

EMC

TEST REPORT

Report No. : TS13100093-EME
Model No. : 7RC04-CF100001
Issued Date : Nov. 18, 2013

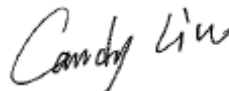
Applicant: Pan-World Control Technologies, Inc.
5F, No. 81, Sec. 1, Sintai 5th. RD., Sijhih, New Taipei City
22101, Taiwan

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

Test By: Intertek Testing Services Taiwan Ltd.
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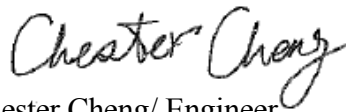
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The test report was prepared by:



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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-CF100001
FCC ID.: R8Y7RC04-CF100001
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: FSK
Rated Power: DC 3V
Power Cord: N/A
Data Cable: N/A
Sample Received: Oct. 22, 2013
Test Date(s): Nov. 07, 2013

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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.

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 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 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.

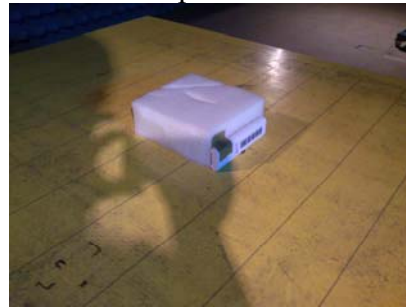
2.2 Operation mode

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

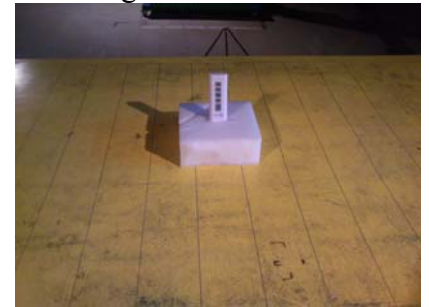
The signal is maximized through rotation and placement in the three orthogonal axes.



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.

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

2.4 Test equipment

Equipment	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
EMI Test Receiver	Rohde & Schwarz	ESCI	100018	2012/11/30	2013/11/29
Spectrum Analyzer	Rohde&schwarz	FSP30	100137	2013/6/21	2014/6/20
Spectrum Analyzer	Rohde&schwarz	FSEK30	100186	2013/1/23	2014/1/22
Horn Antenna (1-18G)	Schwarzbeck	BBHA 9120 D	9120D-456	2012/9/3	2014/9/3
Horn Antenna (14-42G)	SHWARZBECK	BBHA 9170	BBHA9170159	2012/9/5	2014/9/5
Broadband Antenna	SCHWARZBECK	VULB 9168	9168-172	2013/8/8	2015/8/7
Pre-Amplifier	MITEQ	AFS44-00102650 --42-10P-44	1495287	2013/10/27	2015/10/26
Pre-Amplifier	MITEQ	JS4-26004000--2 7-8A	828825	2012/9/18	2014/9/17
Power Meter	Anritsu	ML2495A	0844001	2013/10/10	2014/10/9
Power Sensor	Anritsu	MA2411B	0738452	2013/10/10	2014/10/9
Temperature&Humidity Test Chamber	TERCHY	MHU-225LRU (SA)	950838	2013/6/14	2014/6/13
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.

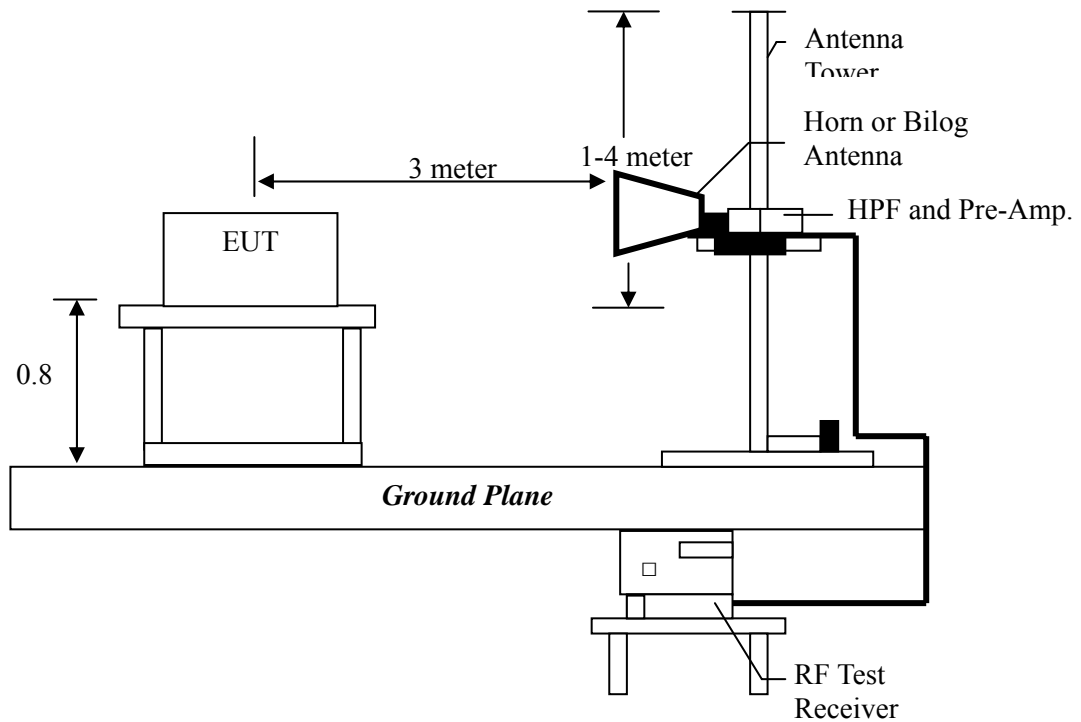
3. Radiated emission test FCC 15.249 (C)

3.1 Operating environment

Temperature: 25 °C
 Relative Humidity: 55 %
 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/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 than 1 GHz

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

EUT : 7RC04-CF100001

Test Condition : Tx at Middle 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	62.98	QP	14.17	5.35	19.52	40.00	-20.48
Vertical	159.98	QP	15.07	5.37	20.44	43.50	-23.06
Vertical	344.28	QP	17.19	4.32	21.51	46.00	-24.49
Vertical	449.04	QP	19.87	5.14	25.01	46.00	-20.99
Vertical	596.48	QP	22.91	6.09	29.00	46.00	-17.00
Vertical	631.40	QP	23.22	5.22	28.44	46.00	-17.56
Horizontal	43.58	QP	14.92	7.80	22.72	40.00	-17.28
Horizontal	264.74	QP	14.41	4.20	18.61	46.00	-27.39
Horizontal	379.20	QP	18.06	6.34	24.40	46.00	-21.60
Horizontal	478.14	QP	20.39	5.84	26.23	46.00	-19.77
Horizontal	538.28	QP	21.55	5.29	26.84	46.00	-19.16
Horizontal	792.42	QP	25.72	5.38	31.10	46.00	-14.90

Remark:

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

3.4.2 Measurement results: frequency above 1GHz

EUT : 7RC04-CF100001

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	-0.36	68.73	68.37	74	-5.63
4820	AV	V	-0.36	45.21	44.85	54	-9.15
4820	PK	H	-0.36	63.62	63.26	74	-10.74
4820	AV	H	-0.36	41.86	41.5	54	-12.50
7230	PK	V	6.35	59.02	65.37	74	-8.63
7230	AV	V	6.35	36.53	42.88	54	-11.12
7230	PK	H	6.35	57.38	63.73	74	-10.27
7230	AV	H	6.35	35.46	41.81	54	-12.19
9640	PK	V	13.95	50.38	64.33	74	-9.67
9640	AV	V	13.95	28.25	42.2	54	-11.80
9640	PK	H	13.95	41.06	55.01	74	-18.99
9640	AV	H	13.95	22.14	36.09	54	-17.91
12050	PK	V	15.78	50.55	66.33	74	-7.67
12050	AV	V	15.78	27.73	43.51	54	-10.49
12050	PK	H	15.78	44.55	60.33	74	-13.67
12050	AV	H	15.78	23.8	39.58	54	-14.42

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-CF100001

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	-0.32	59.19	58.87	74	-15.13
4840	AV	V	-0.32	38.93	38.61	54	-15.39
4840	PK	H	-0.32	51.23	50.91	54	-3.09
7260	PK	V	6.47	47.46	53.93	54	-0.07
7260	PK	H	6.47	40.01	46.48	74	-27.52
9680	PK	V	14.14	42.13	56.27	74	-17.73
9680	AV	V	14.14	22.77	36.91	54	-17.09
9680	PK	H	14.14	38.24	52.38	54	-1.62
12100	PK	V	15.69	40.82	56.51	74	-17.49
12100	AV	V	15.69	21.38	37.07	54	-16.93
12100	PK	H	15.69	34.93	50.62	54	-3.38

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-CF100001

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	-0.32	59.32	59	74	-15.00
4850	AV	V	-0.32	39.02	38.7	54	-15.30
4850	PK	H	-0.32	54.1	53.78	54	-0.22
7275	PK	V	6.47	45.4	51.87	54	-2.13
7275	PK	H	6.47	40.93	47.4	54	-6.60
9700	PK	V	14.14	44.75	58.89	74	-15.11
9700	AV	V	14.14	24.49	38.63	54	-15.37
9700	PK	H	14.14	39.77	53.91	54	-0.09
12125	PK	V	15.69	40.23	55.92	74	-18.08
12125	AV	V	15.69	20.99	36.68	54	-17.32
12125	PK	H	15.69	37.23	52.92	54	-1.08

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-CF100001

Test Condition : Tx at Low channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
Low	2410	PK	V	32.59	40.55	73.14	94	-20.86
Low	2410	PK	H	32.59	50.58	82.05	94	-11.95

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

EUT : 7RC04-CF100001

Test Condition : Tx at Middle channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
Middle	2420	PK	V	32.63	50.77	83.40	94	-10.60
Middle	2420	PK	H	32.63	67.59	100.22	114	-13.78
Middle	2420	AV	H	32.63	33.11	65.74	94	-28.26

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-CF100001
Test Unit : Handset
Test Condition : Tx at High channel

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
High	2425	PK	V	32.64	51.53	84.17	94	-9.83
High	2425	PK	H	32.64	66.50	99.14	114	-14.86
High	2425	AV	H	32.64	32.40	65.04	94	-28.96

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)

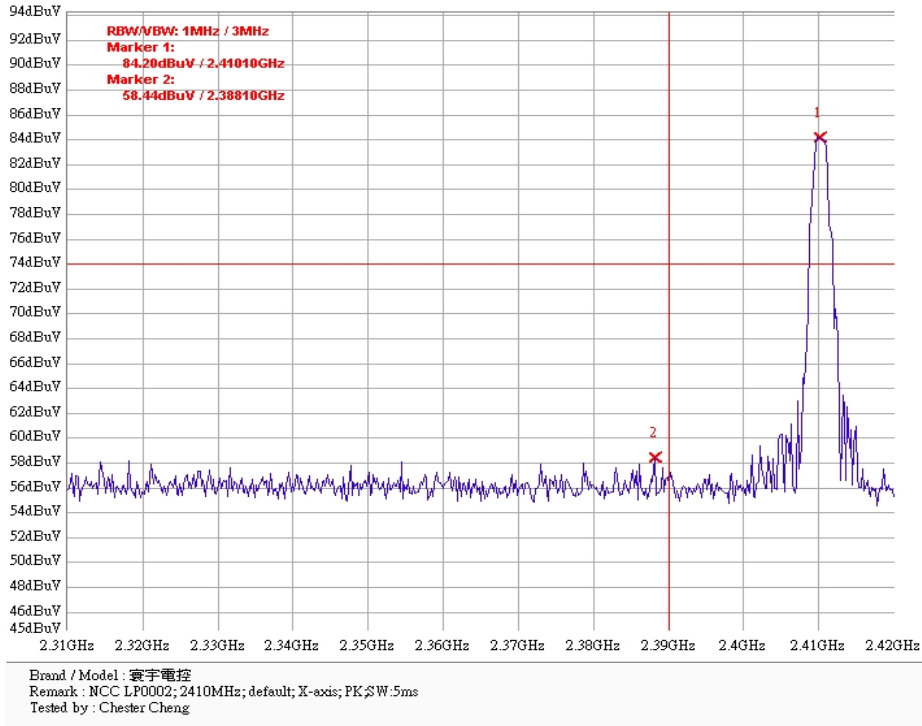
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental (2410 ~ 2425 MHz) or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

Due to operating frequency band is on the 2410~2425MHz, the power EUT delivery on the 2483.5~2500MHz will be vary low. According to the reason above, we don't measure the banedged between 2483.5~2500MHz by our evaluation.

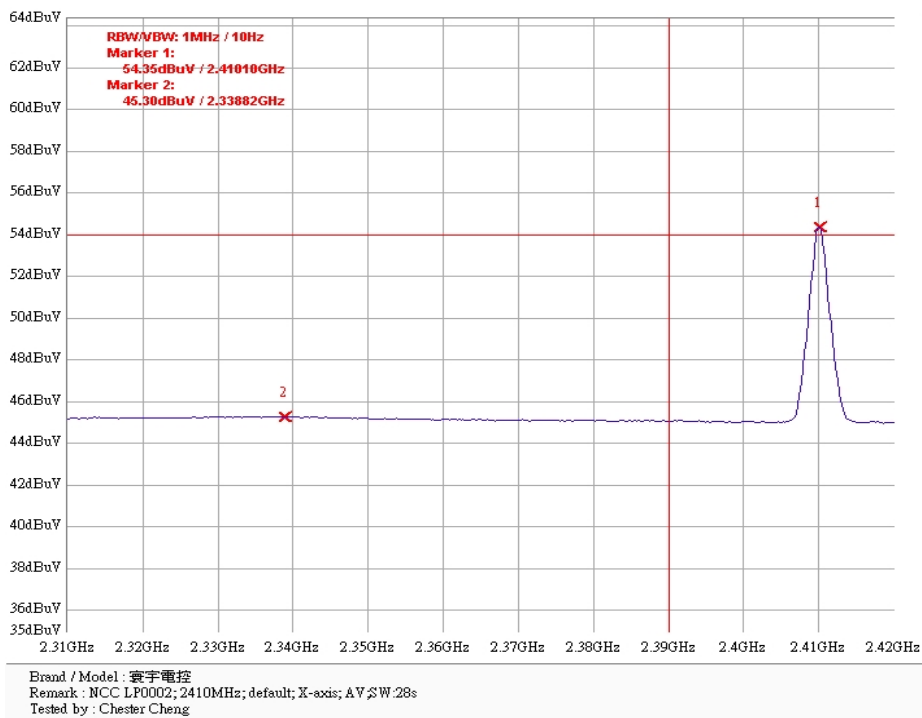
Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)	Restricted band (MHz)
2388.10	PK	H	38.02	31.84	64.62	58.44	74	-15.56	2310~2390
2338.82	AV	H	38.01	31.61	51.70	45.30	54	-8.70	
2410.10	PK	H	38.03	31.95	90.28	84.20		84.20	
2410.10	AV	H	38.03	31.95	60.43	54.35		54.35	

Please see the plot below.

Band edge @ FSK mode Low channel PK



Band edge @ FSK mode Low channel AV





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

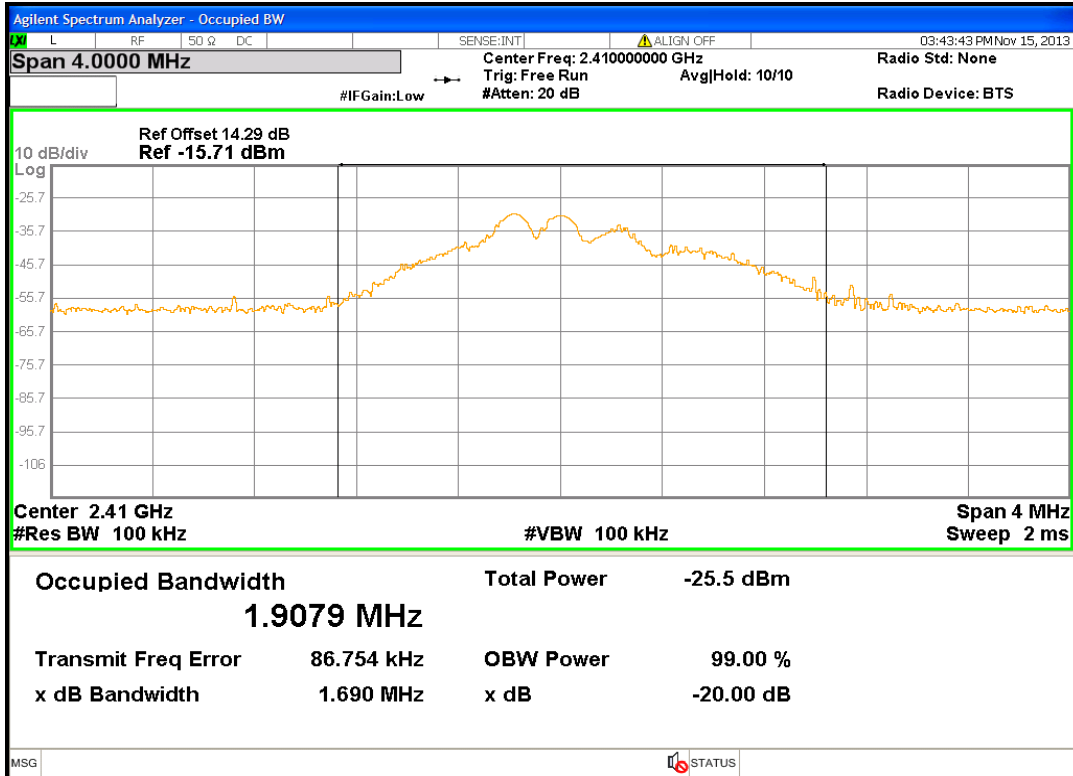
The 20dB bandwidth was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at 100 kHz, the video bandwidth \geq RBW, and the SPAN may equal to approximately 2 to 3 times the 20dB bandwidth. The test was performed at 3 channels (lowest, middle and highest channel). The maximum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

6.3 Measured data of modulated bandwidth test results

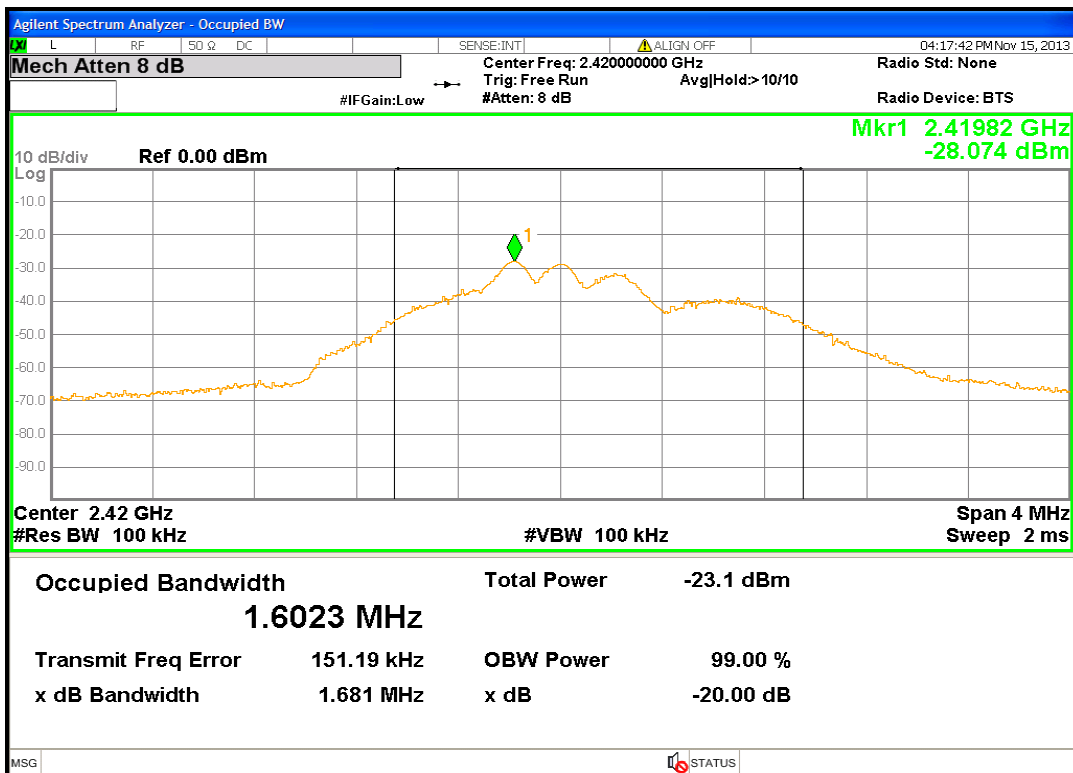
Mode	Channel	Frequency (MHz)	Data rate Mbps	20dB Bandwidth(MHz)	Limit (MHz)	Pass/Fail
				chain0		
FSK	Low	2410	1	1.690	0.5	Pass
	Middle	2420		1.681	0.5	Pass
	High	2425		1.742	0.5	Pass

Please see the plot below.

20 dB Bandwidth @ Low channel



20 dB Bandwidth @ Middle channel





20 dB Bandwidth @ High channel

