

### **FCC/IC - TEST REPORT**

Report Number	:	60.790.15.023.	02R	Date of Issue	e:	2015-09-30
Model	:	FOCUS86, FO	CUS86-W,	FOCUS86-B,	, FO	CUS86T
Product Type	:	WiFi Home Vide	eo Camera			
Applicant	:	Binatone Electr	onics Interi	national Limite	ed	
Address	:	Floor 23A, 9 De	es Voeux R	oad West, Sh	neun	g Wan, Hong Kong.
Production Facility	:	TATUNG COM	PANY			
Address	:	22 Chungshan	N. Rd. 3 <sup>rd</sup> S	Sec. Taipei 10	)4 Ta	aiwan.
Test Result	:	■ Positive	□ Negati	ve		
Total pages including		40				
Appendices	:	42				

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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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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

Model no.: FOCUS86

Listed Models: FOCUS86-B, FOCUS86-W, FOCUS86T

FCC ID: VLJ-FOCUS86

IC: 4522A-FOCUS86

Options and accessories: AC/DC Adapter, Mobile Phone

Rating: DC5V, 1000mA powered by AC/DC power adaptor

RF Transmission Frequency: 2402MHz – 2480 MHz

No. of Operated Channel: 40

Modulation: GFSK

Antenna Type: Integral

Antenna Gain: 0 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)							
СН	MHz	CH	MHz	СН	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 Subj	FCC Part 15 Subpart C, RSS-Gen, RSS-247, RSS-102							
	Test Co	ndition	Test Site	Test Result				
§15.207	RSS-Gen Section 8.8	Conducted emission AC power port	Site 1	Pass				
§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		N/A				
§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*		N/A				
§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-FOCUS86, IC: 4522A-FOCUS86 complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C Rules and RSS-247.

As per Client Declaration, the circuit design, PCB Layout, shielding and interfaces of FOCUS86 are identical for Listed Models of above table, only the Cosmetic are different. So we use the FOCUS86 as a representative model.

SI	I٨	ΛN	ΛA	R	٧٠
J	<i>-</i> , , ,	7111	_		

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.

Reviewed by:

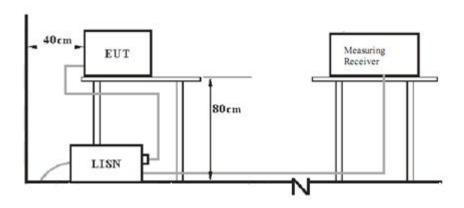
Alan Xiong Project Engineer John Zhi Project Manager

Monstin

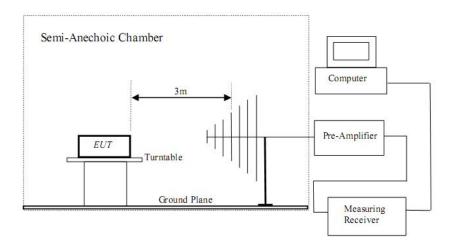


# 7 Test Setups

# 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	TATUNG COMPANY	FOCUS86	

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

Decreasing linearly with logarithm of the frequency



### **Conducted Emission**

Product Type : WiFi Home Video Camera

M/N : FOCUS86

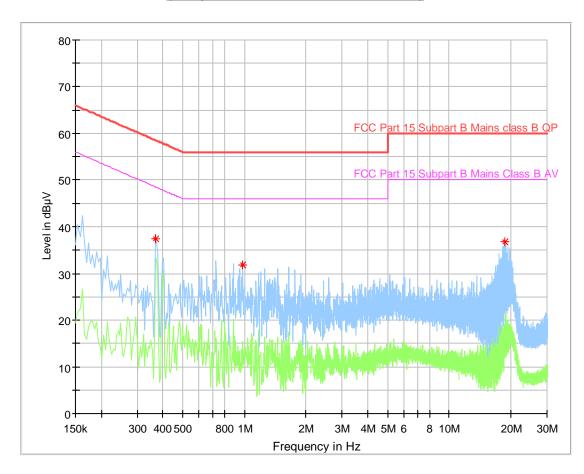
Operating Condition : Transmitting mode

Test Specification : FCC part 15 Section 15.207 Class B

RSS-GEN Issue 4 section 8.8

Comment : ---

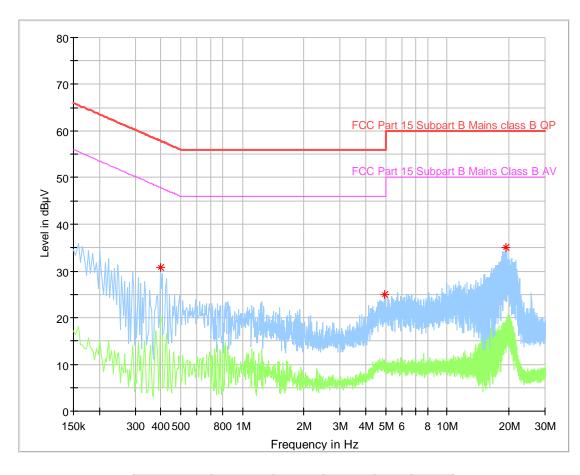
Phase L (Adaptor Model: S005ANU0500100)



Frequency (MHz)	MaxPeak (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.370000	37.42	58.50	21.08	L1	10.2
0.982000	31.74	56.00	24.26	L1	9.8
18.750000	36.82	60.00	23.18	L1	10.1



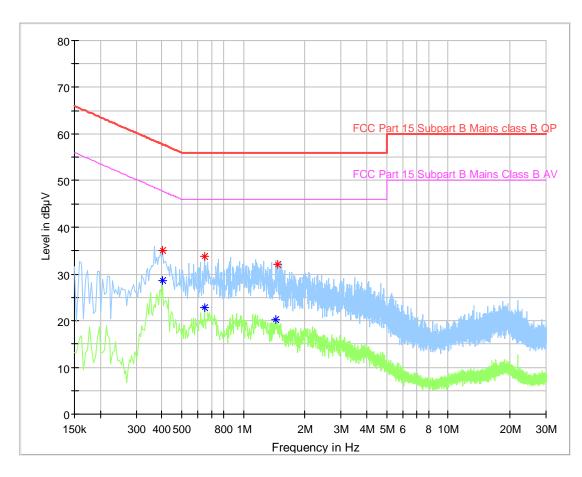
# Phase N (Adaptor Model: S005ANU0500100)



Frequency (MHz)	MaxPeak (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.398000	30.81	57.90	27.08	N	10.1
4.934000	24.99	56.00	31.01	N	9.8
19.318000	35.11	60.00	24.89	N	10.1



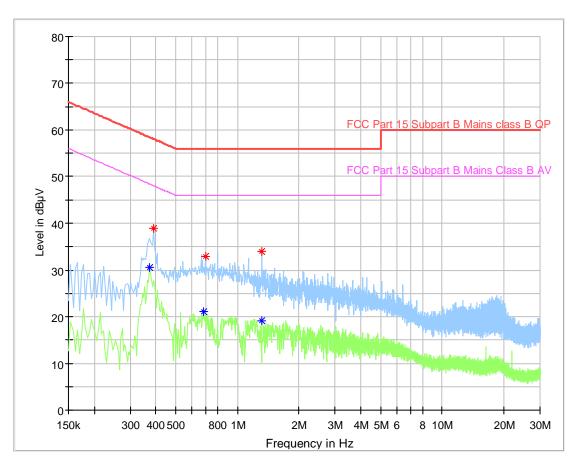
Phase L (Adaptor Model: S006AKU0500100)



Frequency (MHz)	MaxPeak (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.402000		47.81	19.22	L1	10.1
0.402000	35.01	57.81	22.80	L1	10.1
0.646000		46.00	23.17	L1	10.0
0.646000	33.75	56.00	22.25	L1	10.0
1.438000		46.00	25.79	L1	9.8
1.478000	31.98	56.00	24.02	L1	9.8



# Phase N (Adaptor Model: S006AKU0500100)



Frequency (MHz)	MaxPeak (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.374000		48.41	17.92	N	10.1
0.390000	38.86	58.06	19.20	N	10.1
0.686000		46.00	24.86	N	9.9
0.698000	33.00	56.00	23.00	N	9.9
1.318000		46.00	26.81	N	9.8
1.318000	34.03	56.00	21.97	N	9.8



# 9.2 Conducted peak output power

#### **Test Method**

- 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

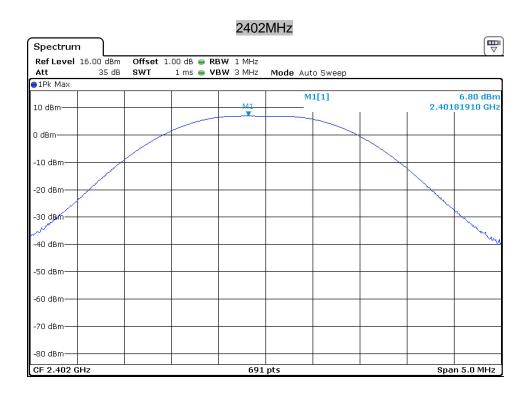
#### Limits

	Frequency Range	Limit	Limit	
_	MHz	W	dBm	
	2400-2483.5	≤0.125	<u>≤2</u> 1	

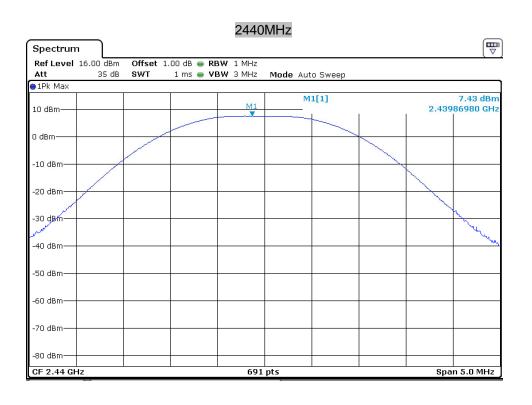


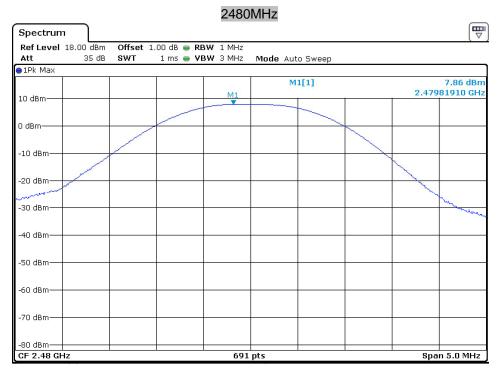
### Conducted peak output power

#### Test Result **Conducted Peak** Frequency **Output Power** Result dBm MHz Pass Low channel 2402MHz 6.80 Middle channel 2440MHz 7.43 **Pass** Pass High channel 2480MHz 7.86











### 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.

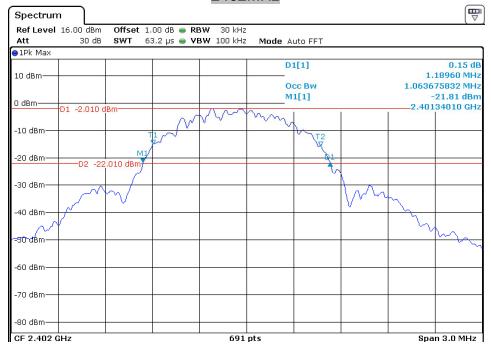
Limit [kHz]



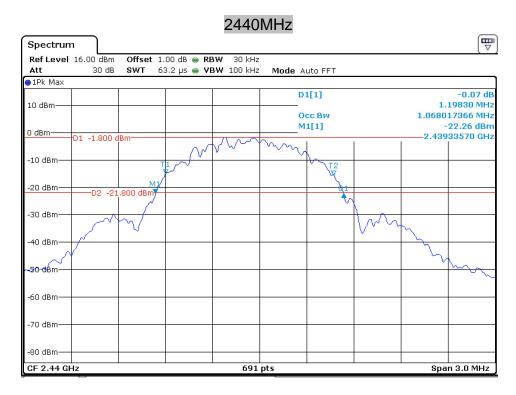
# 20 dB bandwidth and 99% Occupied Bandwidth

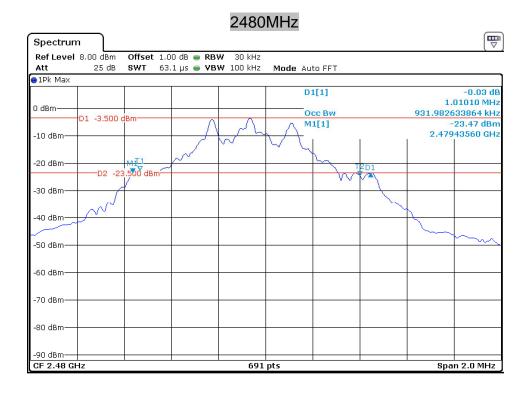
Frequency	20 dB Bandwidth	Result
MHz	MHz	
2402	1.190	Pass
2440	1.190	Pass
2480	1.010	Pass

### 2402MHz











# 9.4 Carrier Frequency Separation

#### **Test Method**

- 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 handwidth which is greater



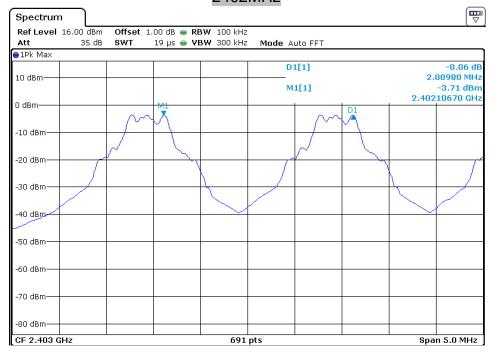
### **Carrier Frequency Separation**

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

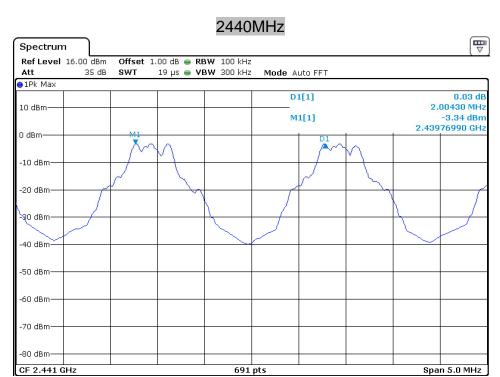
#### **GFSK Modulation test result**

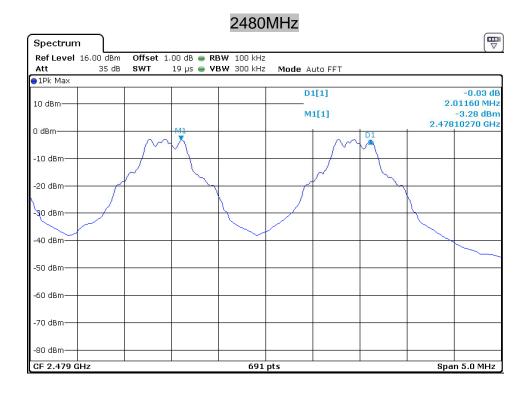
Frequency	Carrier Frequency Separation	Result	
MHz	MHz		
2402	2.00	Pass	
2440	2.00	Pass	
2479	2.01	Pass	

### 2402MHz











# 9.5 Number of hopping frequencies

#### **Test Method**

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

#### Limit

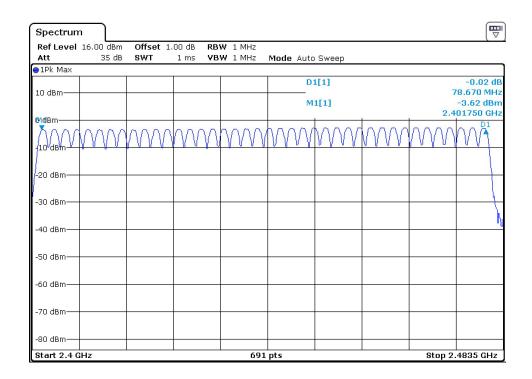
Limit	
number	
> 15	



### **Number of hopping frequencies**

Test result: The measurement was performed with the typical configuration (normal hopping status, 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  $\times 0.4s = 16s$ 

There are 38 pulses within 1s

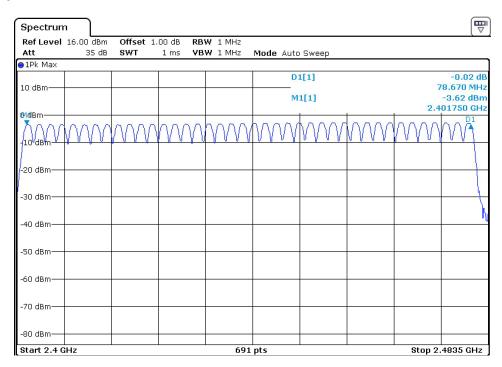
And one set of pulses = 170us

Therefore, the average channel occupancy times (ms)

 $= 170us \times 38 \times 16$ 

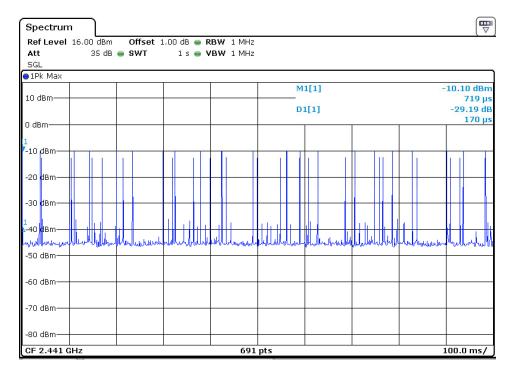
So, total transmitting time is 0.103s. (<0.4s).

#### Result data graph shows total 23 channels are used.

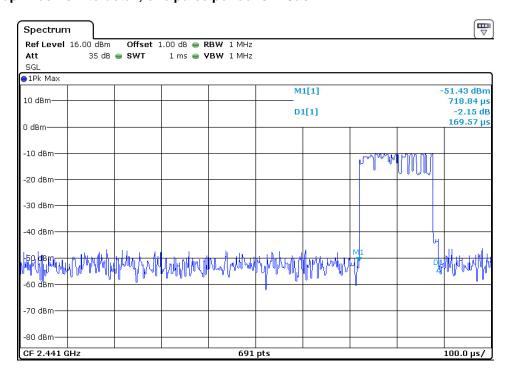




### Result data graph shows total 38 pulses with 1s.



### Result data graph zooms into detail, one pulse period is 170us.





# 9.7 Spurious RF conducted emissions

#### **Test Method**

- 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 10<sup>th</sup> 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

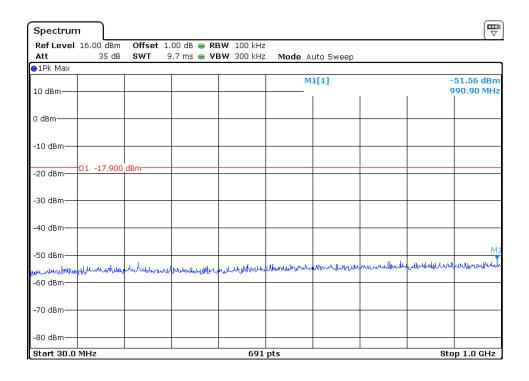
Frequency Range MHz	Limit (dBc)
30-25000	-20

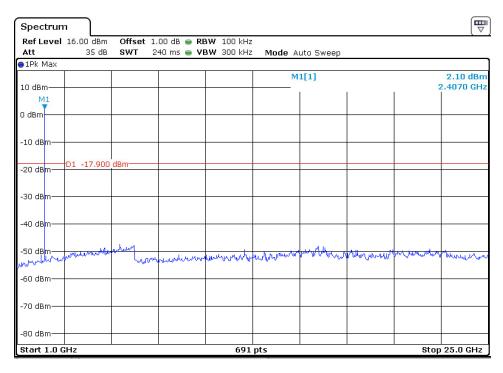


### **Spurious RF conducted emissions**

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

#### 2402MHz







# 9.8 Band edge testing

#### **Test Method**

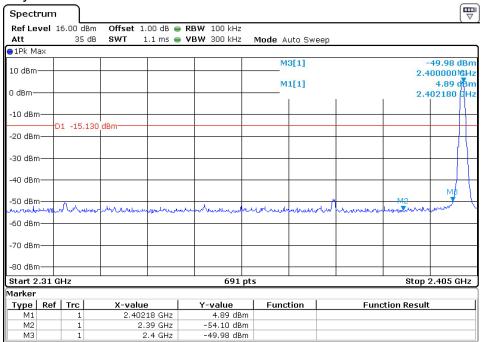
- 1 Use the following spectrum analyzer settings: Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 kHz, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2 Allow the trace to stabilize, use the peak and delta measurement to record the 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.



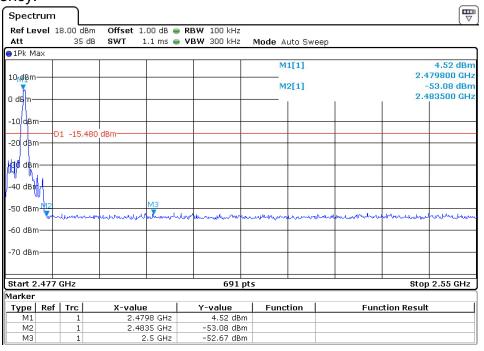
### **Band edge testing**

### 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 ≥ 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

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	Field Strength	Field Strength	Detector
MHz	uV/m	dBμV/m	
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 (Vertical – 30MHz to 3GHz)

Adaptor Model: S005ANU0500100

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol
59.100000	34.18	40.00	5.82	٧
395.993125	42.89	46.00	3.11	V
420.000625	41.95	46.00	4.05	V

Adaptor Model: S006AKU0500100

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol
42.488750	35.72	40.00	4.18	V
92.383125	35.14	43.50	8.36	V
124.938750	32.20	43.50	11.30	V
250.008125	32.05	46.00	13.95	V
455.951250	39.08	46.00	6.92	V
492.023125	41.77	46.00	4.23	V

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Pol
1196.062500	-54.77	-30.00	24.77	V
2416.500000	3.74	-30.00	-33.74	V
2576.625000	-49.41	-30.00	19.41	V



### Frequency (Horizontal - 30MHz to 3GHz)

Adaptor Model: S005ANU0500100

. 6000/ 11 160000 100					
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	
56.008125	34.70	40.00	5.30	Н	
155.978750	35.34	43.50	8.16	Н	
372.004000	44.20	46.00	1.80	Н	
803.999375	39.82	46.00	6.18	Н	

Adaptor Model: S006AKU0500100

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol
250.008125	27.08	46.00	18.92	Н
418.000000	31.45	46.00	14.55	Н
505.966875	34.39	46.00	11.61	Н
804.060000	37.34	46.00	8.66	Н

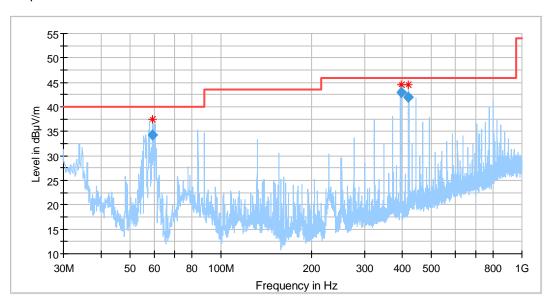
Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Pol
1799.937500	-57.21	-30.00	27.21	Н
2410.375000	2.25	-30.00	-32.25	Н
2478.625000	-44.44	-30.00	14.44	Н



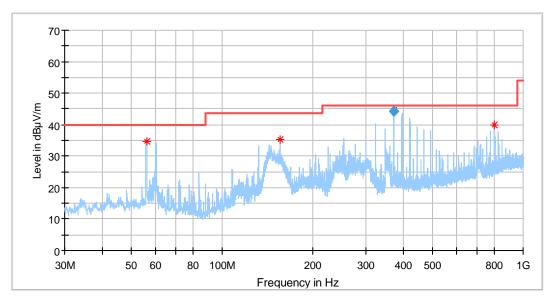
# Spurious radiated emissions for transmitter

### Radiated emission data graph (Vertical polarization, 30MHz-1GHz)

Adaptor Model: S005ANU0500100



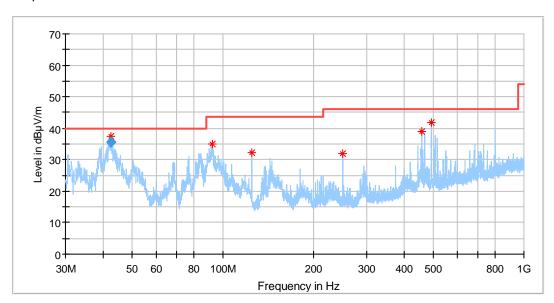
### Radiated emission data graph (Horizontal polarization, 30MHz-1GHz)



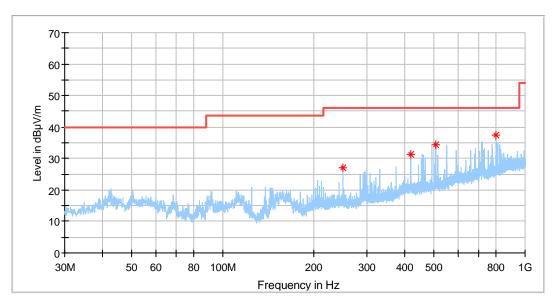


#### Radiated emission data graph (Vertical polarization, 30MHz-1GHz)

Adaptor Model: S006AKU0500100

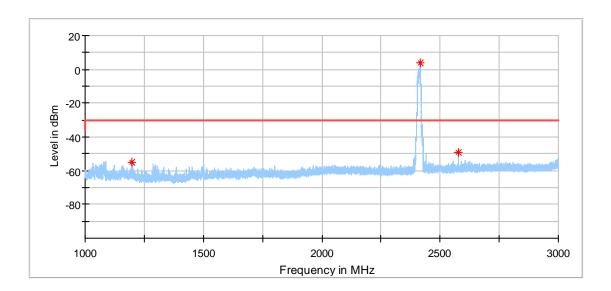


### Radiated emission data graph (Horizontal polarization, 30MHz-1GHz)

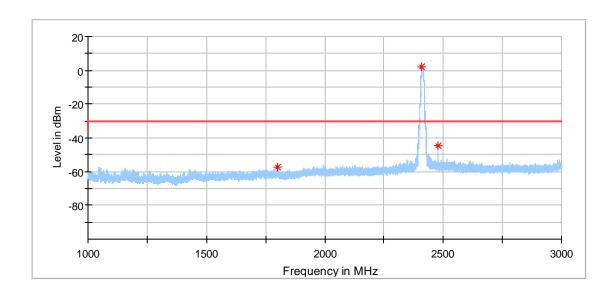




#### Radiated emission data graph (Vertical polarization, 1GHz-3GHz)

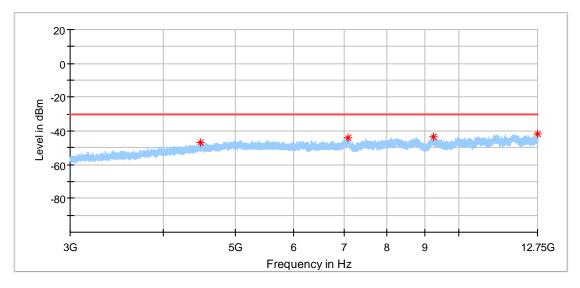


### Radiated emission data graph (Horizontal polarization, 1GHz-3GHz)





### Radiated emission data graph (Vertical polarization, 3GHz-18GHz)

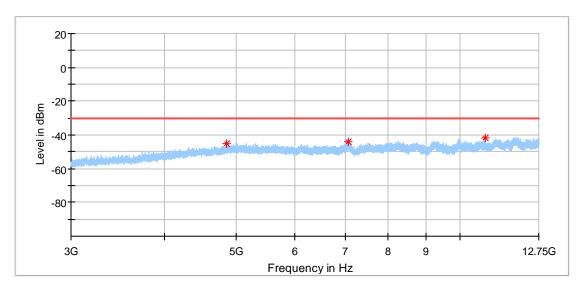


Remark: Only background noise was measured from 12.75GHz-26GHz.

Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Pol
4493.578125	-46.76	-30.00	16.76	٧
7098.351563	-44.23	-30.00	14.23	٧
9245.179688	-43.45	-30.00	13.45	٧
12749.695313	-41.90	-30.00	11.90	V



### Radiated emission data graph (Horizontal polarization, 3GHz-18GHz)



Remark: Only background noise was measured from 12.75GHz-26GHz.

	Frequency (MHz)	MaxPeak (dBm)	Limit (dBm)	Margin (dB)	Pol
ĺ	4853.109375	-44.95	-30.00	14.95	Н
ĺ	7065.750000	-44.03	-30.00	14.03	Н
	10818.585938	-41.48	-30.00	11.48	Н



# 10 Test Equipment List

### **List of Test Instruments**

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
	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
CE	ISN	Rohde & Schwarz	ENY81- CAT6	101664	2016-8-17
	High Voltage Proble	Rohde & Schwarz	TK9420(VT9 420)	9420-58	2016-8-17
	RF Current probe	Rohde & Schwarz	EZ-17	100816	2016-8-17
С	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
	RF Switch Module	Rohde & Schwarz	OSP120/OS P-B157	101226/10085 1	2016-8-17
	EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2016-8-17
RE	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2017-8-17
KE	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		