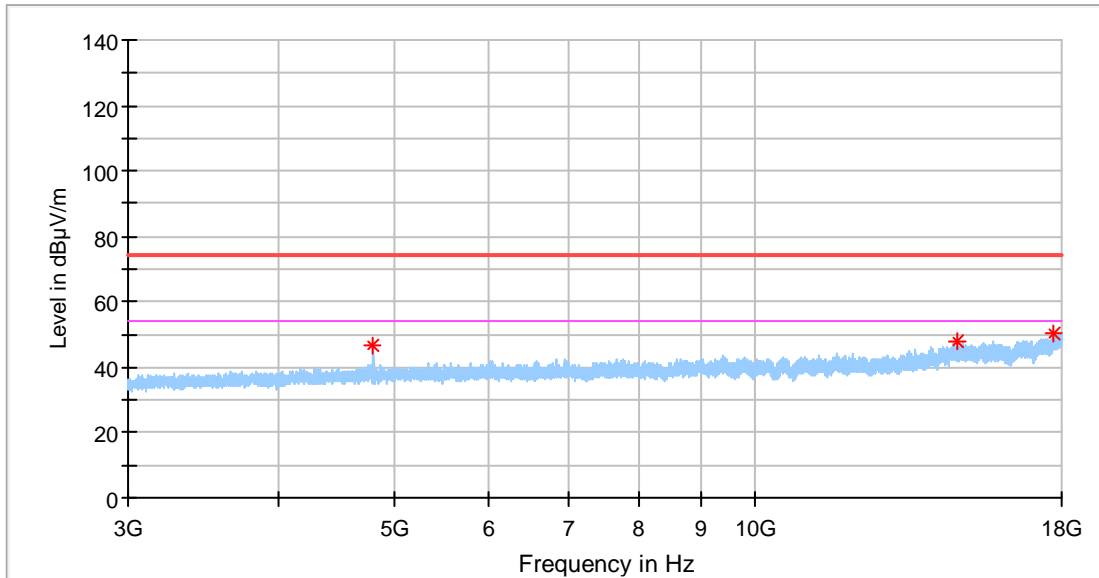
Radiated emission data graph (Vertical polarization, 30MHz-3GHz)



Radiated emission data graph (Horizontal polarization, 30MHz-3GHz)

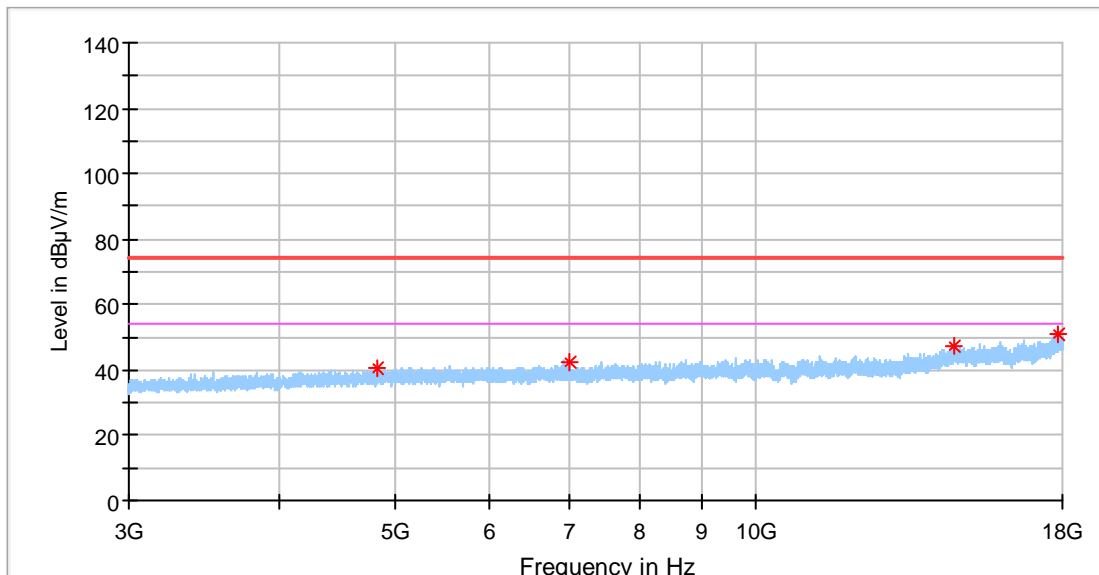


Radiated emission data graph (Vertical polarization, above 3GHz)



Remark: No significant emissions above the noise floor were detected above 18GHz.

Radiated emission data graph (Horizontal polarization, above 3GHz)



Remark: No significant emissions above the noise floor were detected above 18GHz.

10 Test Equipment List

List of Test Instruments

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
CE	EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2016-8-17
	LISN	Rohde & Schwarz	ENV4200	100249	2016-8-17
	LISN	Rohde & Schwarz	ENV216	100326	2016-8-17
	ISN	Rohde & Schwarz	ENY81	100177	2016-8-17
	ISN	Rohde & Schwarz	ENY81-CAT6	101664	2016-8-17
	High Voltage Probe	Rohde & Schwarz	TK9420(VT9420)	9420-58	2016-8-17
C	RF Current probe	Rohde & Schwarz	EZ-17	100816	2016-8-17
	Signal Generator	Rohde & Schwarz	SMB100A	108272	2016-8-17
	Signal Analyzer	Rohde & Schwarz	FSV40	101030	2016-8-17
	Vector Signal Generator	Rohde & Schwarz	SMU 200A	105324	2016-8-17
RE	RF Switch Module	Rohde & Schwarz	OSP120/OS P-B157	101226/100851	2016-8-17
	EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2016-8-17
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2017-8-17
	Horn Antenna	Rohde & Schwarz	HF907	102294	2017-8-17
	Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2016-8-17
	3m Semi-anechoic chamber	TDK	9X6X6	----	2019-5-29

C - Conducted RF tests

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



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: 4.83dB; Vertical: 4.91dB;
Uncertainty for Radiated Emission in 3m chamber 1000MHz-18000MHz	Horizontal: 4.89dB; Vertical: 4.88dB;
Uncertainty for Conducted Emission 9kHz-150KHz	3.88dB