EMC
TEST REPORT

Report No.: TS10070067-EME
Model No.: MA6GC, 2601716
Issued Date: Aug. 11, 2010

Applicant:	**Darfon Electronics Corp.** **167, Shanying Road, Gueishan, Taoyuan 333, Taiwan**
Test Method/ Standard:	**47 CFR FCC Part 15.249 & ANSI C63.4 2003**
Test By:	**Intertek Testing Services Taiwan Ltd.** **No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li,** **Shiang-Shan District, Hsinchu City, Taiwan**

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Table of Contents

Summary of Tests

Test	Reference	Results
Radiated Emission test	15.249(c), 15.209	Pass
Emission on the Band Edge	15.249(d)	Pass
Calculation of Average Factor	15.35	Pass

1. General information

1.1 Identification of the EUT

Product:	Wireless Optical Mouse
Model No.:	MA6GC
FCC ID:	O62MA6GC
Frequency Range:	2403 MHz ~ 2478 MHz
Channel Number:	76 channels
Rated Power:	DC 1.5 V from battery
Power Cord:	N/A
Data Cable:	N/A
Sample Received:	Jul. 05, 2010
Test Date(s):	Jul. 05, 2010
Note 1:	This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.
Note 2:	When determining the test conclusion, the Measurement Uncertainty of test has been considered.

1.2 Additional information about the EUT

The main function of MA6GC (Wireless Optical Mouse) is to send MA6GCRX (Dongle) 2.4GHz RF signals by GFSK modulation.

The model, 2601716, is identical to model MA6GC (EUT).

For more detail features, please refer to User's manual as file name “Installation guide.pdf”

1.3 Antenna description

The EUT uses a permanently connected antenna.

Antenna Type: PCB printed antenna
Connector Type: N/A

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 15 Subpart C Paragraph 15.249 for non-spread spectrum devices.

The test of radiated measurements according to FCC Part15 Section 15.33(a) had been conducted and the field strength of this frequency band were all meet limit requirement, thus we evaluate the EUT pass the specified test.

2.2 Operation mode

The EUT was continuously transmitting during the test.

2.3 Test equipment

Equipment	Brand	Frequency range	Model No.	Serial No.	Calibration Date	Calibration Due Date
EMI Test Receiver	Rohde & Schwarz	9kHz~2.75GHz	ESCS 30	833364/011	Aug. 15, 2009	Aug. 15, 2010
Spectrum Analyzer	Rohde & Schwarz	9kHz~30GHz	FSP 30	100137	Aug. 11, 2009	Aug. 11, 2010
Spectrum Analyzer	Rohde & Schwarz	20Hz~40GHz	FSEK 30	100186	Jan. 18, 2010	Jan. 18, 2011
Horn Antenna	EMCO	1GHz~18GHz	3115	00040729	Mar. 18, 2009	Mar. 18, 2011
Horn Antenna	SCHWARZBECK	14GHz~42GHz	BBHA 9170	BBHA9170159	Aug. 25, 2008	Aug. 25, 2010
Broadband Antenna	SCHWARZBECK	25MHz~1.7GHz	VULB 9160	3133	Aug. 31, 2009	Aug. 31, 2011
Turn Table	HDGmbH	N/A	DS 420S	N/A	N/A	N/A
Antenna Tower	HDGmbH	N/A	MA 240	N/A	N/A	N/A
Pre-Amplifier	MITEQ	100MHz~26.5GHz	Advantest	BB525C	Oct. 27, 2009	Oct. 27, 2011
LISN	Rohde & Schwarz	9KHz~30MHz	ESH3-Z5	825562/003	Mar. 13, 2009	Mar. 13, 2011

Note: The above equipments are within the valid calibration period.

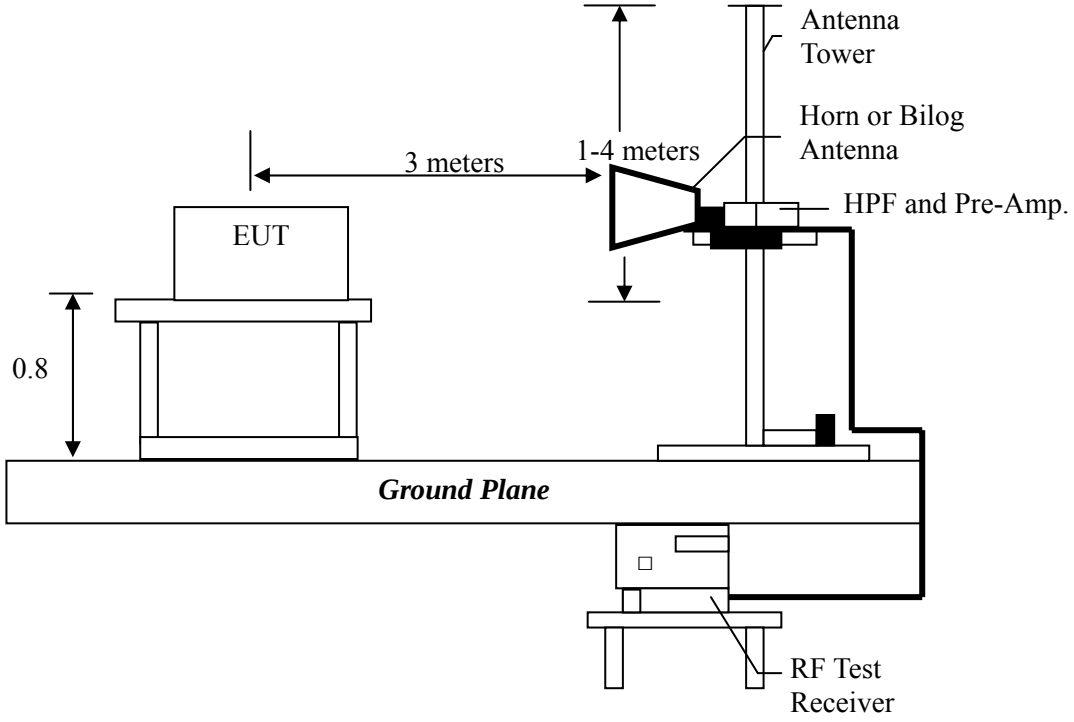
3. Radiated emission test FCC 15.249 (C)

3.1 Operating environment

Temperature:	22	℃
Relative Humidity:	56	%
Atmospheric Pressure	1023	hPa

3.2 Test setup & procedure

The Diagram below shows the test setup, which is utilized to make these measurements.



Radiated emissions were invested cover the frequency range from 30MHz to 1000MHz using a receiver RBW of 120kHz record QP reading, and the frequency over 1GHz using a spectrum analyzer RBW of 1MHz and 10Hz VBW record Average reading. (15.209 paragraphs), the Peak reading (1MHz RBW/VBW) recorded also on the report.
The EUT for testing is arranged on a wooden turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

The EUT configuration please refer to the "Spurious set-up photo.pdf".

3.3 Emission limit

3.3.1 Fundamental and harmonics emission limits

Frequency (MHz)	Field Strength of Fundamental		Field Strength of Harmonics	
	(mV/m@3m)	(dBuV/m@3m)	(uV/m@3m)	(dBuV/m@3m)
2400-2483.5	50	94	500	54

3.3.2 General radiated emission limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

Frequency MHz	15.209 Limits (dB μ V/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:
1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

Measurement uncertainty was calculated in accordance with TR 100 028-1.

Parameter	Uncertainty
Radiated Emission	± 5.10 dB
Conducted Emission	± 2.786 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of k=2.

3.4 Radiated spurious emission test data

3.4.1 Measurement results: frequencies equal to or less than 1 GHz

EUT : MA6GC
Worst Case : Tx at low channel

Polarization (circle)	Frequency (MHz)	Detector	Corr. Factor (dB/m)	Reading (dBuV)	Calculated dBuV/m	Limit (dBuV/m)	Margin (dB)
Vertical	470.38	QP	17.68	10.13	27.81	46.00	-18.19
Vertical	531.49	QP	19.46	9.36	28.82	46.00	-17.18
Vertical	587.75	QP	20.71	9.45	30.16	46.00	-15.84
Vertical	776.90	QP	23.19	9.45	32.64	46.00	-13.36
Vertical	906.88	QP	24.32	10.01	34.32	46.00	-11.68
Vertical	968.96	QP	25.34	10.97	36.30	54.00	-17.70

Polarization (circle)	Frequency (MHz)	Detector	Corr. Factor (dB/m)	Reading (dBuV)	Calculated dBuV/m	Limit (dBuV/m)	Margin (dB)
Horizontal	408.30	QP	16.81	8.95	25.76	46.00	-20.24
Horizontal	429.64	QP	18.12	8.79	26.91	46.00	-19.09
Horizontal	527.61	QP	19.65	9.15	28.80	46.00	-17.20
Horizontal	737.13	QP	22.95	8.53	31.48	46.00	-14.52
Horizontal	864.20	QP	24.12	9.99	34.10	46.00	-11.90
Horizontal	877.78	QP	24.62	9.71	34.32	46.00	-11.68

Remark:

1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor

3.4.2 Measurement results: frequency above 1GHz

EUT : MA6GC
Test Condition : Tx at low channel

Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Corrected Reading (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4806.00	PK	V	35.10	38.54	43.22	-	46.66	74	-27.34
4806.00	AV	V	35.10	38.54	43.22	-13.73	32.93	54	-21.07
7209.00	PK	V	33.00	44.60	36.60	-	48.20	74	-25.80
7209.00	AV	V	33.00	44.60	36.60	-13.73	34.47	54	-19.53
4806.00	PK	H	35.10	38.54	37.38	-	40.82	74	-33.18
4806.00	AV	H	35.10	38.54	37.38	-13.73	27.09	54	-26.91

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz. According to 15.31 (o), the amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported.
4. Average value = peak value + average factor

EUT : MA6GC
Test Condition : Tx at middle channel

Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Corrected Reading (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4880.00	PK	V	35.10	38.54	44.00	-	47.44	74	-26.56
4880.00	AV	V	35.10	38.54	44.00	-13.73	33.71	54	-20.29
4880.00	PK	H	35.10	38.54	41.34	-	44.78	74	-29.22
4880.00	AV	H	35.10	38.54	41.34	-13.73	31.05	54	-22.95

Remark:
1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz. According to 15.31 (o), the amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported.
4. Average value = peak value + average factor

EUT : MA6GC
Test Condition : Tx at high channel

Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Corrected Reading (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4956.00	PK	V	35.10	38.54	42.05	-	45.49	74	-28.51
4956.00	AV	V	35.10	38.54	42.05	-13.73	31.76	54	-22.24
9912.00	PK	V	32.70	49.30	35.08	-	51.68	74	-22.32
9912.00	AV	V	32.70	49.30	35.08	-13.73	37.95	54	-16.05
4956.00	PK	H	35.10	38.54	38.01	-	41.45	74	-32.55
4956.00	AV	H	35.10	38.54	38.01	-13.73	27.72	54	-26.28

Remark:
1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz. According to 15.31 (o), the amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported.
4. Average value = peak value + average factor

3.4.3 Measurement results: Fundamental and harmonics emission

EUT : MA6GC
Test Condition : Tx at low channel

Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Corrected Reading (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
2403.00	PK	H	32.86	66.90	-	99.76	113.9794	-14.22
2403.00	AV	H	32.86	66.90	-13.73	86.03	93.9794	-7.95

Remark:
1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz. According to 15.31 (o), the amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported.
4. Average value = peak value + average factor

EUT : MA6GC
Test Condition : Tx at middle channel

Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Corrected Reading (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
2440.00	PK	H	32.95	64.23	-	97.18	113.9794	-16.80
2440.00	AV	H	32.95	64.23	-13.73	83.45	93.9794	-10.53

Remark:
1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz. According to 15.31 (o), the amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported.
4. Average value = peak value + average factor

EUT : MA6GC
Test Condition : Tx at high channel

Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Corrected Reading (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
2478.00	PK	H	33.06	60.59	-	93.65	113.9794	-20.33
2478.00	AV	H	33.06	60.59	-13.73	79.92	93.9794	-14.06

Remark:

1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1 GHz to 25 GHz. According to 15.31 (o), the amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported.
4. Average value = peak value + average factor

4. Radiated emission on the band edge FCC 15.249(d)

Method of Measurement:

Reference FCC document: KDB558074, ANSI C63.4

The frequency range from 30 MHz to 1000 MHz using Bilog Antenna.
The frequency range over 1 GHz using Horn Antenna.

Radiated emissions were invested cover the frequency range from 30 MHz to 1000 MHz using a receiver RBW of 120 kHz record QP reading, and the frequency over 1 GHz using a spectrum analyzer RBW of 1 MHz and 10 Hz VBW record Average reading. (15.209 paragraph), the Peak reading (1 MHz RBW/VBW) recorded also on the report.

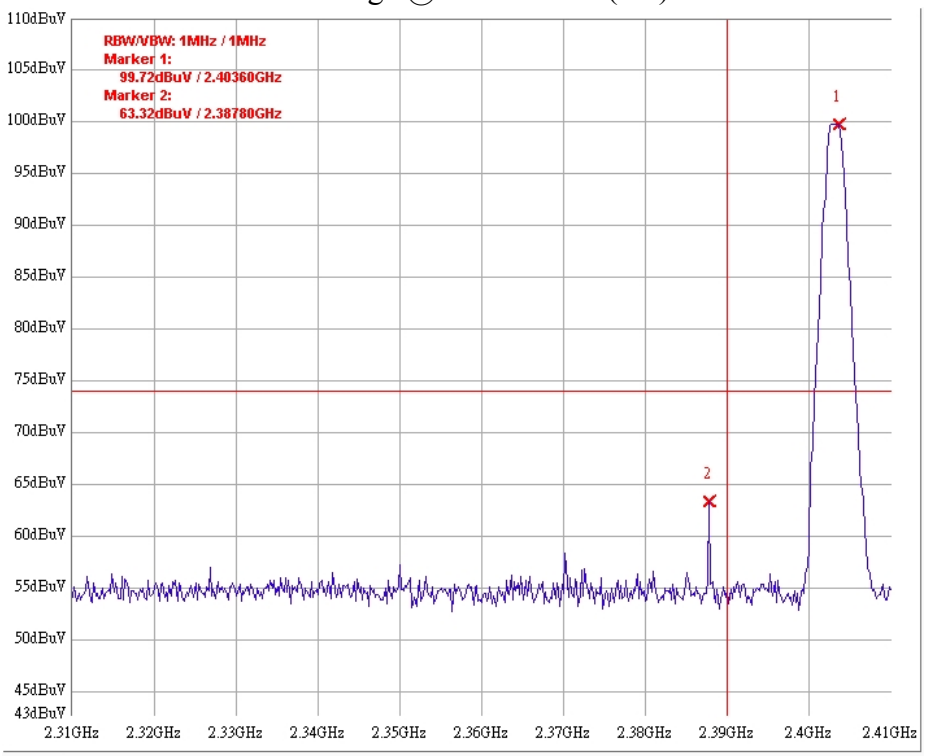
4.1 Measurement results

Channel	Measurement Freq. Band (MHz)	Detector	Average Factor (dB)	The Max. Field Strength in Restrict Band (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
Low Channel	2310-2390	PK	-	63.32	74	-10.68
Low Channel	2310-2390	AV	-13.73	49.59	54	-4.41
High Channel	2483.5-2500	PK	-	63.41	74	-10.59
High Channel	2483.5-2500	AV	-13.73	49.68	54	-4.32

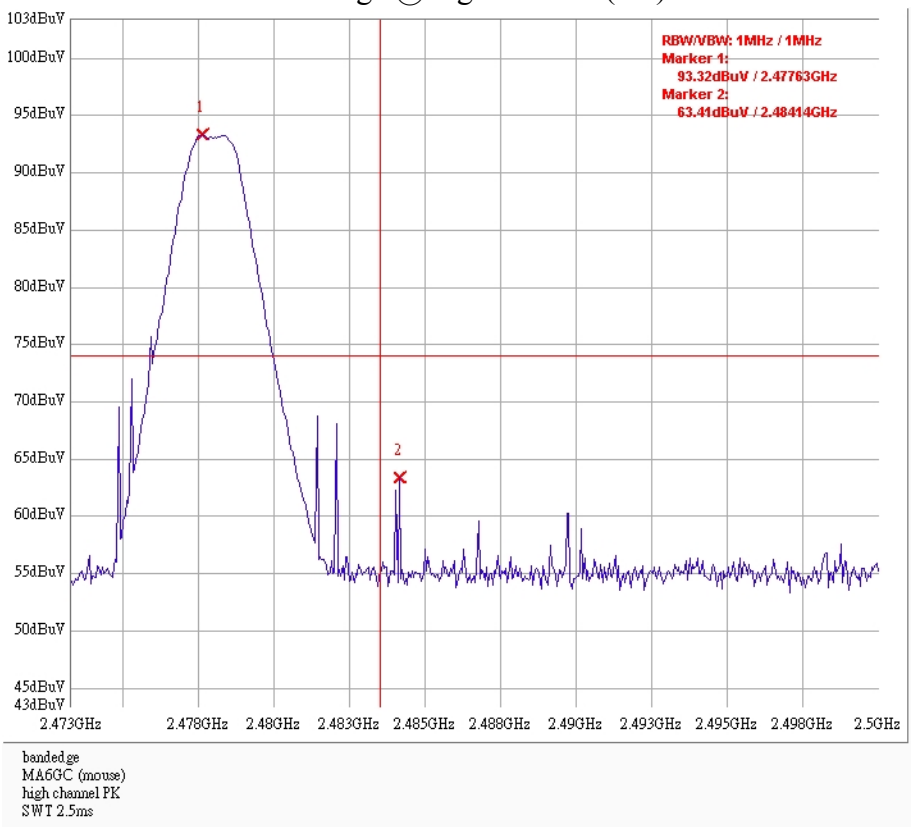
Remark: Average value = peak value + average factor

Please see the plot next page.

Band Edge @ low channel (PK)



Band Edge @ high channel (PK)



5. Calculation of Average Factor

The specification for output field strengths in accordance with the FCC rules specify measurements with an average detector. During testing, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The time period over which the duty cycle is measured in 100 ms or the repetition cycle, whichever is a shorter time frame. The duty cycle is measured by placing the spectrum analyzer in zero span mode at 100 resolution bandwidth.

Averaging factor in dB = 20log (duty cycle)

The duty cycle is simply the on-time divided by the period:

Duty cycle correction factor in dB = 20log (on-time/100ms) or 20log (on-time/period) #If period is less than 100ms

Result:

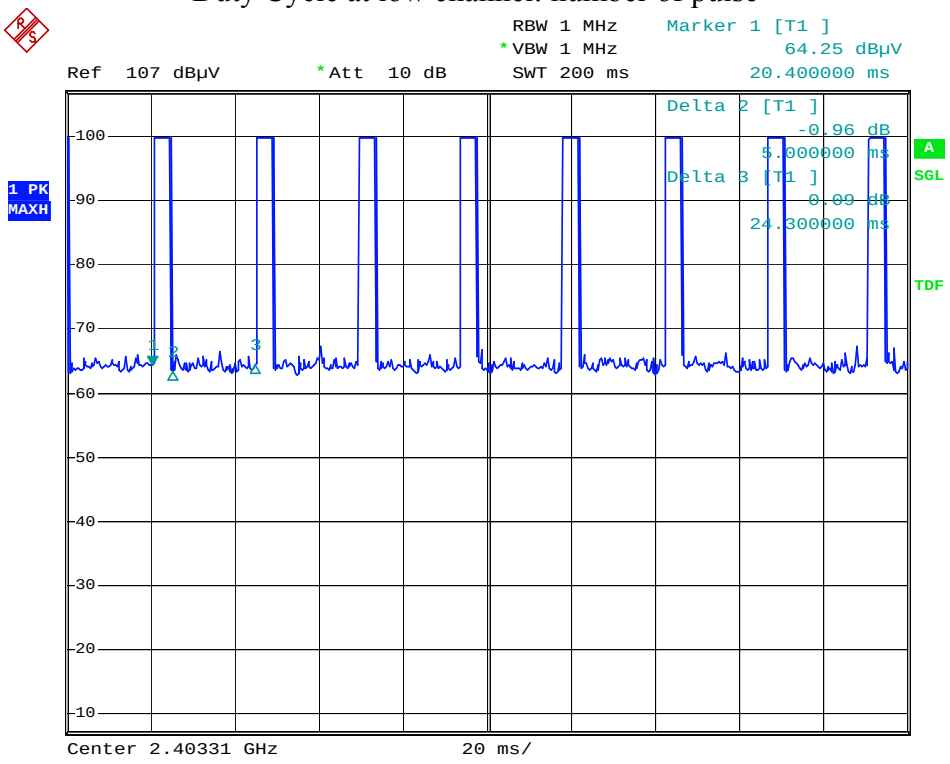
Modulation	: GFSK
Data rate	: 2Mbps

Duty Cycle = 5ms / 24.3ms = 0.2058

Duty cycle correction factor = 20 log10 (0.2058) = -13.7327 dB

Please see the plot next pages.

Duty Cycle at low channel: number of pulse



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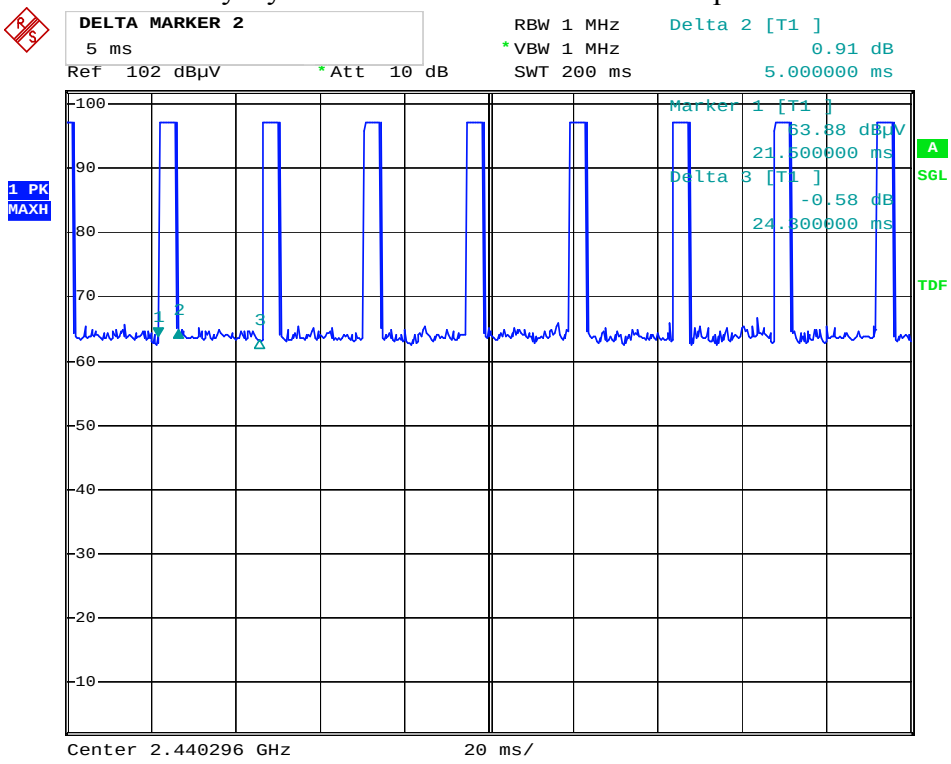
Duty Cycle at middle channel: number of pulse



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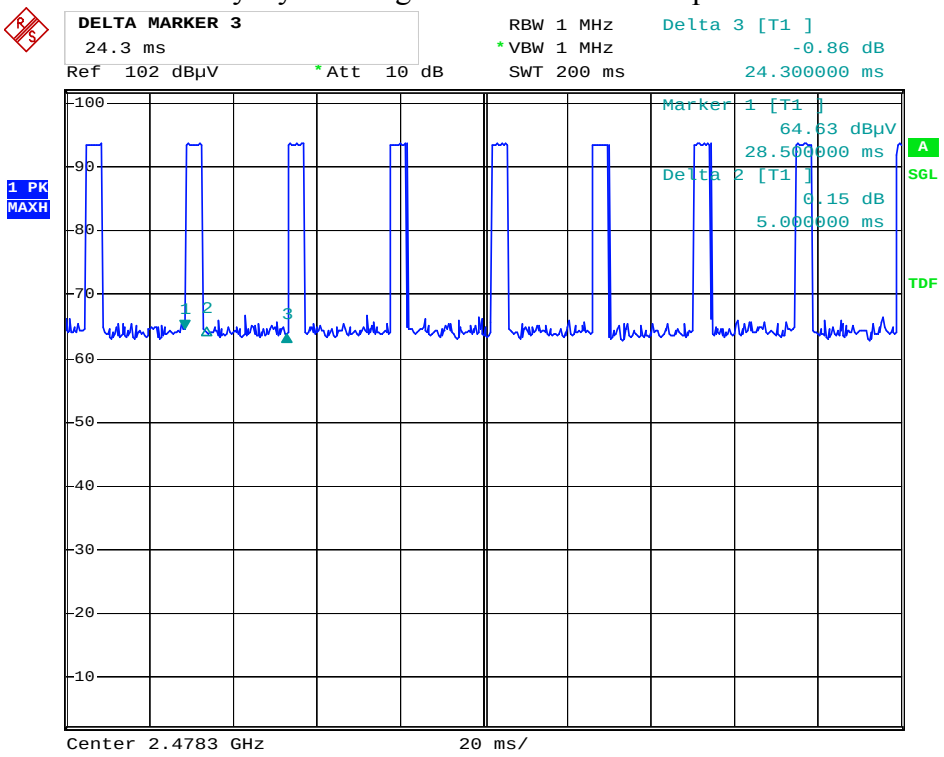
Duty Cycle at high channel: number of pulse



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