

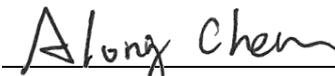
FCC Test Report

FCC ID : IPH- A03408
Equipment : Marine Stereo
Model No. : A03408
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 : Oct. 07, 2021
Tested Date : Mar. 28 ~ Mar. 29, 2022

We, International Certification Corporation, 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 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

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APPENDIX A. RADIATED EMISSION

APPENDIX B. 20dB AND OCCUPIED BANDWIDTH

Release Record

Report No.	Version	Description	Issued Date
FR7N3001-05AF	Rev. 01	Initial issue	May 31, 2022

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. Note ¹ : 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.

1 General Description

1.1 Information

1.1.1 Specification of the Equipment under Test (EUT)

RF General Information				
Frequency Range (MHz)	Modulation	Ch. Freq. (MHz)	Channel Number	Data Rate
2402-2480	GFSK	2460	1 [1]	1 Mbps

1.1.2 Antenna Details

Ant. No.	Type	Gain (dBi)	Connector	Remark
1	PIFA	2.18	N/A	---

1.1.3 Power Supply Type of Equipment under Test (EUT)

Power Supply Type	12Vdc
--------------------------	-------

1.1.4 Accessories

No.	Equipment	Description
1	Power cable	Brand: FUSION Model: Garmin/320-01021-01 Line: 0.2m non-shielded without core
2	Audio cable	Brand: FUSION Model: Garmin/320-01022-01 Line: 0.2m shielded without core
3	Audio cable	Brand: FUSION Model: Garmin/320-01022-02 Line: 0.2m shielded without core
4	NMEA 2M cable	Brand: FUSION Model: Garmin/320-00387-00 Line: 2.1m shielded without core

1.1.5 Test Tool and Duty Cycle

Test Tool	ANT Test	
Duty Cycle and Duty Factor	Duty Cycle (%)	Duty Factor (dB)
	97.38	0.12

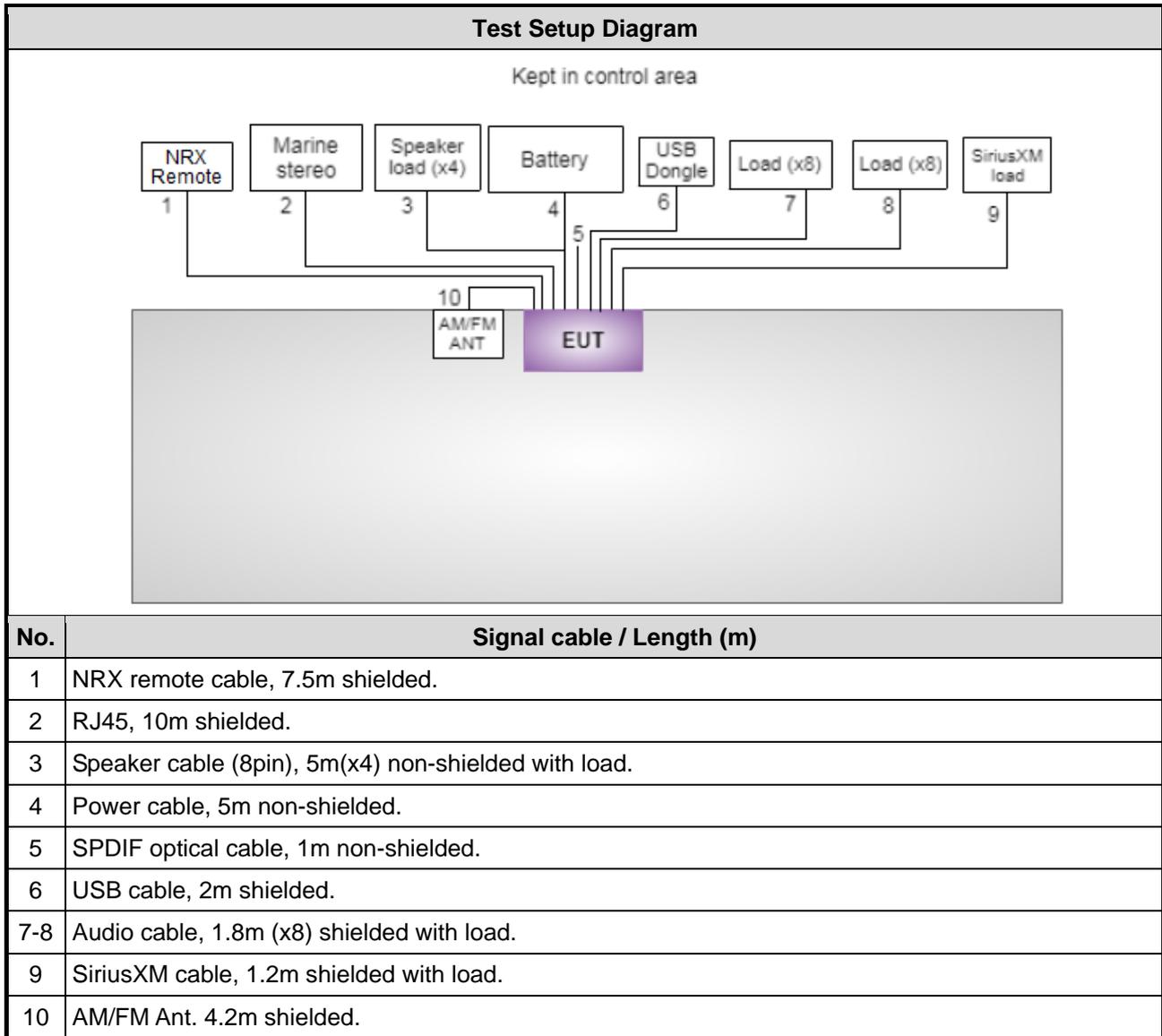
1.1.6 Power Index of Test Tool

Modulation Mode	Test Frequency (MHz)
	2460
GFSK	0

1.2 Local Support Equipment List

Support Equipment List					
No.	Equipment	Brand	Model	FCC ID	Remarks
1	Battery	YUASA	36B20R(S)	---	---
2	SiriusXM	---	---	---	Provided by applicant.
3	Load (x16)	---	---	---	Provided by applicant.
4	USB Dongle	Strontium	Pollex 4 G	---	Provided by applicant.
5	AM/FM ANT	Techbrands	AR-3250	---	Provided by applicant.
6	Speaker load (x4)	FUSION	L25J4R0E	---	Provided by applicant.
7	NRX Remote	Fusion	MS-NRX300	---	Provided by applicant.
8	Marine stereo	FUSION	MS-RA770	---	Provided by applicant.

1.3 Test Setup Chart



1.4 The Equipment List

Test Item	Radiated Emission				
Test Site	966 chamber1 / (03CH01-WS)				
Tested Date	Mar. 28 ~ Mar. 29, 2022				
Instrument	Brand	Model No.	Serial No.	Calibration Date	Calibration Until
Receiver	R&S	ESR3	101657	Mar. 15, 2022	Mar. 14, 2023
Spectrum Analyzer	R&S	FSV40	101063	Apr. 19, 2021	Apr. 18, 2022
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 08, 2021	Nov. 07, 2022
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-522	Jun. 30, 2021	Jun. 29, 2022
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1096	Dec. 03, 2021	Dec. 02, 2022
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170508	Jan. 11, 2022	Jan. 10, 2023
Preamplifier	EMC	EMC02325	980225	Jun. 29, 2021	Jun. 28, 2022
Preamplifier	Agilent	83017A	MY39501308	Sep. 28, 2021	Sep. 27, 2022
Preamplifier	EMC	EMC184045B	980192	Jul. 14, 2021	Jul. 13, 2022
Loop Antenna Cable	KOAX KABEL	101354-BW	101354-BW	Oct. 05, 2021	Oct. 04, 2022
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-001	Oct. 05, 2021	Oct. 04, 2022
LF cable 11M	EMC	EMCCFD400-NW-N W-11000	200801	Oct. 05, 2021	Oct. 04, 2022
LF cable 1M	EMC	EMCCFD400-NM-N M-1000	160502	Oct. 05, 2021	Oct. 04, 2022
RF Cable	EMC	EMC104-35M-35M- 8000	210920	Oct. 05, 2021	Oct. 04, 2022
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16019/4	Oct. 05, 2021	Oct. 04, 2022
Measurement Software	AUDIX	e3	6.120210g	NA	NA

Note: Calibration Interval of instruments listed above is one year.

1.5 Test Standards

47 CFR FCC Part 15.249

ANSI C63.10-2013

1.6 Deviation from Test Standard and Measurement Procedure

None

1.7 Measurement Uncertainty

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

2 Test Configuration

2.1 Testing Facility

Test Laboratory	International Certification Corporation
Test Site	03CH01-WS
Address of Test Site	No.3-1, Lane 6, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 33381, Taiwan (R.O.C.)

- FCC Designation No.: TW2732
- FCC 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
AC Power Line Conducted Emissions	GFSK	2460	1 Mbps	--
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	--

3 Transmitter Test Results

3.1 Radiated Emission

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

3.1.1 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

3.1.2 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.

3.1.3 Test Procedures

1. 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:

1. Radiated emission below 1GHz
120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission
2. Radiated emission above 1GHz / Peak value except fundamental
RBW=1MHz, VBW=1/T and Peak detector
3. 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:

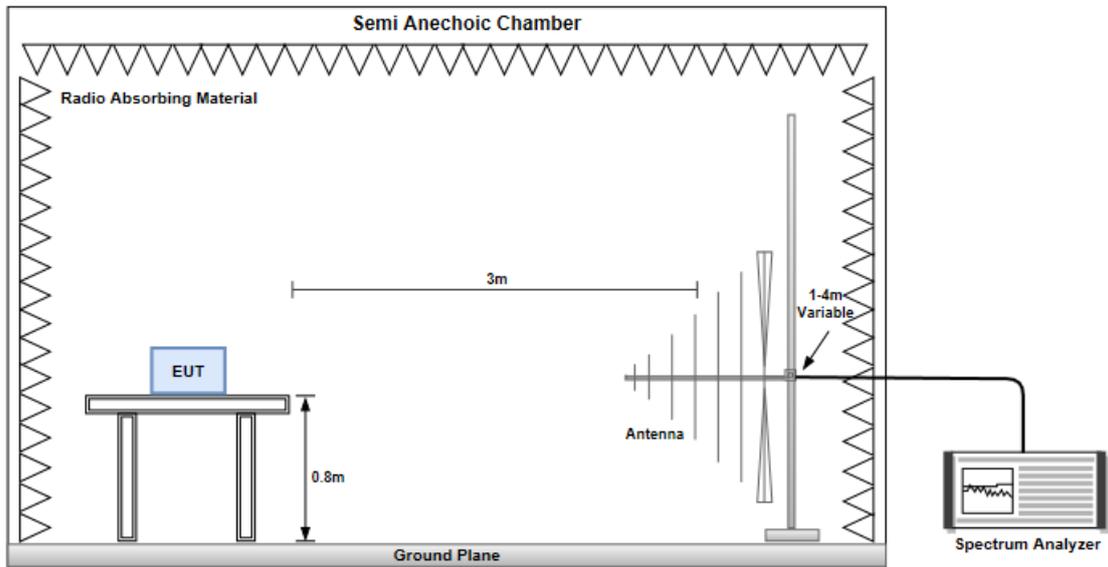
$$20\log(\text{Duty cycle}) = 20\log \frac{0.23043 \times 2\text{ms}}{100 \text{ms}} = -46.73\text{dB}$$

Please see APPENDIX A. RADIATED EMISSION

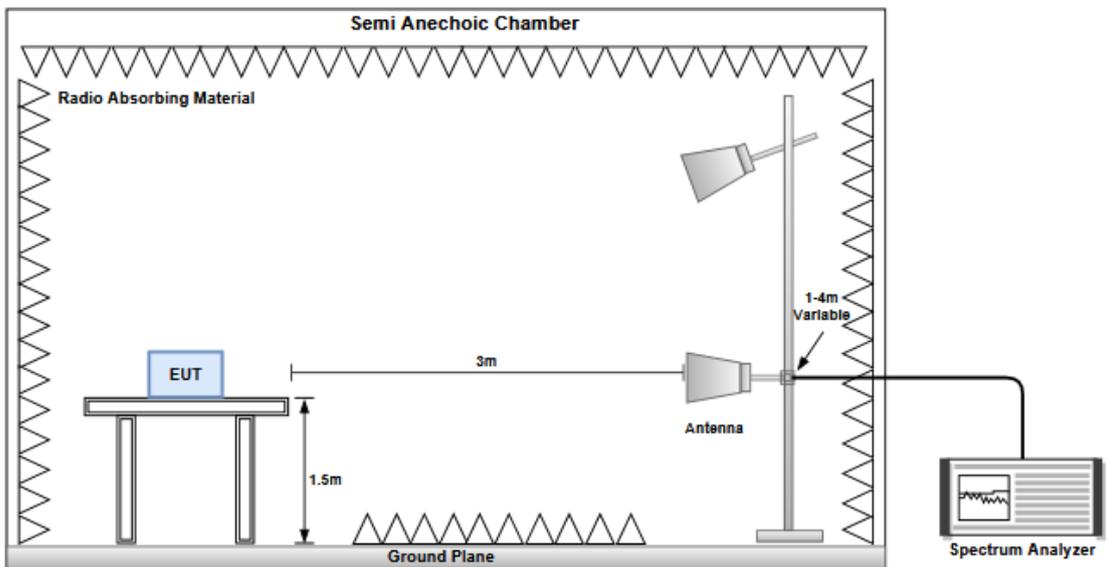
4. Radiated emission above 1GHz / Average value for other emissions
RBW=1MHz, VBW=1/T and Peak detector
5. Radiated emission Peak value for fundamental
RBW=1MHz, VBW=3MHz and Peak detector

3.1.4 Test Setup

Radiated Emissions below 1 GHz



Radiated Emissions above 1 GHz



3.1.5 Test Results

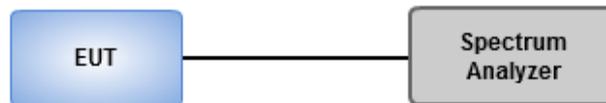
Refer to Appendix A.

3.2 20dB and Occupied Bandwidth

3.2.1 Test Procedures

1. Set resolution bandwidth (RBW) = 20 kHz, Video bandwidth = 100 kHz.
2. Detector = Peak(20 dB bandwidth) / Sample(Occupied bandwidth), 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 spectrum analyzer to measure 99% occupied bandwidth.

3.2.2 Test Setup



3.2.3 20dB and Occupied Bandwidth

Ambient Condition	25°C / 63%	Tested By	Akun Chung
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Refer to Appendix B

4 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 Corporation (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 Dist., Tao Yuan
City 33381, Taiwan (R.O.C.)
No.2-1, Lane 6, Wen San 3rd
St., Kwei Shan Dist., Tao Yuan
City 33381, Taiwan (R.O.C.)

Kwei Shan Site II

Tel: 886-3-271-8640

No.14-1, Lane 19, Wen San 3rd
St., Kwei Shan Dist., 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: 886-3-318-0345

Email: ICC_Service@icertifi.com.tw

==END==



Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	GFSK	Test Freq. (MHz)	2460						
Polarization	Horizontal								
Test By :Brad Wu Temperature(°C):23 Humidity(%):66									
<p>The graph plots Level (dBuV/m) on the y-axis (0 to 90) against Frequency (MHz) on the x-axis (30 to 1000). A red line represents the CLASS-B limit, which is constant at 46 dBuV/m from 30 MHz to 1000 MHz. Six blue vertical lines indicate measured peaks at frequencies 1 through 6, with their respective levels and margins shown in the table below.</p>									
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB/m	Remark	ANT High cm	Turn Table deg
1	61.04	33.27	40.00	-6.73	42.63	-9.36	Peak	---	---
2	171.62	36.35	43.50	-7.15	45.50	-9.15	Peak	---	---
3	399.57	41.09	46.00	-4.91	46.88	-5.79	Peak	---	---
4	515.97	40.03	46.00	-5.97	42.98	-2.95	Peak	---	---
5	664.38	41.51	46.00	-4.49	41.87	-0.36	Peak	---	---
6	712.88	42.94	46.00	-3.06	42.54	0.40	Peak	---	---

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



Modulation	GFSK	Test Freq. (MHz)	2460																																																																																																																																									
Polarization	Vertical																																																																																																																																											
Test By : Brad Wu		Temperature(°C): 23		Humidity(%): 66																																																																																																																																								
<p>The graph plots Level (dBuV/m) on the y-axis (0 to 90) against Frequency (MHz) on the x-axis (30 to 1000). A red step function represents the CLASS-B limit, starting at 40 dBuV/m from 30 MHz to 100 MHz, then stepping up to 45 dBuV/m from 100 MHz to 1000 MHz. Six blue vertical lines indicate peak emissions at 61.04, 171.62, 399.57, 614.91, 664.38, and 712.88 MHz.</p>																																																																																																																																												
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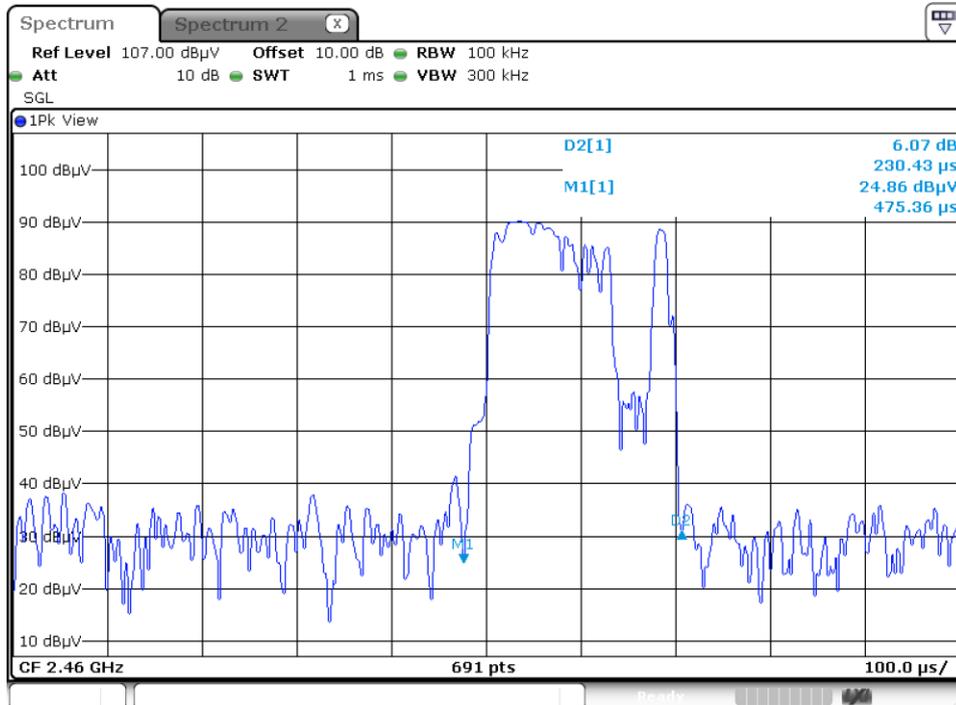
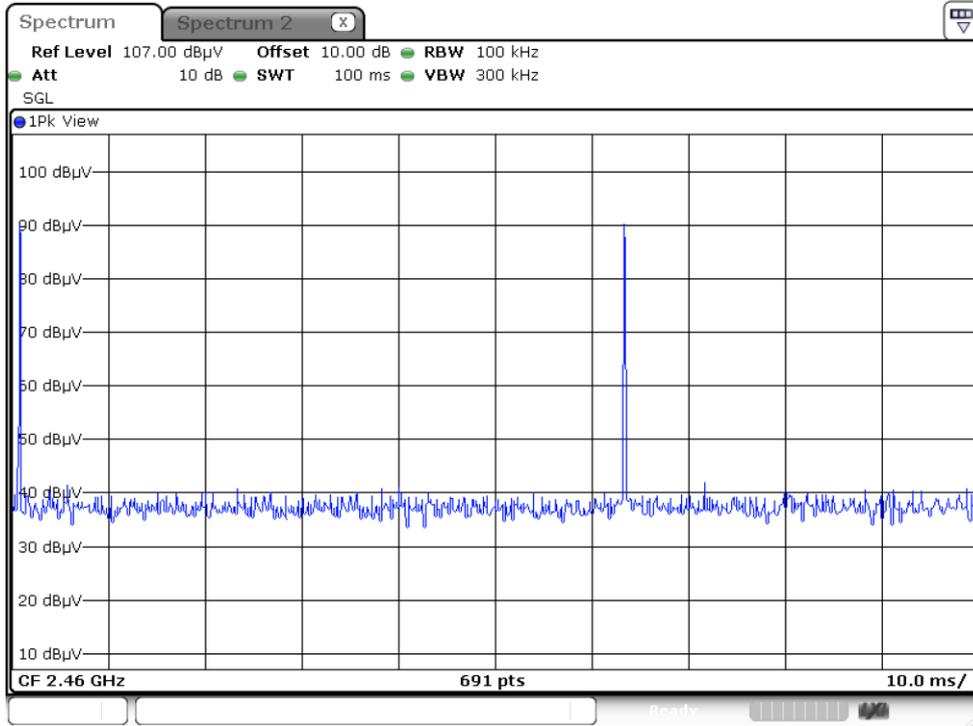
Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation	GFSK	Test Freq. (MHz)	2460						
Polarization	Horizontal								
Test By : Akun Chung Temperature(°C):22 Humidity(%):68									
	Freq.	Emission level	Limit	Margin	SA reading	Factor	Remark	ANT High	Turn Table
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m		cm	deg
1	2390.00	39.16	54.00	-14.84	41.91	-2.75	Average	103	46
2	2390.00	52.04	74.00	-21.96	54.79	-2.75	Peak	103	46
3	2400.00	39.18	54.00	-14.82	41.95	-2.77	Average	103	46
4	2400.00	52.04	74.00	-21.96	54.81	-2.77	Peak	103	46
5	2460.00	49.19	94.00	-44.81	51.96	-2.77	Average	103	46
6	2460.00	95.92	114.00	-18.08	98.69	-2.77	Peak	103	46
7	2483.50	38.97	54.00	-15.03	41.67	-2.70	Average	103	46
8	2483.50	52.11	74.00	-21.89	54.81	-2.70	Peak	103	46
9	2495.00	38.87	54.00	-15.13	41.53	-2.66	Average	103	46
10	2495.00	61.98	74.00	-12.02	64.64	-2.66	Peak	103	46
11	2560.00	39.00	54.00	-15.00	41.45	-2.45	Average	103	46
12	2560.00	61.41	74.00	-12.59	63.86	-2.45	Peak	103	46
13	4920.00	1.05	54.00	-52.95	-3.02	4.07	Average	100	100
14	4920.00	47.78	74.00	-26.22	43.71	4.07	Peak	100	100
15	7380.00	6.31	54.00	-47.69	-2.94	9.25	Average	100	105
16	7380.00	53.04	74.00	-20.96	43.79	9.25	Peak	100	105

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV) + Factor* (dB/m)
 *Factor includes antenna factor , cable loss and amplifier gain
 Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).



Modulation	GFSK	Test Freq. (MHz)	2460																																																																																																																																																																			
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$$20\log(\text{Duty cycle}) = 20\log \frac{0.23043 \times 2 \text{ ms}}{100 \text{ ms}} = -46.73\text{dB}$$



Frequency (MHz)	20dB Bandwidth (MHz)	99% Occupied BW
2460	0.920	0.894

