

FCC Test Report

FCC ID : IPH-03771

Equipment : Marine Stereo

Model No. : A03771

Brand Name : FUSION

Applicant : Garmin International, Inc.

Address : 1200 E. 151st Street Olathe, KS 66062 United

States

Standard : 47 CFR FCC Part 15.249

Received Date : Jul. 01, 2019

Tested Date : Jul. 15 ~ Sep. 05, 2019

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by: Approved by:

Along Chen / Assistant Manager Gary Chang / Manager

TAF

Testing Laboratory

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Release Record

Report No.	Version	Description	Issued Date
FR970101-1	Rev. 01	Initial issue	Oct. 16, 2019

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Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	AC Power Line Conducted Emissions	Note ¹	N/A
15.249(a)	Field Strength of Fundamental	Meet the requirement of limit	Pass
15.249(a)(d)	Field Strength of Harmonics and Emissions Radiated outside of the Specified Frequency Bands	Meet the requirement of limit	Pass
15.215(c)	20dB bandwidth	Meet the requirement of limit	Pass
15.203	Antenna Requirement	Meet the requirement of limit	Pass

N/A means Not Applicable.

Note¹: The EUT consumes DC power, so the test is not required.

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

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1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

RF General Information							
Frequency Range (MHz) Channel Number Data Rate							
2460	GFSK	2460	1 [1]	1 Mbps			

1.1.2 Antenna Details

Ant. No.	Туре	Gain (dBi)	Gain (dBi) Connector	
1	PIFA	0.76	No	

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	12Vdc
rower Supply Type	12 vuc

1.1.4 Accessories

No.	Equipment	Description
1	Power cable x1	Brand: FUSION Model: Ca Assy, A Port, PWR/SPKR, FusConn 0.2m non-shielded without core
2	Audio cable x2	Brand: FUSION Model: Ca Assy, B Port, RCA, Zone 1, Zone 2, Aux, FusConn 0.2m non-shielded without core

1.1.5 EUT mode and Duty Cycle

EUT mode	Hardware control		
Duty Cycle and Duty Factor	Duty Cycle (%)	Duty Factor (dB)	
Duty Cycle and Duty Factor	100	0.00	

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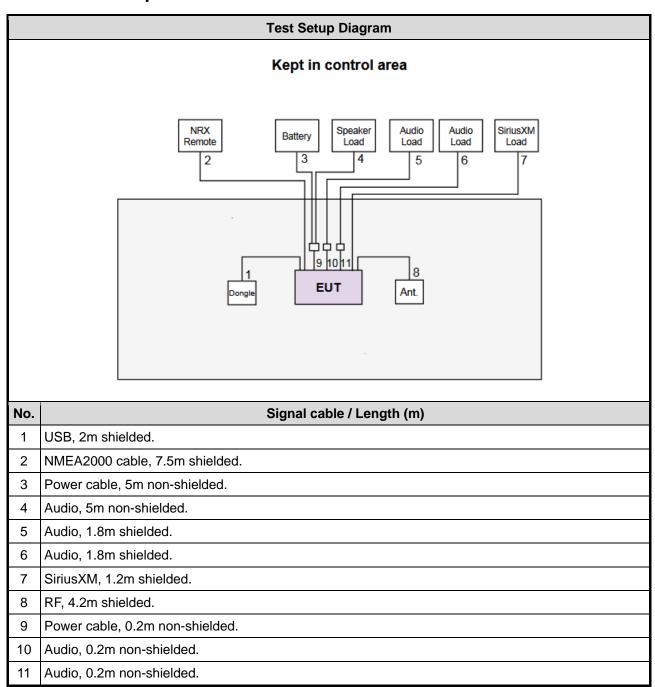
1.2 Local Support Equipment List

	Support Equipment List							
No.	Equipment	Brand	Model	FCC ID	Remarks			
1	AM/FM ANT				Provided by applicant.			
2	NRX Remote				Provided by applicant.			
3	Speaker Load				Provided by applicant.			
4	SiriusXM Load				Provided by applicant.			
5	Audio Load x2				Provided by applicant.			
6	USB Dongle				Provided by applicant.			

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1.3 Test Setup Chart



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1.4 The Equipment List

Test Item	Radiated Emission be	elow 1 GHz					
Test Site	966 chamber1 / (03CH01-WS) Sep. 05, 2019						
Tested Date							
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until		
Spectrum Analyzer	R&S	FSV40	101498	Dec. 27, 2018	Dec. 26, 2019		
Receiver	R&S	ESR3	101658	Dec. 11, 2018	Dec. 10, 2019		
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jul. 12, 2019	Jul. 11, 2020		
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 18, 2018	Dec. 17, 2019		
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 15, 2018	Nov. 14, 2019		
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 09, 2018	Nov. 08, 2019		
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 08, 2018	Oct. 07, 2019		
Preamplifier	EMC	EMC02325	980225	Jul. 09, 2019	Jul. 08, 2020		
Preamplifier	Agilent	83017A	MY39501308	Oct. 04, 2018	Oct. 03, 2019		
Preamplifier	EMC	EMC184045B	980192	Aug. 01, 2019	Jul. 31, 2020		
RF Cable	EMC	EMC104-SM-SM-80 00	181106	Oct. 08, 2018	Oct. 07, 2019		
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Oct. 08, 2018	Oct. 07, 2019		
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Oct. 08, 2018	Oct. 07, 2019		
LF cable 1M	EMC	EMCCFD400-NM-N M-1000	160502	Oct. 08, 2018	Oct. 07, 2019		
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Oct. 08, 2018	Oct. 07, 2019		
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-002	Oct. 08, 2018	Oct. 07, 2019		
Measurement Software	AUDIX	e3	6.120210g	NA	NA		

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Test Item	Radiated Emission above 1 GHz						
Test Site 966 chamber1 / (03CH01-WS)							
Tested Date	Jul. 15, 2019						
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until		
Spectrum Analyzer	R&S	FSV40	101498	Dec. 27, 2018	Dec. 26, 2019		
Receiver	R&S	ESR3	101658	Dec. 11, 2018	Dec. 10, 2019		
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jul. 18, 2018	Jul. 17, 2019		
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 18, 2018	Dec. 17, 2019		
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Nov. 15, 2018	Nov. 14, 2019		
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 09, 2018	Nov. 08, 2019		
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 08, 2018	Oct. 07, 2019		
Preamplifier	EMC	EMC02325	980225	Jul. 20, 2018	Jul. 19, 2019		
Preamplifier	Agilent	83017A	MY39501308	Oct. 04, 2018	Oct. 03, 2019		
Preamplifier	EMC	EMC184045B	980192	Aug. 09, 2018	Aug. 08, 2019		
RF Cable	EMC	EMC104-SM-SM-80 00	181106	Oct. 08, 2018	Oct. 07, 2019		
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Oct. 08, 2018	Oct. 07, 2019		
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16014/4	Oct. 08, 2018	Oct. 07, 2019		
LF cable 1M	EMC	EMCCFD400-NM-N M-1000	160502	Oct. 08, 2018	Oct. 07, 2019		
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Oct. 08, 2018	Oct. 07, 2019		
LF cable 10M	Woken	CFD400NL-LW	CFD400NL-002	Oct. 08, 2018	Oct. 07, 2019		
Measurement Software	AUDIX	e3	6.120210g	NA	NA		
	val of instruments liste	d above is one year.			ı		

RF Conducted							
(TH01-WS)							
Jul. 17, 2019							
Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until			
R&S	FSV40	101063	Apr. 17, 2019	Apr. 16, 2020			
Anritsu	ML2495A	1241002	Oct. 09, 2018	Oct. 08, 2019			
Anritsu	MA2411B	1207366	Oct. 09, 2018	Oct. 08, 2019			
GW INSTEK	GPC-6030D	EM892433	Oct. 25, 2018	Oct. 24, 2019			
R&S	CBT	100959	Sep. 24, 2018	Sep. 23, 2019			
ICC	SENSE-15247_FS	V5.10.1	NA	NA			
	Manufacturer R&S Anritsu Anritsu GW INSTEK R&S	Manufacturer Model No. R&S FSV40 Anritsu ML2495A Anritsu MA2411B GW INSTEK GPC-6030D R&S CBT	Manufacturer Model No. Serial No. R&S FSV40 101063 Anritsu ML2495A 1241002 Anritsu MA2411B 1207366 GW INSTEK GPC-6030D EM892433 R&S CBT 100959	Manufacturer Model No. Serial No. Calibration Date R&S FSV40 101063 Apr. 17, 2019 Anritsu ML2495A 1241002 Oct. 09, 2018 Anritsu MA2411B 1207366 Oct. 09, 2018 GW INSTEK GPC-6030D EM892433 Oct. 25, 2018 R&S CBT 100959 Sep. 24, 2018			

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1.5 Test Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.249

ANSI C63.10-2013

1.6 Deviation from Test Standard and Measurement Procedure

None

1.7 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

Measurement Uncertainty		
Parameters	Uncertainty	
Bandwidth	±34.130 Hz	
Radiated emission ≤ 1GHz	±3.41 dB	
Radiated emission > 1GHz	±4.59 dB	

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2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
Radiated Emissions	03CH01-WS	25°C / 65-66% 24°C / 64%	Akun Chung
RF Conducted	TH01-WS	25°C / 65%	Akun Chung

FCC Designation No.: TW2732FCC site registration No.: 181692

➤ ISED#: 10807A

➤ CAB identifier: TW2732

2.2 The Worst Test Modes and Channel Details

Test item	Mode	Test Frequency (MHz)	Data Rate	Test Configuration
Field Strength of Fundamental	GFSK	2460	1 Mbps	
Radiated Emissions ≤ 1GHz	GFSK	2460	1 Mbps	
Radiated Emissions > 1GHz	GFSK	2460	1 Mbps	
20dB bandwidth	GFSK	2460	1 Mbps	

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2.3 Radiated Emission

This section includes field strength of fundamental, field strength of harmonics and emissions radiated outside of the operating frequency bands.

2.3.1 Limit of field strength of fundamental and field strength of harmonics

Fundamental Frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
2400–2483.5 MHz	50	500

2.3.2 Limit of Unwanted Emissions

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in below table, whichever is the lesser attenuation.

Radiated emission limits			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1:

Qusai-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit **Note 2:**

Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

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2.3.3 Test Procedures

- Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at test table. For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height is 1.5 m
- 2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
- 3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

Note:

- Radiated emission below 1GHz
 120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission
- Radiated emission above 1GHz / Peak value except fundamental RBW=1MHz, VBW=3MHz and Peak detector
- Radiated emission above 1GHz / Average value for field strength of fundamental and harmonics
 The average value is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:

20log (Duty cycle) =
$$20log \frac{0.32029 \times 2 \text{ ms}}{100 \text{ ms}} = -43.87 \text{dB}$$

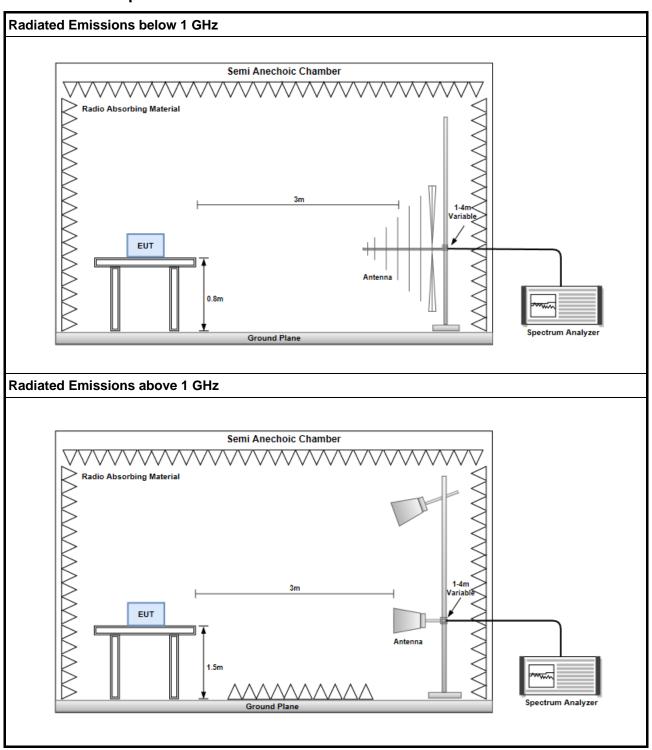
Please see page 18 for plotted duty

- Radiated emission Peak value for fundamental RBW=3MHz, VBW=10MHz and Peak detector
- Radiated emission Average value for fundamental RBW=3MHz, VBW=3kHz and Peak detector

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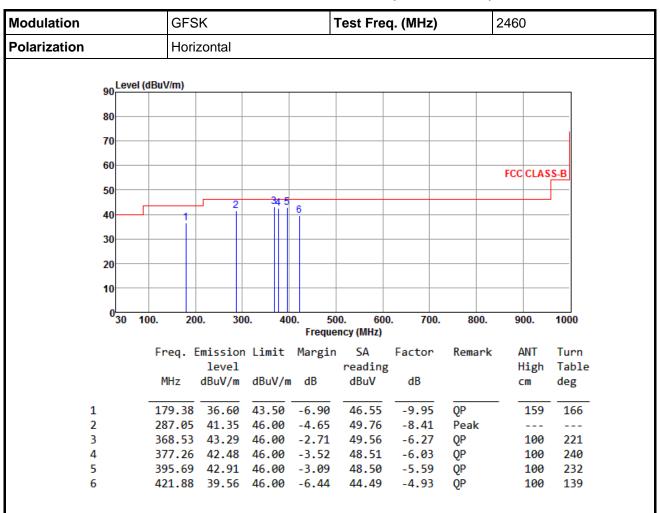
2.3.4 Test Setup



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2.3.5 Transmitter Radiated Unwanted Emissions (Below 1GHz)



Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

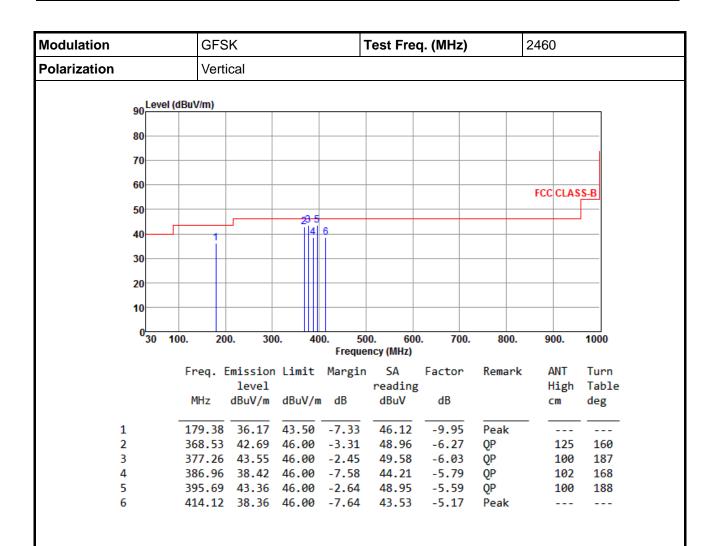
*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor, cable loss and amplifier gain

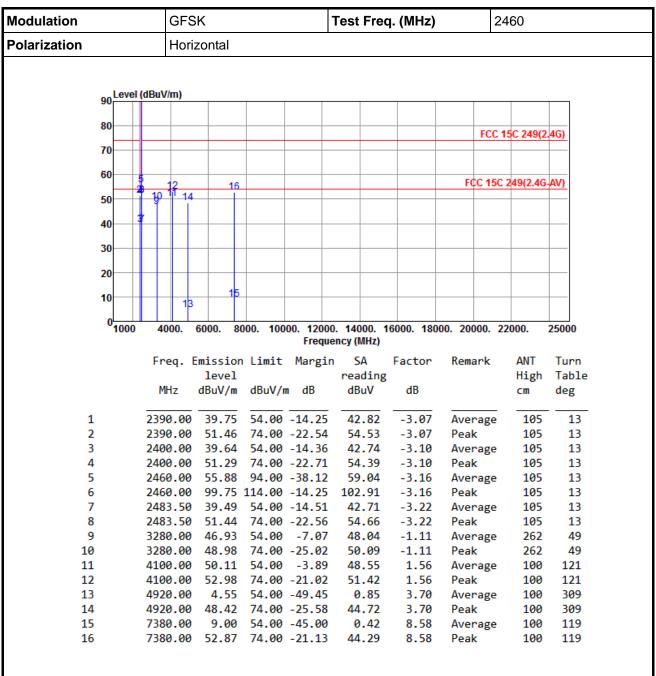
Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Note 3: All spurious emissions below 30MHz are more than 20 dB below the limit.

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2.3.6 Transmitter Radiated Unwanted Emissions (Above 1GHz)



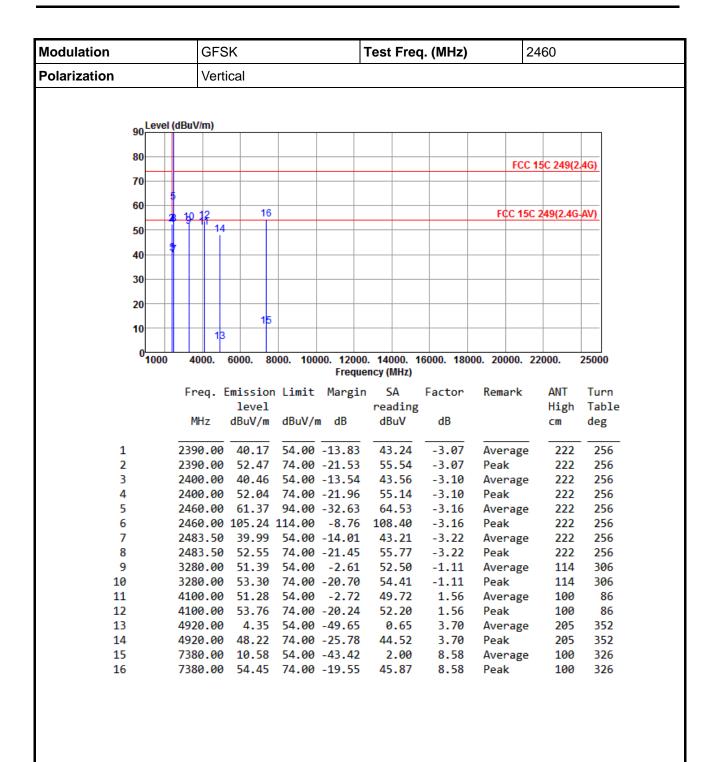
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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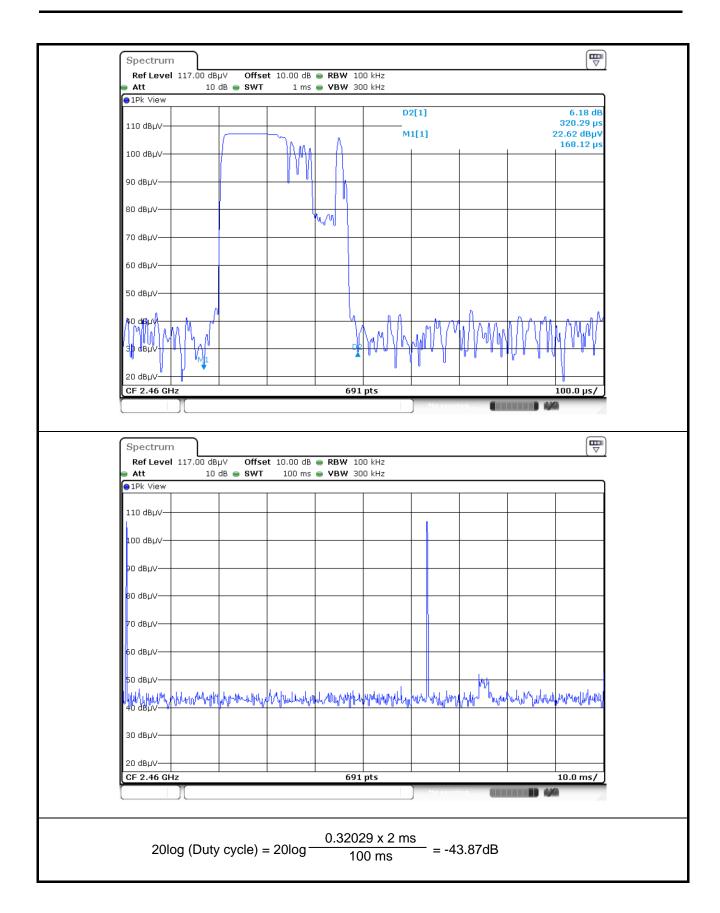
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor , cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

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2.4 20dB and Occupied Bandwidth

2.4.1 Test Procedures

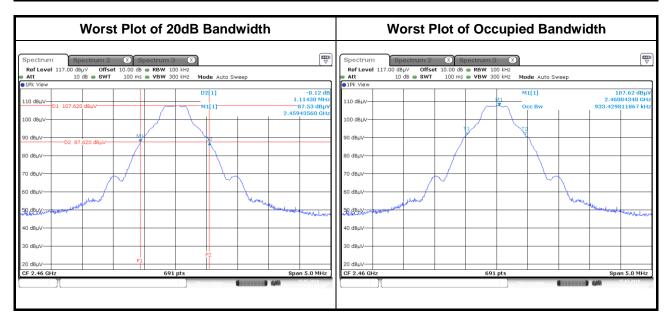
- 1. Set resolution bandwidth (RBW) = 100 kHz, Video bandwidth = 300 kHz.
- 2. Detector = Peak, Trace mode = max hold
- 3. Sweep = auto couple, Allow the trace to stabilize.
- 4. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 20dB relative to the maximum level measured in the fundamental emission.
- 5. Use the occupied measurement function of specturm analyzer to measure 99% occupied bandwidth.

2.4.2 Test Setup



2.4.3 20dB and Occupied Bandwidth

Freq. (MHz)	20dB Bandwidth (MHz)	Occupied Bandwidth (MHz)
2460	1.114	0.933



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3 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website http://www.icertifi.com.tw.

Linkou

Tel: 886-2-2601-1640 No. 30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan, R.O.C.

Kwei Shan

Tel: 886-3-271-8666 No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

Kwei Shan Site II

Tel: 886-3-271-8640 No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

If you have any suggestion, please feel free to contact us as below information.

Tel: 886-3-271-8666 Fax: 886-3-318-0155

Email: ICC_Service@icertifi.com.tw

___END___

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