

EMC

TEST REPORT

Report No. : TW14040007
Model No. : 7RC04-CF100005
Issued Date : Aug. 21, 2014

Applicant: Pan-World Control Technologies, Inc.
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22101, Taiwan

Test Method/ Standard: 47 CFR FCC Part 15.249 & ANSI C63.4 2003

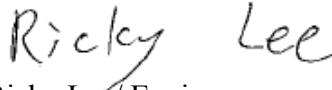
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Table of Contents

Summary of Tests	3
1. General information.....	4
1.1 Identification of the EUT	4
1.2 Additional information about the EUT	5
1.3 Antenna description	5
2. Test specifications.....	6
2.1 Test standard	6
2.2 Operation mode.....	6
2.3 Test equipment	7
3. Radiated emission test FCC 15.249 (C)	8
3.1 Operating environment	8
3.2 Test setup & procedure	8
3.3 Emission limit	9
3.3.1 Fundamental and harmonics emission limits	9
3.3.2 General radiated emission limits.....	9
3.4 Radiated spurious emission test data	10
3.4.1 Measurement results: frequencies equal to or less than 1 GHz	10
3.4.2 Measurement results: frequency above 1GHz	11
3.4.3 Measurement results: Fundamental and harmonics emission	14
4. Radiated emission on the band edge FCC 15.249(d)	16
5. Conducted emission test FCC 15.207	19
6. 20dB Bandwidth test	20
6.1 Operating environment	20
6.2 Test setup & procedure	20
6.3 Measured data of modulated bandwidth test results	20



Summary of Tests

Test	Reference	Results
Radiated Emission test	15.249(c), 15.209	Pass
Emission on the Band Edge	15.249(d)	Pass
Conducted Emission of AC Power	15.207	N/A
20dB Bandwidth	15.215(c)	Pass



1. General information

1.1 Identification of the EUT

Product:	Remote control for ceiling fan
Model No.:	7RC04-CF100005
FCC ID.:	R8Y7RC04-CF100002
Frequency Range:	2410MHz, 2420MHz, 2425MHz
Channel Number:	3 channels
Frequency of Each Channel:	Low channel: 2410 MHz, Middle channel: 2420 MHz, High channel: 2425 MHz
Type of Modulation:	GFSK
Rated Power:	DC 3V
Power Cord:	N/A
Data Cable:	N/A
Sample Received:	Aug. 15, 2014
Test Date(s):	Aug. 18, 2014
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Note 2:	When determining the test conclusion, the Measurement Uncertainty of test has been considered.

1.2 Additional information about the EUT

The EUT is a Remote control for ceiling fan, and was defined as information technology equipment.

Modification (R1) to test report No.: TW14040007(R1) (Verification No.: TW14040007(R1))

The original Test Report Ref. No.: TW14040007, dated Apr. 25, 2014 was modified on Aug. 21, 2014 to include the following changes and/or additions, which were considered technical modifications:

Add a serial model “7RC04-CF100005”, and the different is in microphone.

After engineer judgment, the difference does not affect the RF characteristic; the model was evaluated and deemed as meet the standards requirement, radiated emission test was considered necessary.

For more detail features, please refer to user's Manual.

1.3 Antenna description

The EUT uses a permanently connected antenna.

Antenna Gain : 0 dBi

Antenna Type : Print antenna

Connector Type : Fixed

2. Test specifications

2.1 Test standard

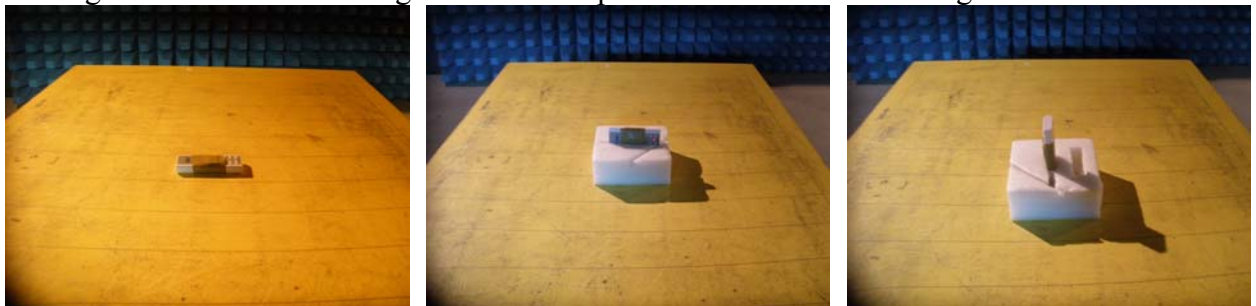
The EUT was performed according to the procedures in FCC Part 15 Subpart C Paragraph 15.249 for non-spread spectrum devices.

The test of radiated measurements according to FCC Part 15 Section 15.33(a) had been conducted and the field strength of this frequency band was all meet limit requirement, thus we evaluate the EUT pass the specified test.

2.2 Operation mode

The EUT is supplied with DC 3 V from battery and use of individual EUT fixed frequency, press the power button for continuous emission.

The signal is maximized through rotation and placement in the three orthogonal axes.



X axis

Y axis

Z axis

After verifying three axes, we found the maximum electromagnetic field was occurred at X axis. The final test data was executed under this configuration.

2.3 Test equipment

Equipment	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
EMI Test Receiver	Rohde & Schwarz	ESCI	100018	2013/11/29	2014/11/28
Spectrum Analyzer	Rohde & Schwarz	FSP30	100137	2014/06/16	2015/06/15
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100186	2014/01/20	2015/01/19
Horn Antenna (1-18G)	Schwarzbeck	BBHA 9120 D	9120D-456	2012/09/03	2014/09/03
Horn Antenna (14-42G)	SHWARZBECK	BBHA 9170	BBHA9170159	2012/09/05	2014/09/05
Broadband Antenna	SCHWARZBECK	VULB 9168	9168-172	2013/08/08	2015/08/07
Pre-Amplifier	MITEQ	AFS44-0010265 0--42-10P-44	1495287	2013/10/27	2015/10/26
Pre-Amplifier	MITEQ	JS4-26004000-- 27-8A	828825	2012/09/18	2014/09/17
Power Meter	Anritsu	ML2495A	0844001	2013/10/10	2014/10/09
Power Sensor	Anritsu	MA2411B	0738452	2013/10/10	2014/10/09
Temperature&Humidity Test Chamber	TERCHY	MHU-225LRU (SA)	950838	2014/06/12	2015/06/11
Two-Line V-Network	Rohde & Schwarz	ESH3-Z5	838979/014	2013/10/12	2014/10/11

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

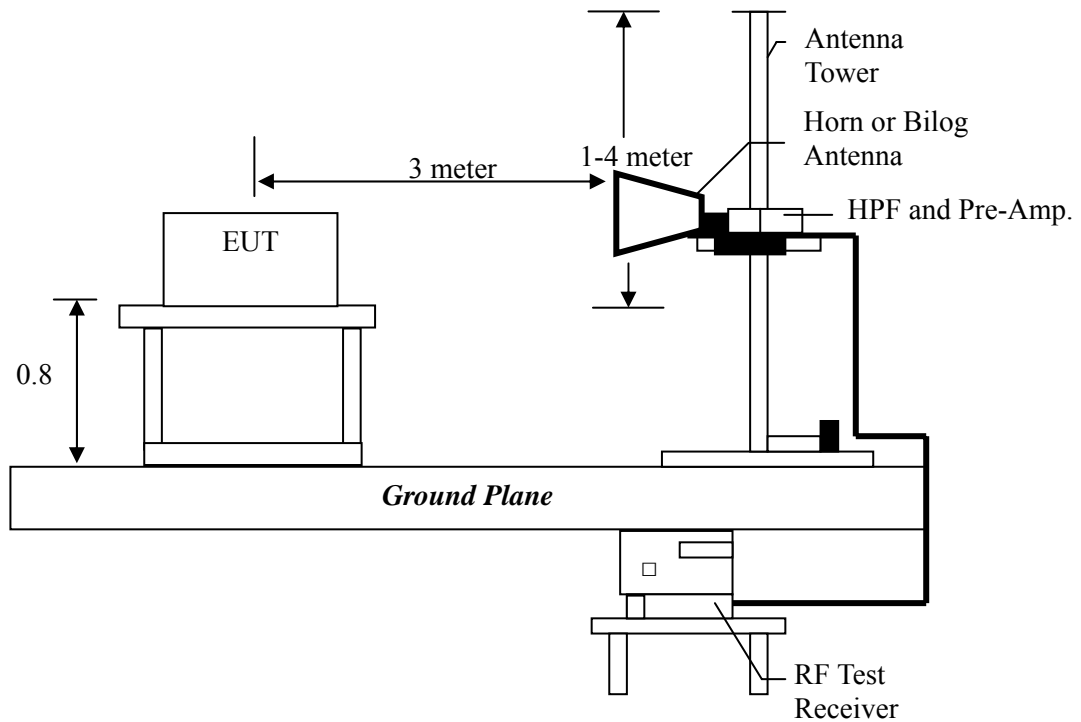
3. Radiated emission test FCC 15.249 (C)

3.1 Operating environment

Temperature:	25	°C
Relative Humidity:	50	%
Atmospheric Pressure	1008	hPa

3.2 Test setup & procedure

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



Radiated emissions were investigated 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 paragraph), the Peak reading (1MHz RBW; 3MHz 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.

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 1 G than Hz

The test was performed on EUT under Low, Middle, High channel continuously transmitting mode. The worst case occurred at Tx High channel.

EUT : 7RC04-CF100002

Test Condition : Tx at High channel

Antenna Polariz. (V/H)	Freq. (MHz)	Receiver Detector	Corr. Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
Vertical	274.44	QP	16.66	6.41	23.07	46.00	-22.93
Vertical	313.24	QP	17.76	23.00	23.53	46.00	-22.47
Vertical	383.08	QP	19.51	23.00	27.44	46.00	-18.56
Vertical	435.46	QP	20.82	23.00	27.89	46.00	-18.11
Vertical	464.56	QP	21.44	23.00	28.45	46.00	-17.55
Vertical	577.08	QP	23.69	23.00	31.95	46.00	-14.05
Horizontal	383.08	QP	19.37	23.00	27.96	46.00	-18.04
Horizontal	429.64	QP	20.18	23.00	27.01	46.00	-18.99
Horizontal	497.54	QP	21.37	23.00	29.62	46.00	-16.38
Horizontal	516.94	QP	21.71	23.00	34.44	46.00	-11.56
Horizontal	544.10	QP	22.19	23.00	31.67	46.00	-14.33
Horizontal	577.08	QP	22.77	21.00	35.00	46.00	-11.00

Remark:

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

3.4.2 Measurement results: frequency above 1GHz

EUT : 7RC04-CF100002

Test Condition : Tx at Low channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4820	PK	V	-0.13	46.04	45.91	74.00	-28.09
4820	PK	H	-0.13	44.90	44.77	74.00	-29.23
7230	PK	V	8.21	38.46	46.67	74.00	-27.33
7230	PK	H	8.21	38.91	47.12	75.00	-27.88
9640	PK	V	12.21	40.89	53.10	74.00	-20.90
12050	PK	V	14.25	50.44	64.69	74.00	-9.31
12050	AV	V	14.25	23.72	37.97	54.00	-16.03
12050	PK	H	14.25	37.73	51.98	74.00	-22.02

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. The data value listed above which is higher than the system noise floor.

EUT : 7RC04-CF100002

Test Condition : Tx at Middle channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4840	PK	V	-0.04	50.42	50.38	74.00	-23.62
4840	PK	H	-0.04	58.45	58.41	74.00	-15.59
4840	AV	H	-0.04	32.58	32.54	54.00	-21.46
7260	PK	V	8.34	61.55	69.89	74.00	-4.11
7260	AV	V	8.34	25.21	33.55	54.00	-20.45
7260	PK	H	8.34	50.15	58.49	74.00	-15.51
7260	AV	H	8.34	24.07	32.41	54.00	-21.59
9680	PK	V	12.21	50.89	63.10	74.00	-10.90
9680	AV	V	12.21	23.68	35.89	54.00	-18.11
9680	PK	H	12.21	48.49	60.70	74.00	-13.30
9680	AV	H	12.21	32.36	44.57	54.00	-9.43
12120	PK	V	14.28	37.88	52.16	74.00	-21.84

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. The data value listed above which is higher than the system noise floor.

EUT : 7RC04-CF100002

Test Condition : Tx at High channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4850	PK	V	0.01	48.65	48.66	74.00	-25.34
4850	PK	H	0.01	45.99	46.00	74.00	-28.00
7275	PK	V	8.41	55.81	64.22	74.00	-9.78
7275	AV	V	8.41	24.57	32.98	54.00	-21.02
7275	PK	H	8.41	52.48	60.89	74.00	-13.11
7275	AV	H	8.41	23.95	32.36	54.00	-21.64
9700	PK	V	12.21	51.75	63.96	74.00	-10.04
9700	AV	V	12.21	23.92	36.13	54.00	-17.87
9700	PK	H	12.21	45.17	57.38	74.00	-16.62
9700	AV	H	12.21	23.17	35.38	54.00	-18.62
12125	PK	V	14.29	51.11	65.40	74.00	-8.60
12125	AV	V	14.29	23.32	37.61	54.00	-16.39

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. The data value listed above which is higher than the system noise floor.

3.4.3 Measurement results: Fundamental and harmonics emission

EUT : 7RC04-CF100002
 Test Condition : Tx at Low channel

Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
2410	PK	V	32.58	49.54	82.12	94.00	-11.88
2410	PK	H	32.58	60.09	92.67	94.00	-1.33

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. The data value listed above which is higher than the system noise floor.

EUT : 7RC04-CF100002
 Test Condition : Tx at Middle channel

Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
2420	PK	V	32.62	48.18	80.80	94.00	-13.20
2420	PK	H	32.62	56.54	89.16	94.00	-4.84

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. The data value listed above which is higher than the system noise floor.

EUT : 7RC04-CF100002

Test Condition : Tx at High channel

Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dB μ V)	Corrected Reading (dB μ V/m)	Limit @ 3 m (dB μ V/m)	Margin (dB)
2425	PK	V	32.63	50.23	82.86	94.00	-11.14
2425	PK	H	32.63	60.82	93.45	94.00	-0.55

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. The data value listed above which is higher than the system noise floor.



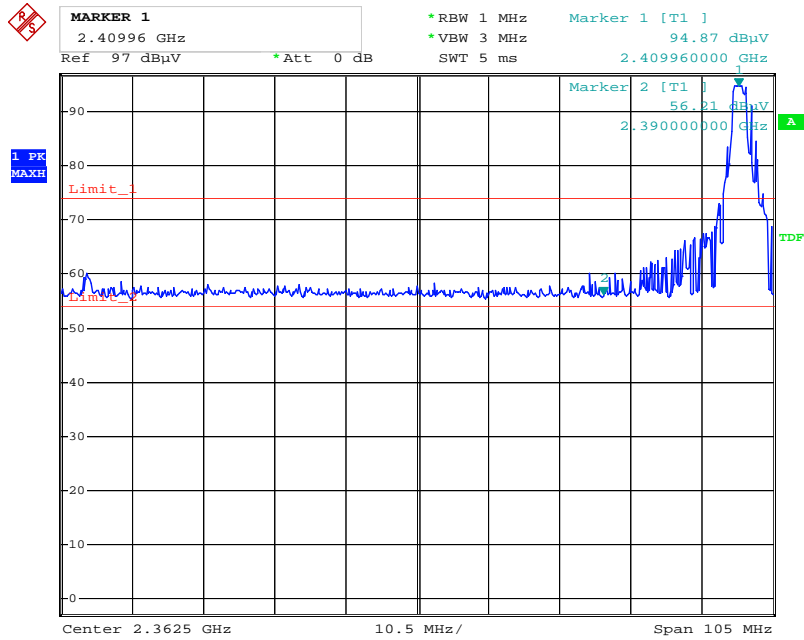
4. Radiated emission on the band edge FCC 15.249(d)

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 (2410 ~ 2425 MHz) or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dB μ V)	Corrected Reading (dB μ V/m)	Limit @ 3 m (dB μ V/m)	Margin (dB)	Restricted band (MHz)
2390.00	PK	H	32.51	23.70	56.21	74	-17.79	2310~2390
2390.00	AV	H	32.51	12.31	44.82	54	-9.18	
2410.00	PK	H	32.58	62.29	94.87	-	94.87	-
2410.00	AV	H	32.58	15.92	48.50	-	48.50	
2425.00	PK	H	32.63	64.97	97.60	-	97.60	-
2425.00	AV	H	32.63	16.40	49.03	-	49.03	
2483.50	PK	H	32.84	25.18	58.02	74	-15.98	2483.5~2500
2383.50	AV	H	32.49	12.91	45.40	54	-8.60	

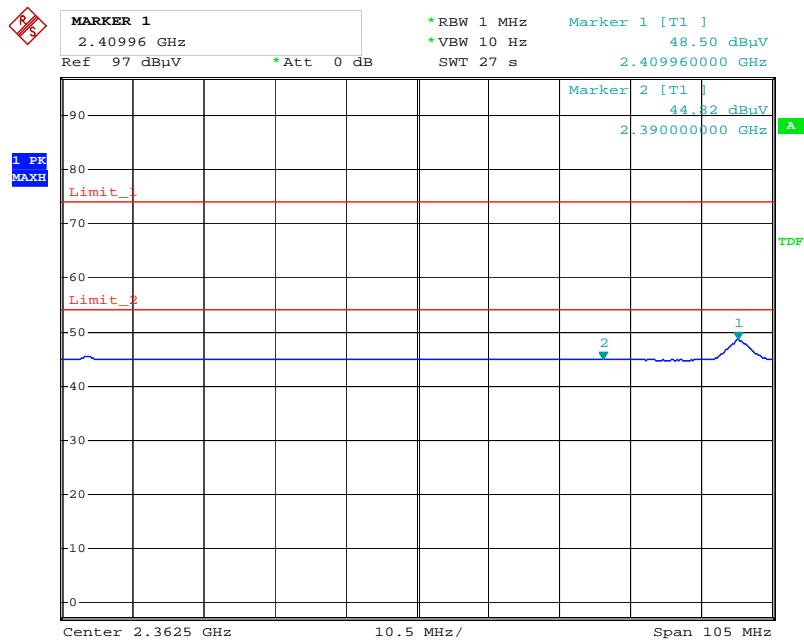
Please see the plot below.

Band edge @ GFSK mode Low channel PK



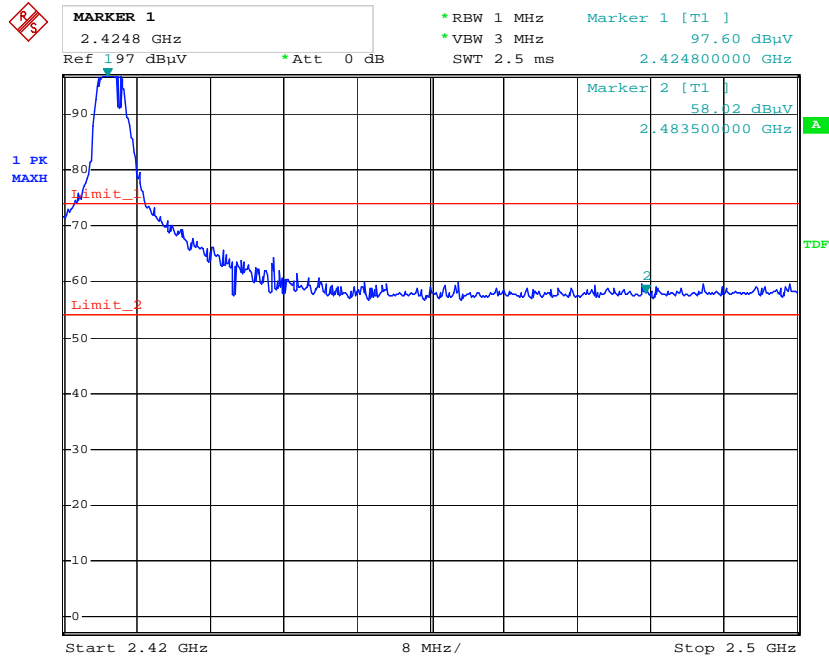
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Band edge @ GFSK mode Low channel AV



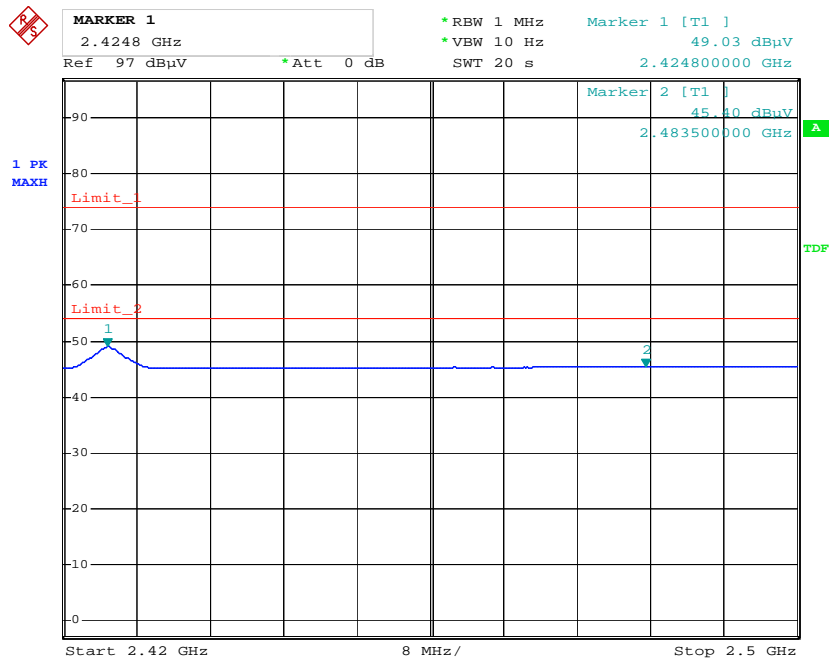
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Band edge @ GFSK mode High channel PK



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Band edge @ GFSK mode High channel AV



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 Date: 23.APR.2014 16:51:08



5. Conducted emission test FCC 15.207

Since the EUT is not connected to AC source, therefore, the test can be waived.



6. 20dB Bandwidth test

6.1 Operating environment

Temperature: 25 °C
Relative Humidity: 50 %
Atmospheric Pressure: 1008 hPa

6.2 Test setup & procedure

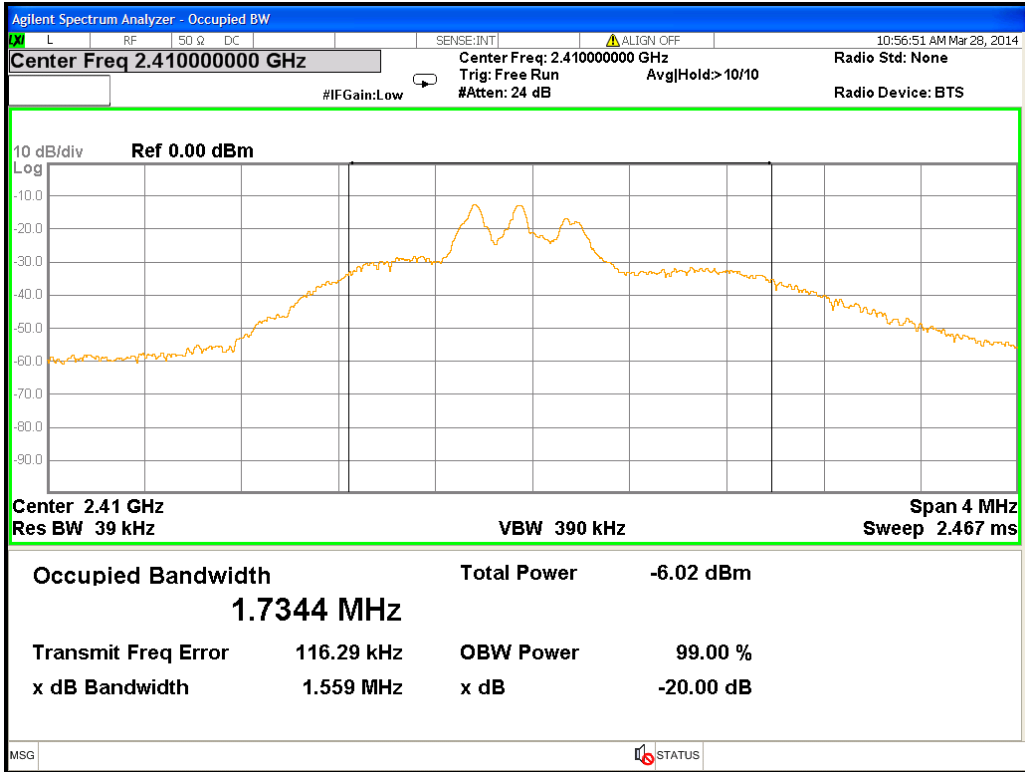
The 20dB bandwidth was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at 100 kHz, the video bandwidth \geq RBW, and the SPAN may equal to approximately 2 to 3 times the 20dB bandwidth. The test was performed at 3 channels (lowest, middle and highest channel). The maximum 20dB modulation bandwidth is in the following Table.

6.3 Measured data of modulated bandwidth test results

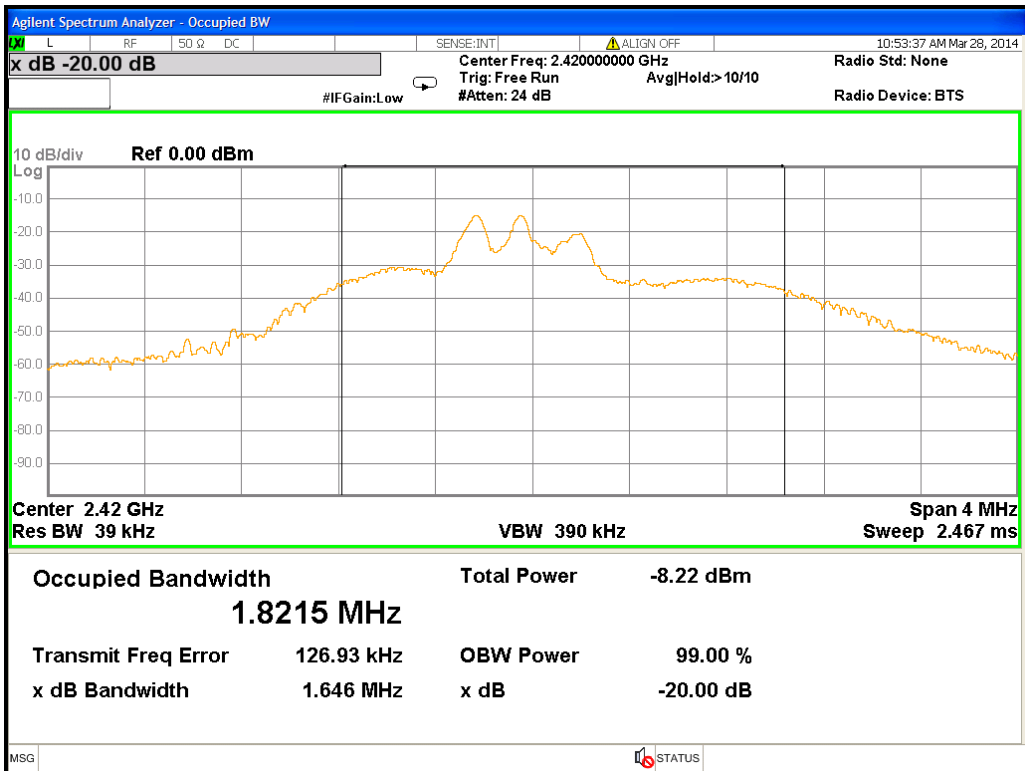
Mode	Channel	Frequency (MHz)	Data rate Mbps	20dB Bandwidth(MHz)	Limit (MHz)	Pass/Fail
				chain0		
GFSK	Low	2410	1	1.56	0.5	Pass
	Middle	2420		1.65	0.5	Pass
	High	2425		1.41	0.5	Pass

Please see the plot below.

20 dB Bandwidth @ Low channel



20 dB Bandwidth @ Middle channel





20 dB Bandwidth @ High channel

