



FCC Radio Test Report
FCC ID: QISCRO-LX2
This report concerns (check one):
Project No.: 1701C155GEquipment: Smart PhoneModel Name: CRO-L22, CRO-L02Applicant: Huawei Technologies Co.,Ltd.Address: Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District Shenzhen China
Date of Receipt : Jan. 18, 2017(CRO-L03) Mar. 28, 2017(CRO-L22, CRO-L02) May 09, 2017   Date of Test : Jan. 18, 2017 ~ Feb. 27, 2017 May 16, 2017 ~ Jun. 05, 2017   Issued Date Tested by : Jun. 06, 2017   BTL Inc.
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# Declaration

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**BTL**'s laboratory quality assurance procedures are in compliance with the **ISO Guide 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

### Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.



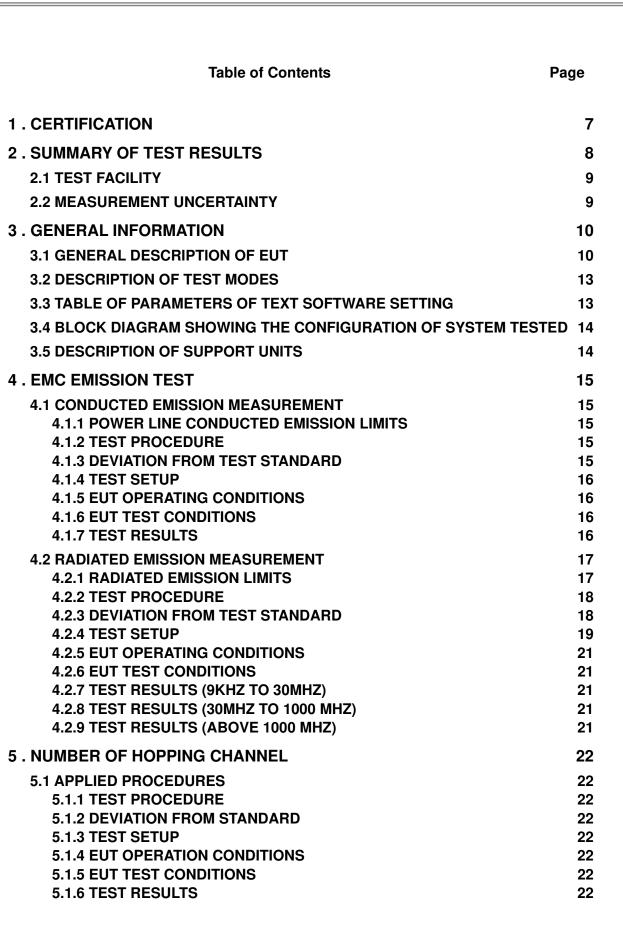






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# **REPORT ISSUED HISTORY**

Issued No.	Description	Issued Date
BTL-FCCP-1-1701C155	Original Report.	Feb. 28, 2017
BTL-FCCP-1-1701C155B	Compared with the original report (BTL-FCCP-1-1701C155), the model name are changed and differences please see the below table. According to the differences description below table, CRO-L22 and CRO-L02 shares the same test data of CRO-L03 of the same bands which does not affect the test results of the test report.	Apr. 13, 2017
BTL-FCCP-1-1701C155G	Compared with the original report (BTL-FCCP-1-1701C155B), the antenna is changed and battery, earphone are added. The Radiated Spurious Emissions had been evaluated and recorded in the test report, the rest are the same.	Jun. 06, 2017

Project ID	1701C155	1701C155B, 1701C155	G
Model	CRO-L03	CRO-L22	CRO-L02
Brand	HUAWEI	HUAWEI	HUAWEI
2G Frequency	850/1900	850/1900	850/1900
3G Frequency	B2/ B5	B2/B5	B2/B5
4G Frequency	B2/B4/B5/B7	B5/B7	B5/B7
Hardware version	The same	The same	The same
Software version	The difference	The difference	The difference
SIM Card	Single	Dual	Single
Dimensions	The same	The same	The same
Appearance	The same	The same	The same
main antenna	The same	The same	The same
BT/Wi-Fi antenna	The same	The same	The same
GPS antenna	The same	The same	The same
PA(GSM)	The same	The same	The same
PA(WCDMA/FDD)	The same	The same	The same





# **1. CERTIFICATION**

Equipment : Brand Name :	
	CRO-L22, CRO-L02
	Huawei Technologies Co.,Ltd.
	Huawei Technologies Co.,Ltd.
Address :	Administration Building, Headquarters of Huawei Technologies Co., Ltd.,
	Bantian, Longgang District Shenzhen China
Factory :	Huawei Technologies Co.,Ltd.
	Administration Building, Headquarters of Huawei Technologies Co., Ltd.,
	Bantian, Longgang District Shenzhen China
Date of Test :	Jan. 18, 2017 ~ Feb. 27, 2017
	May 16, 2017 ~ Jun. 05, 2017
Test Sample :	Engineering Sample
	FCC Part15, Subpart C (15.247)/ ANSI C63.10-2013

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. BTL-FCCP-1-1701C155G) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-17025 quality assessment standard and technical standard(s).



# 2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

Applied Standard(s): FCC Part15, Subpart C (15.247)				
Standard(s) Section	Test Item	Judgment	Remark	
15.207	Conducted Emission	PASS		
15.247(d)	Antenna conducted Spurious Emission	PASS		
15.247 (a)(1)	Hopping Channel Separation	PASS		
15.247(a)(1)	Bandwidth	PASS		
15.247 (b)(1)	Peak Output Power	PASS		
15.247(d) 15.209	Radiated Spurious Emission	PASS		
15.247 (a)(1)(iii)	Number of Hopping Frequency	PASS		
15.247 (a)(1)(iii)	Dwell Time	PASS		
15.205	Restricted Bands	PASS		
15.203	Antenna Requirement	PASS		

Note:

(1)" N/A" denotes test is not applicable in this test report





# 2.1 TEST FACILITY

The test facilities used to collect the test data in this report is at the location of No.3, Jinshagang 1st Road, Shixia, Dalang Town, Dongguan, Guangdong, China. BTL's test firm number for FCC: 319330

# 2.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. The measurement instrumentation uncertainty considerations contained in CISPR 16-4-2.

The reported uncertainty of measurement  $\mathbf{y} \pm \mathbf{U}$ , where expanded uncertainty  $\mathbf{U}$  is based on a standard uncertainty multiplied by a coverage factor of **k=2**, providing a level of confidence of approximately **95** %.

A. Conducted Measurement :

Test Site	Method	Measurement Frequency Range	U, (dB)
DG-C02	CISPR	150 KHz ~ 30MHz	2.32

B. Radiated Measurement :

Test Site	Method	Measurement Frequency Range	Ant. H / V	U, (dB)
		9KHz~30MHz	V	3.79
		9KHz~30MHz	Н	3.57
		30MHz ~ 200MHz	V	3.82
		30MHz ~ 200MHz	Н	3.78
DG-CB03	CISPR	200MHz ~ 1,000MHz	V	4.10
DG-CB03	CISPR	200MHz ~ 1,000MHz	Н	4.06
		1GHz~18GHz	V	3.12
		1GHz~18GHz	Н	3.68
		18GHz~40GHz	V	4.15
		18GHz~40GHz	Н	4.14

# C. Other Measurement:

Test Item	Uncertainty
Conducted Spurious Emission	2.67dB
Hopping Channel Separation	53.46MHz
Peak Output Power	0.95dB
Number of Hopping Frequency	53.46MHz
Temperature	<b>0.08</b> ℃
Humidity	1.5%

Note: Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.



# **3. GENERAL INFORMATION**

# 3.1 GENERAL DESCRIPTION OF EUT

Equipment	Smart Phone	
Brand Name	HUAWEI	
Model Name	CRO-L22, CRO-L02	
Model Difference	Please refer to page 6.	
	Operation Frequency	2402~2480 MHz
	Modulation Technology	GFSK(1Mbps)
Output Power (Max.)	Bit Rate of Transmitter	$\pi$ /4-DQPSK(2Mbps) 8-DPSK(3Mbps)
	Output Power Max.	7.52 dBm(1Mbps) 6.95 dBm(3Mbps)
Power Source	#1 DC Voltage supplied from AC/DC adapter. #2 Battery Supplied.	
Power Rating	#1:AC 100–240V 50/60Hz DC 5V 1A #2:DC 3.82V 2200mAh	
HW Version	HL1CROM	
SW Version	CRO-L22:Cairo-L22C636B015 CRO-L02:Cairo-L02C636B022	





### Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

Item	Mfr/Brand	Model.
	SCUD (FUJIAN) Electronics Co., Ltd	
Battery	Shenzhen Desay Battery Tech Co., Ltd.	HB3742A0EZC+
	Sunwoda Electronic Co.,LTD.	
	FOXCONN INTERCONNECT TECHNOLOGY LIMITED	CUBB01M-HC208-D
USB Cable	HONGLIN TECHNOLOGY CO.,LTD	130-26654
	Luxshare Precision Industry Co., Ltd.	L99U2013-CS-H
	Jiangxi Lianchuang Hongsheng Electronic Co.,LTD	MEMD1632B580C0
	BOLUO COUNTY QUANCHENG ELECTRONIC CO.,LTD	1311-3291-3.5mm-22
	MERRY ELECTRONICS CO., LTD.	EMC309-001
Earphone	Jiangxi Lianchuang Hongsheng Electronic Co.,LTD (Black)	MEMD1532B52800
	BOLUO COUNTY QUANCHENG ELECTRONIC CO.,LTD (Black)	1293#+3283# 3.5MM-150
	GoerTek (Black),	HA1-3
	GoerTek (White)	NA12
	HUIZHOU BYD ELECTRONIC CO., LTD.	
Adapter	Shenzhen Huntkey Electric Co., Ltd.	HW-050100U01
	DONG GUAN PHITEK ELECTRONICS CO., LTD.	





# 2. Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	27	2429	54	2456
01	2403	28	2430	55	2457
02	2404	29	2431	56	2458
03	2405	30	2432	57	2459
04	2406	31	2433	58	2460
05	2407	32	2434	59	2461
06	2408	33	2435	60	2462
07	2409	34	2436	61	2463
08	2410	35	2437	62	2464
09	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470
15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478
23	2425	50	2452	77	2479
24	2426	51	2453	78	2480
25	2427	52	2454		
26	2428	53	2455		

# 3 Table for Filed Antenna

.

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	N/A	N/A	Internal	N/A	2.14



# 3.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	TX Mode Note (1)

The EUT system operated these modes were found to be the worst case during the pre-scanning test as following:

For Conducted Emission			
Final Test Mode	Description		
Mode 1	TX Mode		

For Radiated Emission				
Final Test Mode Description				
Mode 1 TX Mode Note (1)				

Note:

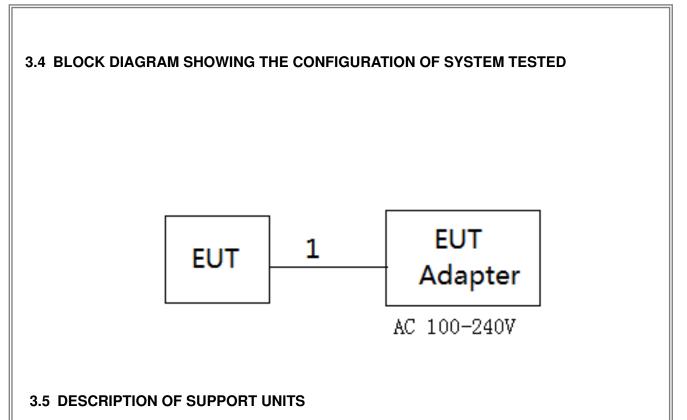
- (1) The measurements are performed at the high, middle, low available channels.
- (2) The measurements for Hopping Channel Separation, Bandwidth and Peak Output Power were tested during 1Mbps, 2Mbps and 3Mbps, the worst case are 1Mbps and 3Mbps, only worst case was documented.

# 3.3 TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING

During testing, channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of FHSS

Test Software Version		N/A	
Frequency	2402 MHz	2441 MHz	2480 MHz
Parameters(1Mbps)	7	7	7
Parameters(3Mbps)	7	7	7





The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.
-	-	-	-	-	-

Item	Shielded Type	Ferrite Core	Length	Note
1	NO	NO	1.2m	USB Cable





# 4. EMC EMISSION TEST

# 4.1 CONDUCTED EMISSION MEASUREMENT

# 4.1.1 POWER LINE CONDUCTED EMISSION LIMITS (Frequency Range 150KHz-30MHz)

Frequency of Emission (MHz)	Conducted Li	mit (dBµV)
Frequency of Emission (Minz)	Quasi-peak	Average
0.15 -0.50	66 to 56*	56 to 46*
0.50 -5.0	56	46
5.0 -30.0	60	50

Note:

(1) The limit of " \* " decreases with the logarithm of the frequency

 (2) The test result calculated as following: Measurement Value = Reading Level + Correct Factor Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor(if use) Margin Level = Measurement Value - Limit Value

### The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 KHz

# 4.1.2 TEST PROCEDURE

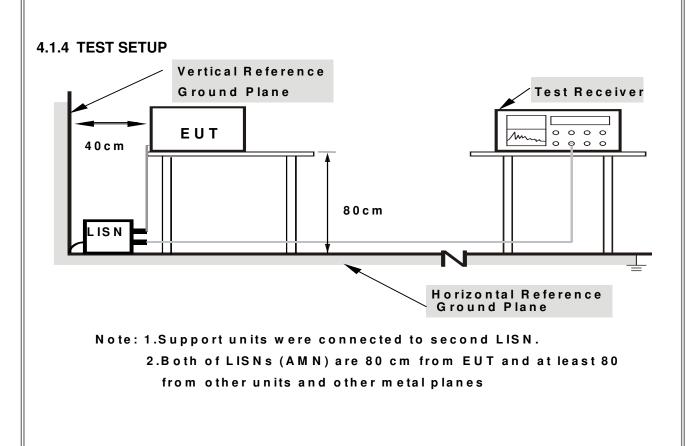
- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipment powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

# 4.1.3 DEVIATION FROM TEST STANDARD

No deviation







# 4.1.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical function (as a customer would normally use it), EUT was programmed to be in continuously transmitting/receiving data or hopping on mode.

# 4.1.6 EUT TEST CONDITIONS

Temperature: 25°C Relative Humidity: 55% Test Voltage: AC 120V/60Hz

# 4.1.7 TEST RESULTS

Please refer to the Attachment A.

Remark:

- (1) All readings are QP Mode value unless otherwise stated AVG in column of Note. If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform in this case, a "\*" marked in AVG Mode column of Interference Voltage Measured.
- (2) Measuring frequency range from 150KHz to 30MHz.



# 4.2 RADIATED EMISSION MEASUREMENT

# 4.2.1 RADIATED EMISSION LIMITS (Frequency Range 9KHz -1000MHz)

In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency	Field Strength	Measurement Distance
(MHz)	(microvolts/meter)	(meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
960~1000	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

	Band edge at 3	3m (dBµV/m)	Harmonic at 1.5m (dBµV/m)		
Frequency (MHz)	Peak	Average	Peak	Average	
Above 1000	74	54	80 (Note 5)	60(Note 5)	

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C/RSS-247.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).
- (4) The test result calculated as following: Measurement Value = Reading Level + Correct Factor Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain(if use) Margin Level = Measurement Value - Limit Value
- (5)

$$FS_{\text{limit}} = FS_{\text{max}} - 20\log\left(\frac{d_{\text{limit}}}{d_{\text{measure}}}\right)$$

20log d limit/d measure=20log 3/1.5=6dB. LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)





Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW	1 MHz / 1 MHz for Dook, 1 MHz / 10Hz for Average
(emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

Spectrum Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9KHz ~90KHz for PK/AVG detector
Start ~ Stop Frequency	90KHz ~110KHz for QP detector
Start ~ Stop Frequency	110KHz ~490KHz for PK/AVG detector
Start ~ Stop Frequency	490KHz ~30MHz for QP detector
Start ~ Stop Frequency	30MHz~1000MHz for QP detector

# 4.2.2 TEST PROCEDURE

- a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
- b. The measuring distance of 3 m or 1.5m shall be used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(above 1GHz)
- c. The height of the equipment or of the substitution antenna shall be 0.8m or 1.5m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights find the maximum reading (used Bore sight function).
- e. The receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1GHz.
- f. The initial step in collecting radiated emission data is a receiver peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- g. All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform. (below 1GHz)
- h. All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn't perform. (above 1GHz)
- i. For the actual test configuration, please refer to the related Item -EUT Test Photos.

# 4.2.3 DEVIATION FROM TEST STANDARD

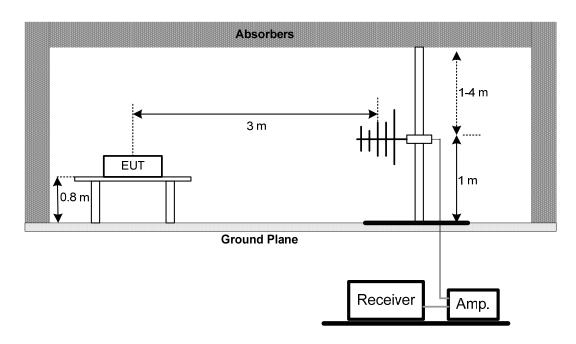
No deviation





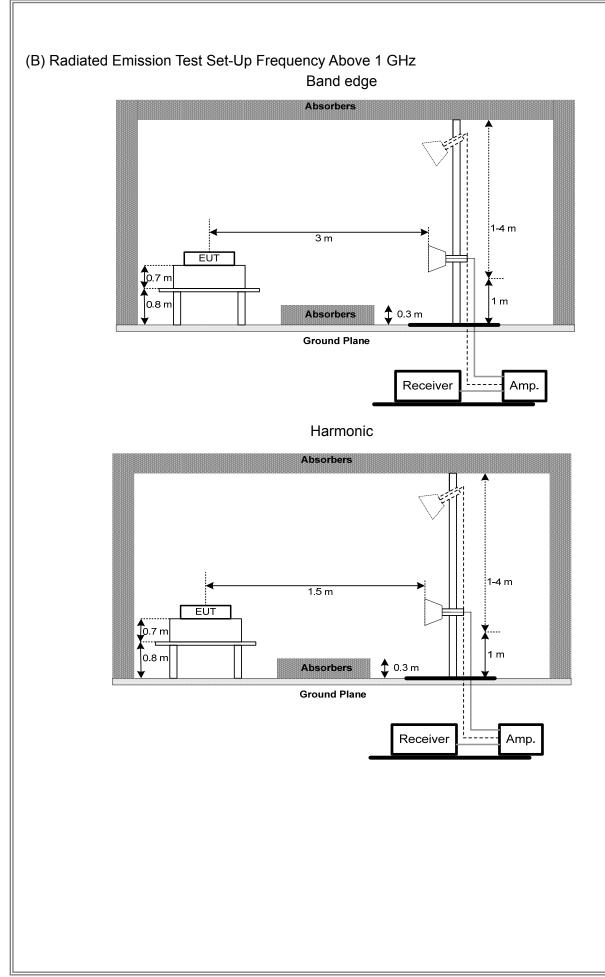
# 4.2.4 TEST SETUP

(A) Radiated Emission Test Set-Up Frequency Below 1 GHz





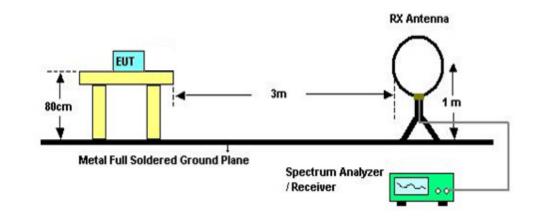








(C) For Radiated Emissions Below 30MHz



# 4.2.5 EUT OPERATING CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

# 4.2.6 EUT TEST CONDITIONS

Temperature: 25°C Relative Humidity: 55% Test Voltage: AC 120V/60Hz

# 4.2.7 TEST RESULTS (9KHZ TO 30MHZ)

Please refer to the Attachment B

Remark:

- (1) The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.
- (2) Distance extrapolation factor = 40 log (specific distance / test distance) (dB).
- (3) Limit line = specific limits (dBuV) + distance extrapolation factor.

# 4.2.8 TEST RESULTS (30MHZ TO 1000 MHZ)

Please refer to the Attachment C.

# 4.2.9 TEST RESULTS (ABOVE 1000 MHZ)

Please refer to the Attachment D.

Remark:

(1) No limit: This is fundamental signal, the judgment is not applicable. For fundamental signal judgment was referred to Peak output test.



# 5. NUMBER OF HOPPING CHANNEL

# 5.1 APPLIED PROCEDURES

FCC Part15 (15.247) , Subpart C			
Section	Test Item	Frequency Range (MHz)	Result
15.247(a)(1)(iii)	Number of Hopping Channel	2400-2483.5	PASS

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> Operating Frequency Range
RBW	100 KHz
VBW	100 KHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

# 5.1.1 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- b. Spectrum Setting: RBW=100KHz, VBW=100KHz, Sweep time = Auto.

# 5.1.2 DEVIATION FROM STANDARD

No deviation.

# 5.1.3 TEST SETUP

EUT	SPECTRUM
	ANALYZER

# 5.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.1.5 unless otherwise a special operating condition is specified in the follows during the testing.

# 5.1.5 EUT TEST CONDITIONS

Temperature: 25°C Relative Humidity: 55% Test Voltage: AC 120V/60Hz

# 5.1.6 TEST RESULTS

Please refer to the Attachment E



# 6. AVERAGE TIME OF OCCUPANCY

# 6.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(1)(iii)	Average Time of Occupancy	0.4sec	2400-2483.5	PASS

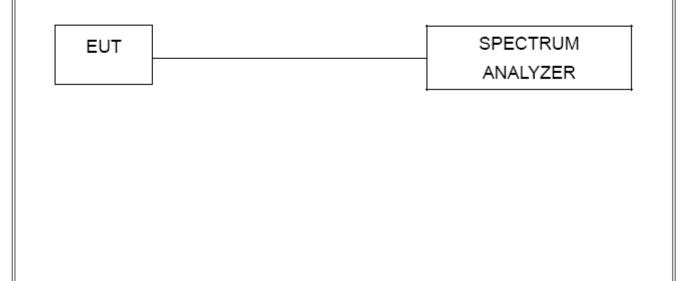
# 6.1.1 TEST PROCEDURE

- a. The transmitter output (antenna port) was connected to the spectrum analyzer
- b. Set RBW of spectrum analyzer to 1MHz and VBW to 1MHz.
- c. Use a video trigger with the trigger level set to enable triggering only on full pulses.
- d. Sweep Time is more than once pulse time.
- e. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
- $\ensuremath{\text{f}}$  . Measure the maximum time duration of one single pulse.
- g. Set the EUT for DH5, DH3 and DH1 packet transmitting.
- $\tilde{h}$ . Measure the maximum time duration of one single pulse.
- i. DH5 Packet permit maximum 1600/ 79 / 6 = 3.37 hops per second in each channel (5 time slots TX, 1 time slot RX). So, the dwell time is the time duration of the pulse times 3.37 x 31.6 = 106.6 within 31.6 seconds.
- j. DH3 Packet permit maximum 1600 / 79 / 4 = 5.06 hops per second in each channel (3 time slots TX, 1 time slot RX). So, the dwell time is the time duration of the pulse times 5.06 x 31.6 = 160 within 31.6 seconds.
- k. DH1 Packet permit maximum 1600 / 79 /2 = 10.12 hops per second in each channel (1 time slot TX, 1 time slot RX). So, the dwell time is the time duration of the pulse times 10.12 x 31.6 = 320 within 31.6 seconds.

# 6.1.2 DEVIATION FROM STANDARD

No deviation.

# 6.1.3 TEST SETUP







# 6.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.1.5 unless otherwise a special operating condition is specified in the follows during the testing.

# 6.1.5 EUT TEST CONDITIONS

Temperature: 25°C Relative Humidity: 55% Test Voltage: AC 120V/60Hz

# 6.1.6 TEST RESULTS

Please refer to the Attachment F



# 7. HOPPING CHANNEL SEPARATION MEASUREMENT

# 7.1 APPLIED PROCEDURES / LIMIT

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 KHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

Spectrum Parameter	Setting	
Attenuation	Auto	
Span Frequency	> Measurement Bandwidth or Channel Separation	
RBW	30 KHz	
VBW	100 KHz	
Detector	Peak	
Trace	Max Hold	
Sweep Time	Auto	

# 7.1.1 TEST PROCEDURE

- a. The EUT must have its hopping function enabled
- b. Span = wide enough to capture the peaks of two adjacent channels Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span Video (or Average) Bandwidth (VBW) ≥ RBW Sweep = Auto Detector function = Peak Trace = Max Hold

# 7.1.2 DEVIATION FROM STANDARD

No deviation.

# 7.1.3 TEST SETUP



Spectrum Analayzer

EUT

# 7.1.4 EUT TEST CONDITIONS

Temperature: 25°C Relative Humidity: 55% Test Voltage: AC 120V/60Hz

# 7.1.5 TEST RESULTS

Please refer to the Attachment G





# 8. BANDWIDTH TEST

# 8.1 APPLIED PROCEDURES

FCC Part15 (15.247) , Subpart C			
Section	Test Item	Frequency Range (MHz)	
15.247(a)(2)	Bandwidth	2400-2483.5	

Spectrum Parameter	Setting			
Attenuation	Auto		Auto	
Span Frequency	> Measurement Bandwidth or Channel Separation			
RBW	30 KHz (20dB Bandwidth) / 30 KHz (Channel Separation)			
VBW	100 KHz (20dB Bandwidth) / 100 KHz (Channel Separation)			
Detector	Peak			
Trace	Max Hold			
Sweep Time	Auto			

# 8.1.1 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- b. Spectrum Setting: RBW= 30KHz, VBW=100KHz, Sweep Time = Auto.

# 8.1.2 DEVIATION FROM STANDARD

No deviation.

# 8.1.3 TEST SETUP

EUT	SPECTRUM	ĺ
	ANALYZER	

# 8.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.1.5 unless otherwise a special operating condition is specified in the follows during the testing.

### 8.1.5 EUT TEST CONDITIONS

Temperature: 25°C Relative Humidity: 55% Test Voltage: AC 120V/60Hz

### 8.1.6 TEST RESULTS

Please refer to the Attachment H



# 9. PEAK OUTPUT POWER TEST

# 9.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(1)	Peak Output Power	1 Watt or 30dBm ( hopping channel >75) 0.125Watt or 21dBm (hopping channel <75	2400-2483.5	PASS

# 9.1.1 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- b. Spectrum Setting: RBW= 1MHz/3MHz, VBW= 1MHz/3MHz, Sweep time = Auto.

# 9.1.2 DEVIATION FROM STANDARD

No deviation.

# 9.1.3 TEST SETUP

EUT	SPECTRUM
	ANALYZER

# 9.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.1.5 unless otherwise a special operating condition is specified in the follows during the testing.

# 9.1.5 EUT TEST CONDITIONS

Temperature: 25°C Relative Humidity: 55% Test Voltage: AC 120V/60Hz

# 9.1.6 TEST RESULTS

Please refer to the Attachment I



# **10. ANTENNA CONDUCTED SPURIOUS EMISSION**

# 10.1 APPLIED PROCEDURES / LIMIT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits.

# 10.1.1 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- b. Spectrum Setting: RBW= 100KHz, VBW=100KHz, Sweep time = Auto.
- c. Offset=antenna gain+cable loss

# **10.1.2 DEVIATION FROM STANDARD**

No deviation.

# 10.1.3 TEST SETUP



# **10.1.4 EUT OPERATION CONDITIONS**

The EUT tested system was configured as the statements of 4.1.5 unless otherwise a special operating condition is specified in the follows during the testing.

# **10.1.5 EUT TEST CONDITIONS**

Temperature: 25°C Relative Humidity: 55% Test Voltage: AC 120V/60Hz

# 10.1.6 TEST RESULTS

Please refer to the Attachment J



# **11. MEASUREMENT INSTRUMENTS LIST**

Conducted Emission Measurement									
ltem	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until				
1	1 EMI Test Receiver R&S		ESCI	100382	Mar. 26, 2018				
2	LISN	EMCO	3816/2	52765	Mar. 26, 2018				
3	50Ω Terminator	SHX	TF2-3G-A	8122901	Mar. 26, 2018				
4	TWO-LINE V-NETWORK	R&S	ENV216	101447	Mar. 26, 2018				
5	Cable	emci	RG223(9KHz-30 MHz)(5m)	N/A	Mar. 09, 2018				
6 Measurement Software		Farad	EZ-EMC Ver.NB-03A1-01 N/A		N/A				

		Radiated Em	nission Measurer	nent	
Item	Kind of Equipment	Manufacturer	Type No.	Calibrated until	
1	Antenna	Schwarbeck	VULB9160	9160-3232	Mar. 26, 2018
2	Amplifier	HP	8447D	2944A09673	Oct. 20, 2017
3	Receiver	Agilent	N9038A	MY52130039	Sep. 04, 2017
4	4 Cable emci		LMR-400(30MH z-1GHz)(8m+5m )	N/A	Jun. 27, 2017
5	Controller CT		SC100	N/A	N/A
6	Controller	MF	MF-7802	MF780208416	N/A
7	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
8	Amplifier	Agilent	8449B	3008A02274	Mar. 09, 2018
9	Receiver	Agilent	N9038A	MY52130039	Sep. 04, 2017
10	Antenna	EM	EM-6876-1	230	Jul. 08, 2017
11	Controller	MF	MF-7802	MF780208416	N/A
12	Cable	emci	EMC104-SM-S M-12000(12m) N/A		Jul. 06, 2017



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		Number of I	Hopping Chann	el	
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP40	100185	Sep. 04, 2017

		Average Tir	ne of Occupano	cy	
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP40	100185	Sep. 04, 2017

		Hopping Channel S	Separation Mea	surement	
Iten	N Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP40	100185	Sep. 04, 2017

Bandwidth								
	Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until		
	1	Spectrum Analyzer	R&S	FSP40	100185	Sep. 04, 2017		

			Peak O	utput Power		
ľ	tem	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
	1	Spectrum Analyzer	R&S	FSP40	100185	Sep. 04, 2017

		Antenna Conduct	ted Spurious E	mission	
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP40	100185	Sep. 04, 2017

Remark: "N/A" denotes no model name, serial no. or calibration specified. All calibration period of equipment list is one year.

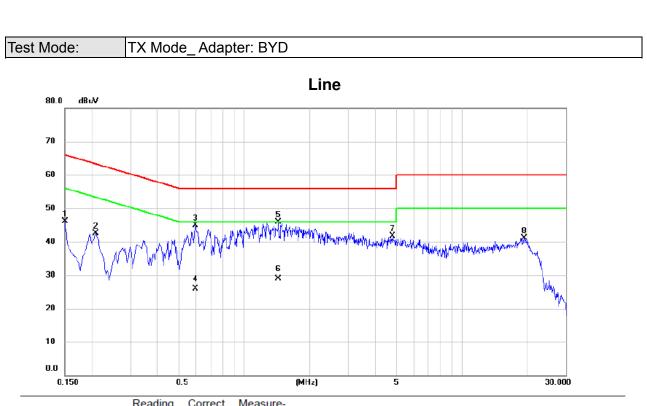




# **ATTACHMENT A - CONDUCTED EMISSION**



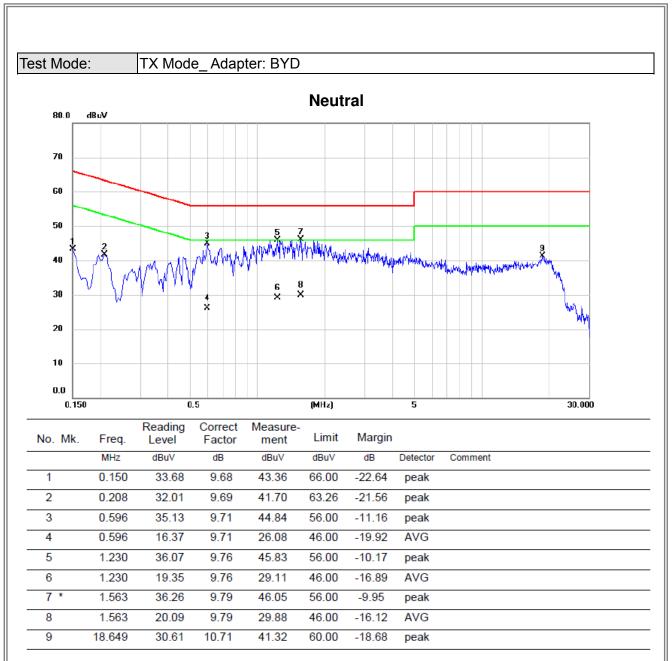




No. Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Margin		
	MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	0.150	36.38	9.68	46.06	66.00	-19.94	peak	
2	0.208	32.87	9.69	42.56	63.26	-20.70	peak	
3	0.596	35.19	9.71	44.90	56.00	-11.10	peak	
4	0.596	16.27	9.71	25.98	46.00	-20.02	AVG	
5 *	1.437	36.19	9.78	45.97	56.00	-10.03	peak	
6	1.437	19.06	9.78	28.84	46.00	-17.16	AVG	
7	4.780	31.64	10.00	41.64	56.00	-14.36	peak	
8	19.235	30.38	10.73	41.11	60.00	-18.89	peak	

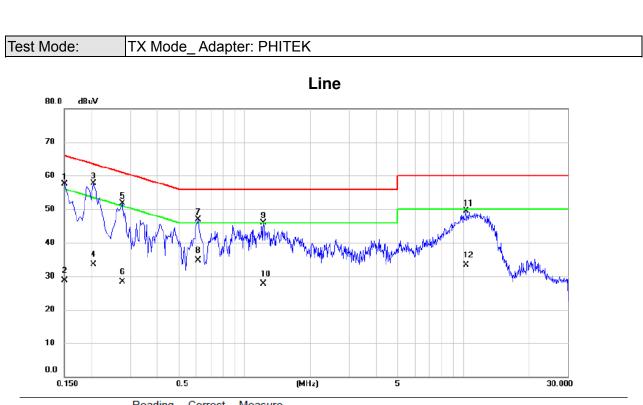








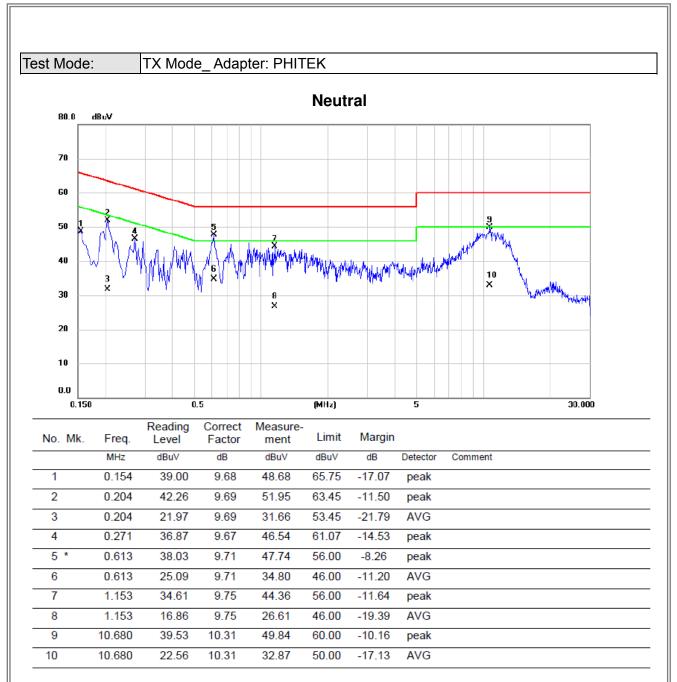




No. Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Margin		
	MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	0.150	47.87	9.68	57.55	66.00	-8.45	peak	
2	0.150	18.97	9.68	28.65	56.00	-27.35	AVG	
3 *	0.204	47.97	9.69	57.66	63.45	-5.79	peak	
4	0.204	23.86	9.69	33.55	53.45	-19.90	AVG	
5	0.276	42.03	9.68	51.71	60.94	-9.23	peak	
6	0.276	18.67	9.68	28.35	50.94	-22.59	AVG	
7	0.613	37.29	9.71	47.00	56.00	-9.00	peak	
8	0.613	25.07	9.71	34.78	46.00	-11.22	AVG	
9	1.221	36.14	9.76	45.90	56.00	-10.10	peak	
10	1.221	18.03	9.76	27.79	46.00	-18.21	AVG	
11	10.289	39.22	10.29	49.51	60.00	-10.49	peak	
12	10.289	23.04	10.29	33.33	50.00	-16.67	AVG	

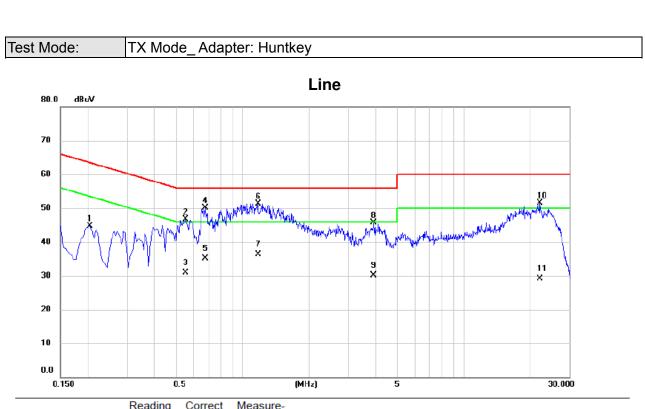












No. Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Margin		
	MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	0.204	35.06	9.69	44.75	63.45	-18.70	peak	
2	0.550	36.96	9.71	46.67	56.00	-9.33	peak	
3	0.550	21.10	9.71	30.81	46.00	-15.19	AVG	
4	0.676	40.33	9.72	50.05	56.00	-5.95	peak	
5	0.676	25.34	9.72	35.06	46.00	-10.94	AVG	
6 *	1.176	41.63	9.75	51.38	56.00	-4.62	peak	
7	1.176	26.65	9.75	36.40	46.00	-9.60	AVG	
8	3.917	35.77	9.95	45.72	56.00	-10.28	peak	
9	3.917	20.15	9.95	30.10	46.00	-15.90	AVG	
10	22.069	40.61	10.84	51.45	60.00	-8.55	peak	
11	22.069	18.26	10.84	29.10	50.00	-20.90	AVG	



6 \*

7

8

9

10

11

0.978

0.978

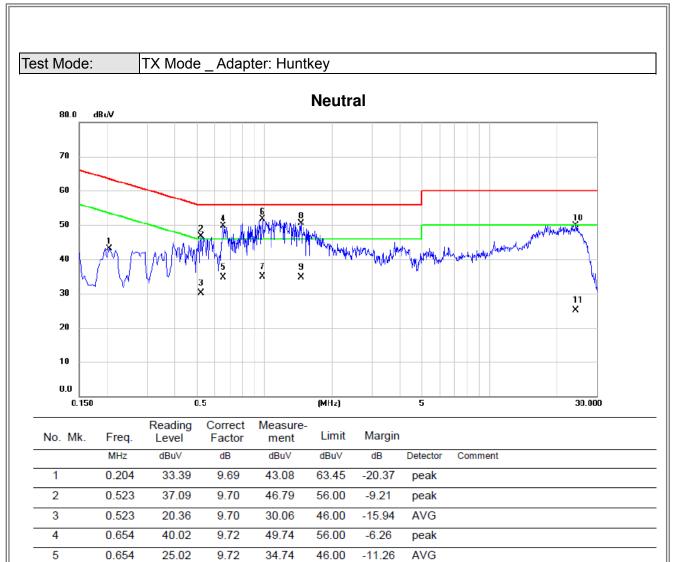
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1.450

24.247

24.247





9.75

9.75

9.78

9.78

10.92

10.92

51.64

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34.69

49.85

25.13

56.00

46.00

56.00

46.00

60.00

50.00

-4.36

-11.12

-5.52

-11.31

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peak

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peak

AVG

peak

AVG

41.89

25.13

40.70

24.91

38.93

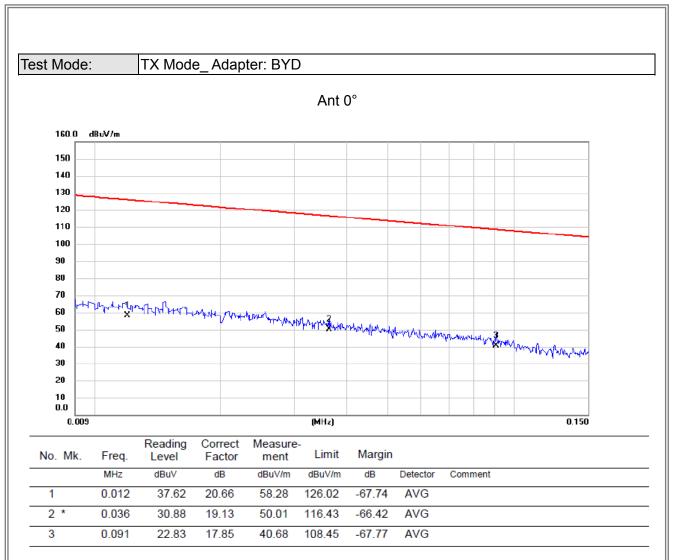
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## ATTACHMENT B - RADIATED EMISSION (9KHZ-30MHZ)

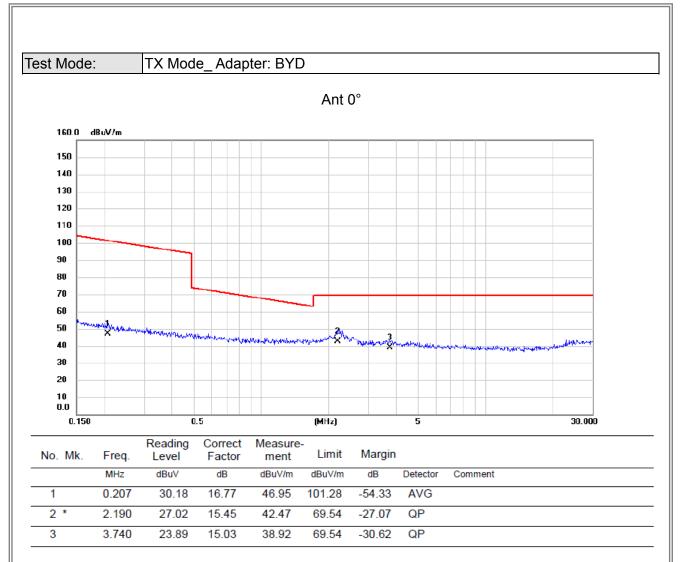






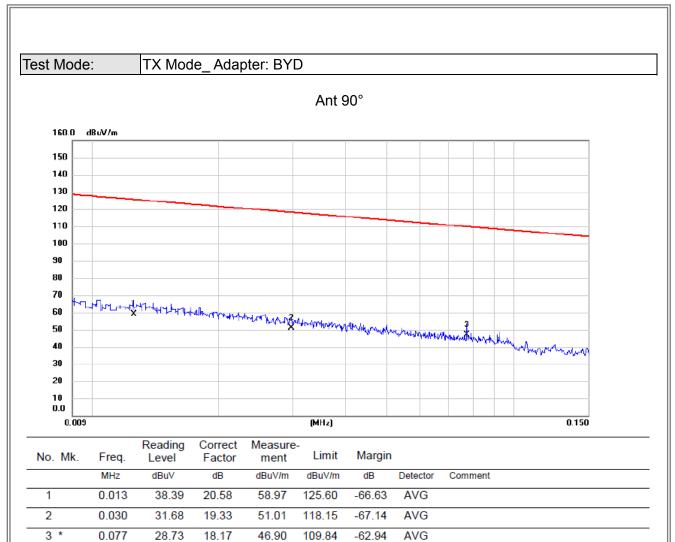






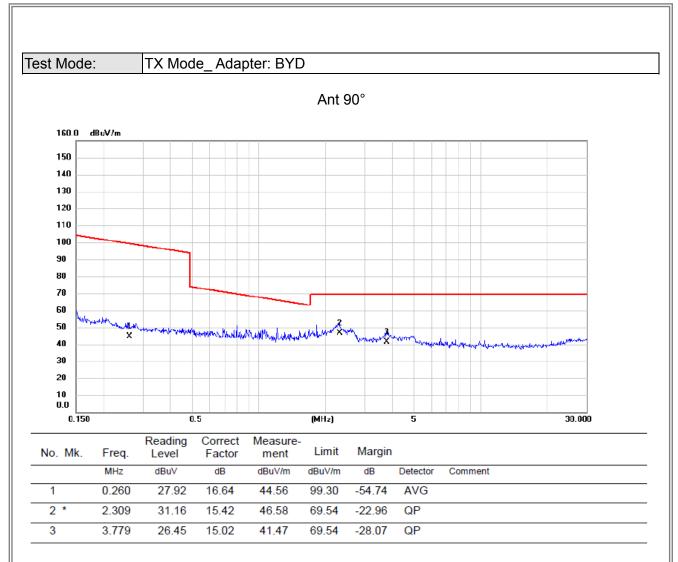






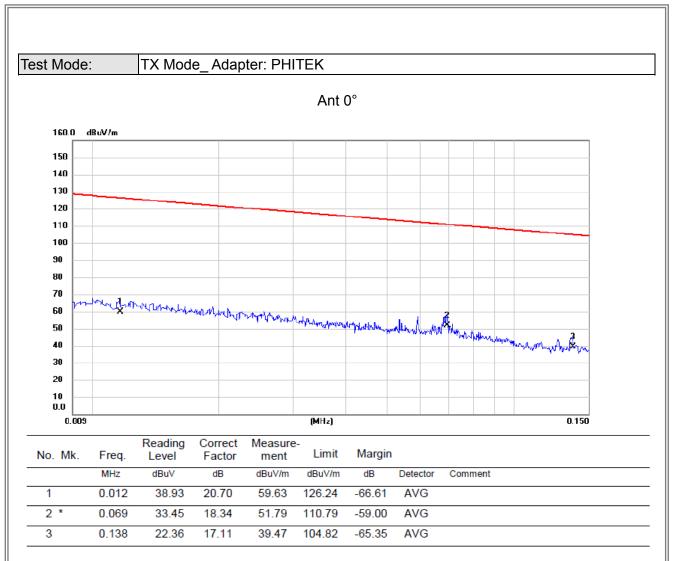






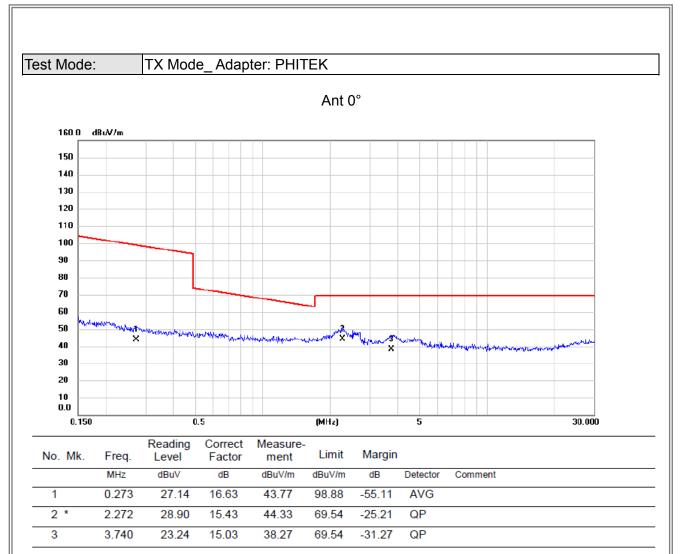






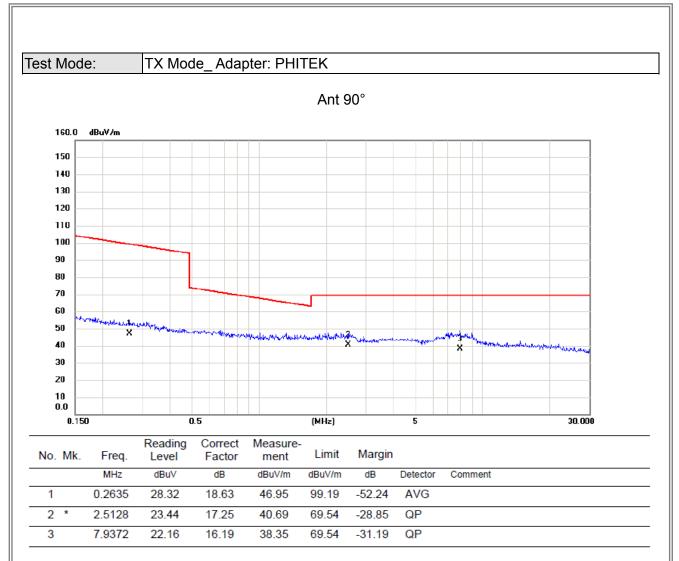






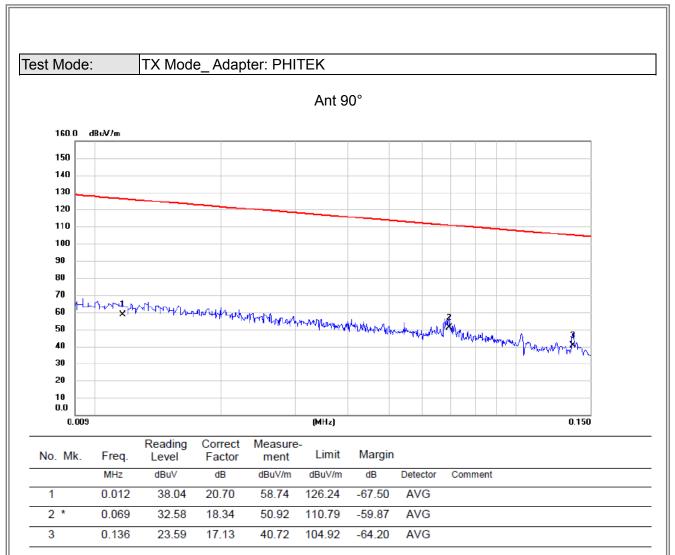






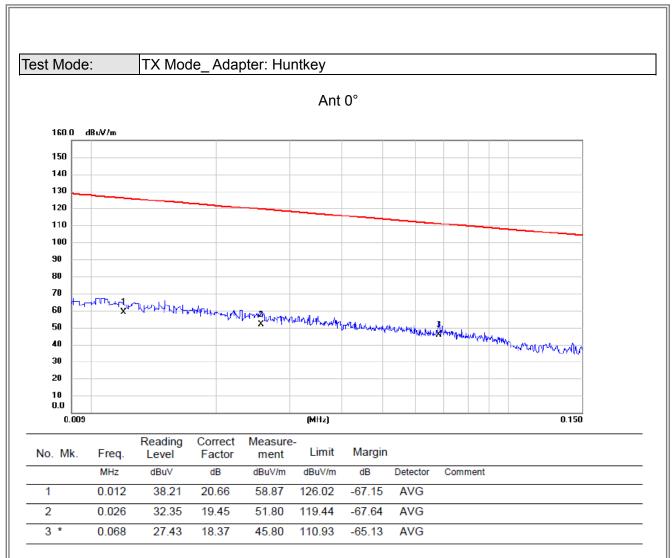






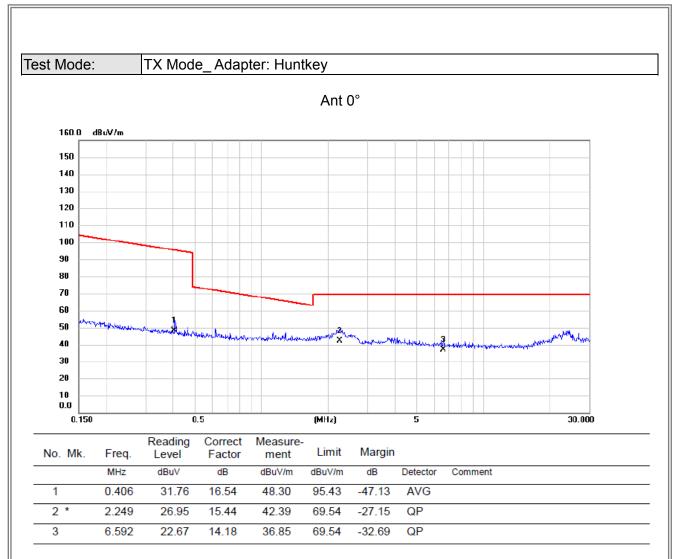






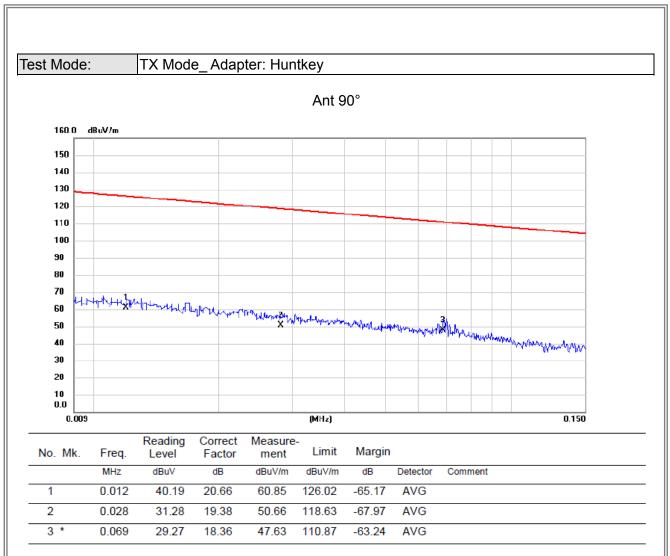






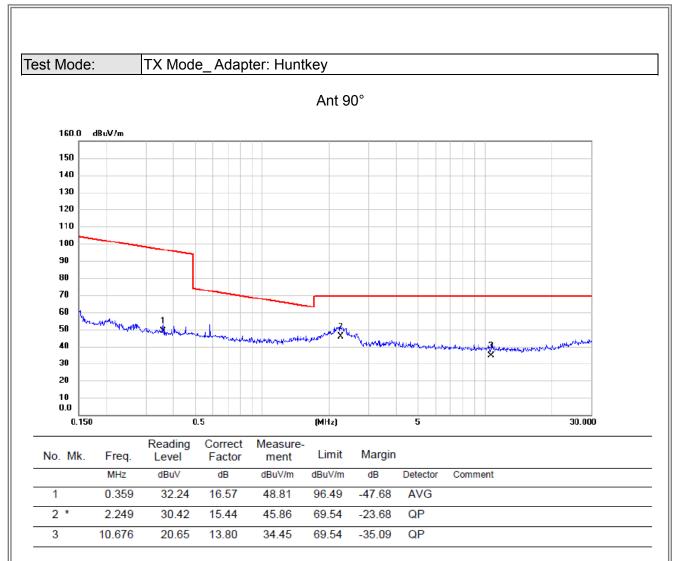












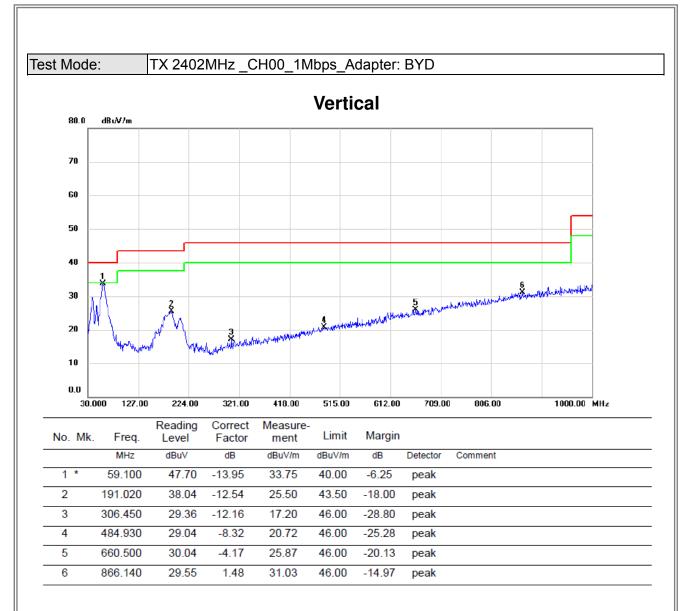




## ATTACHMENT C - RADIATED EMISSION (30MHZ TO 1000MHZ)

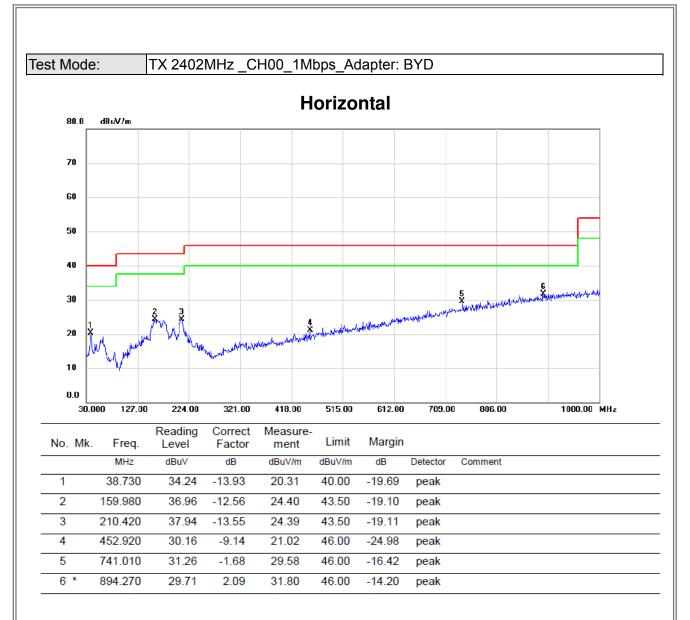






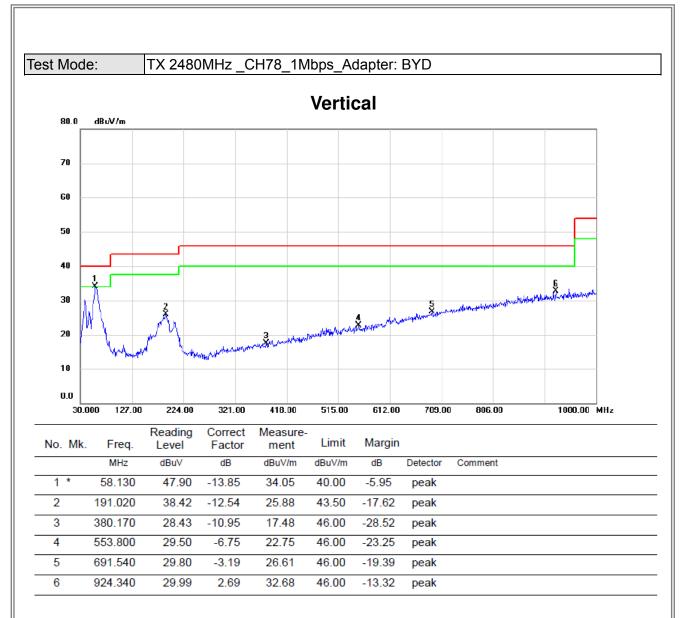






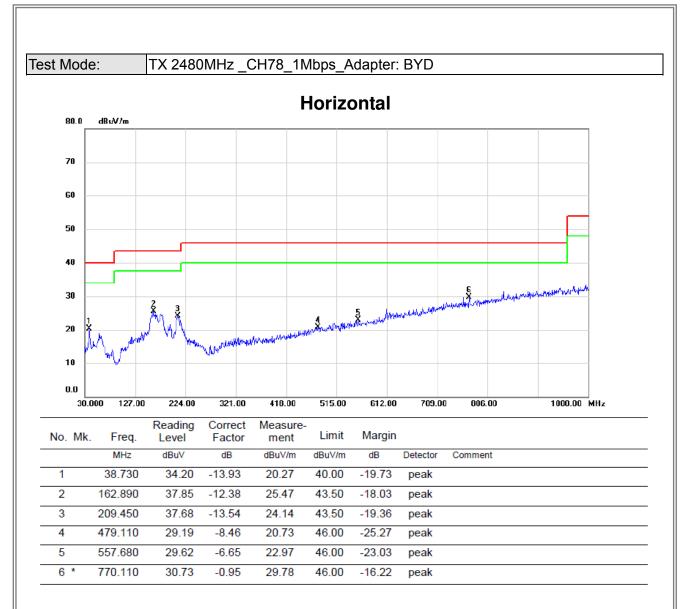






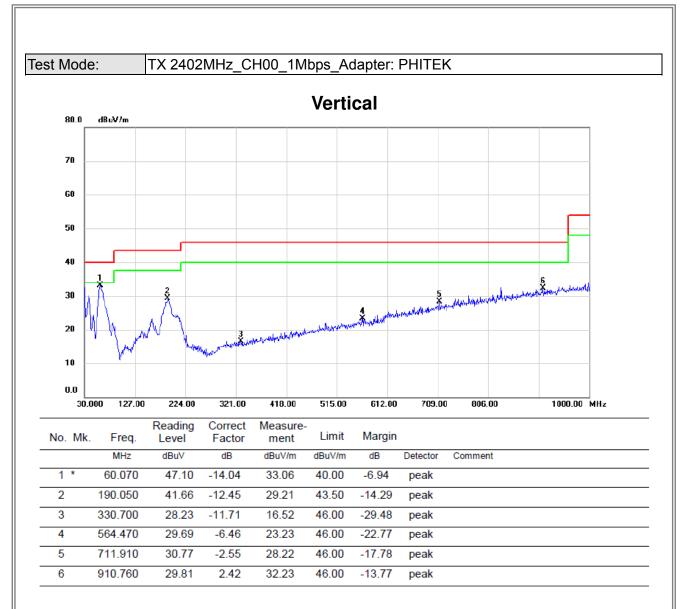






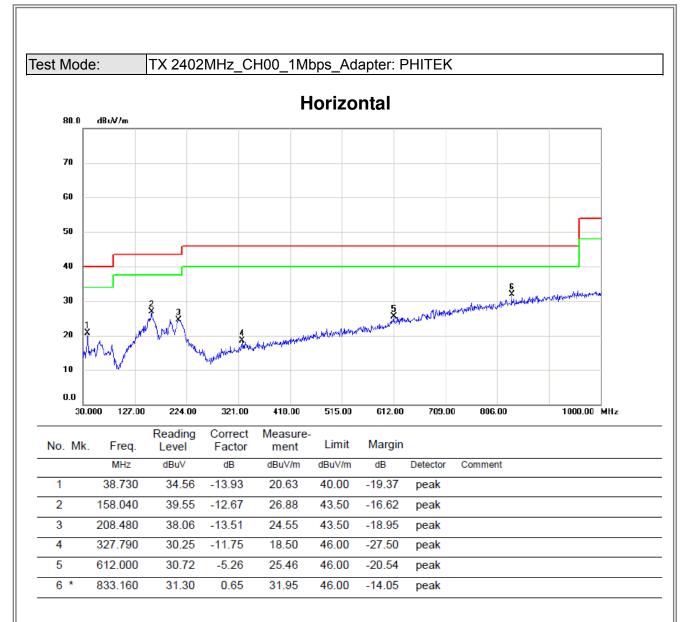






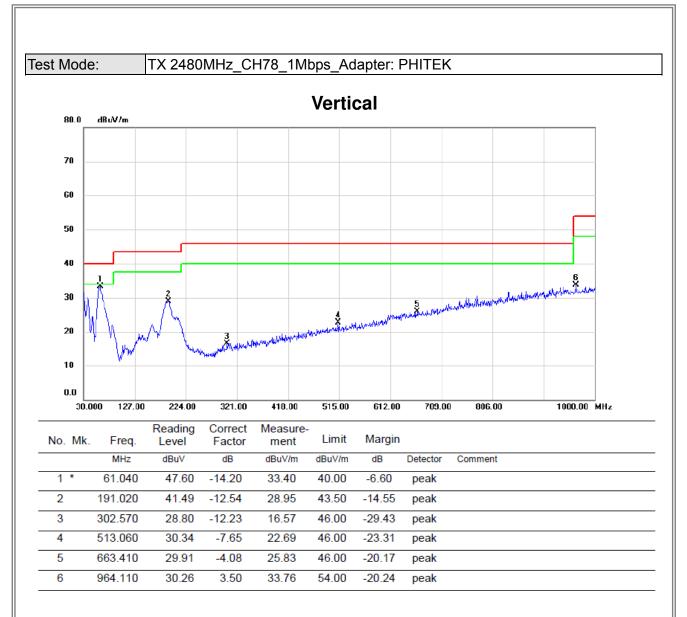






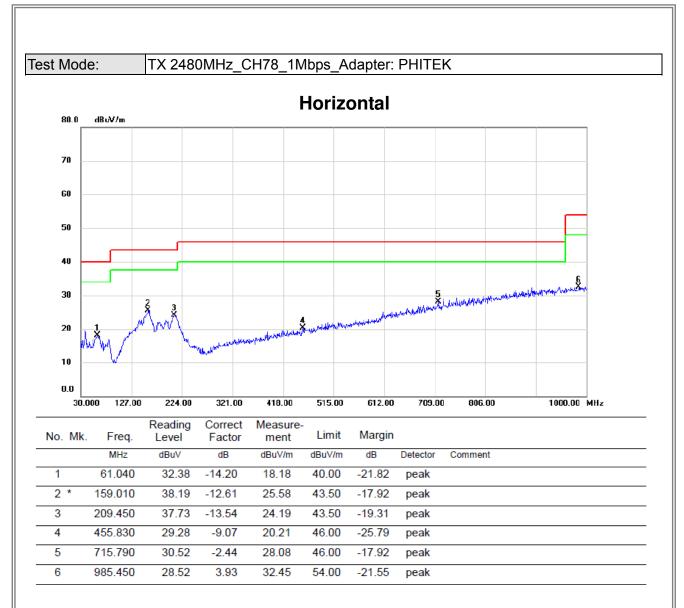






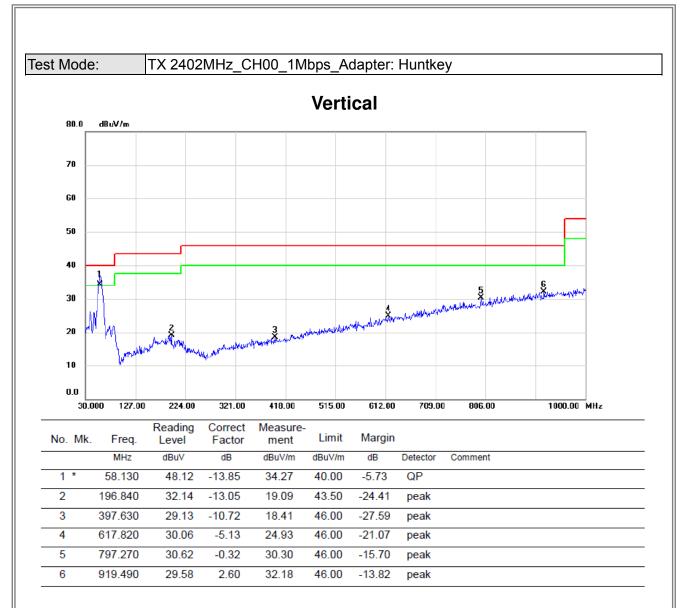






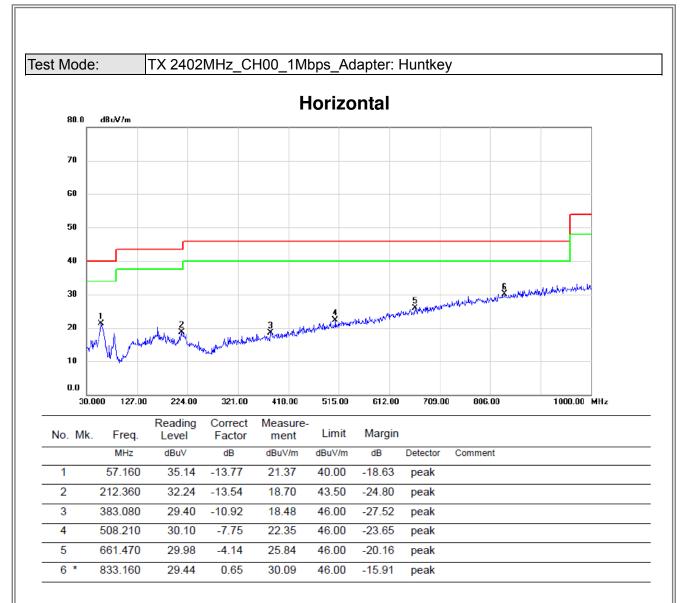






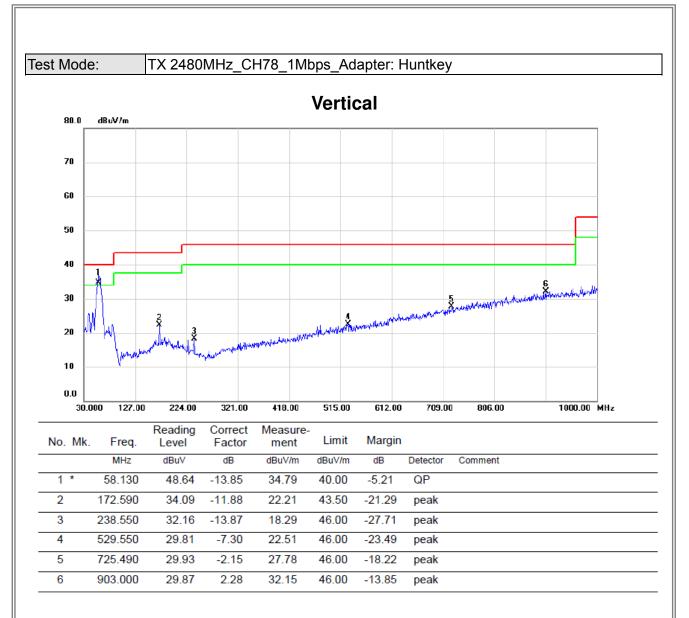






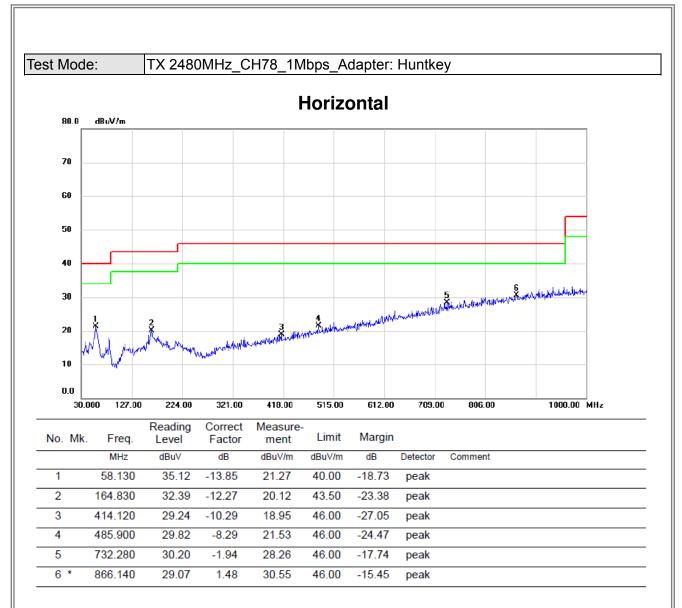










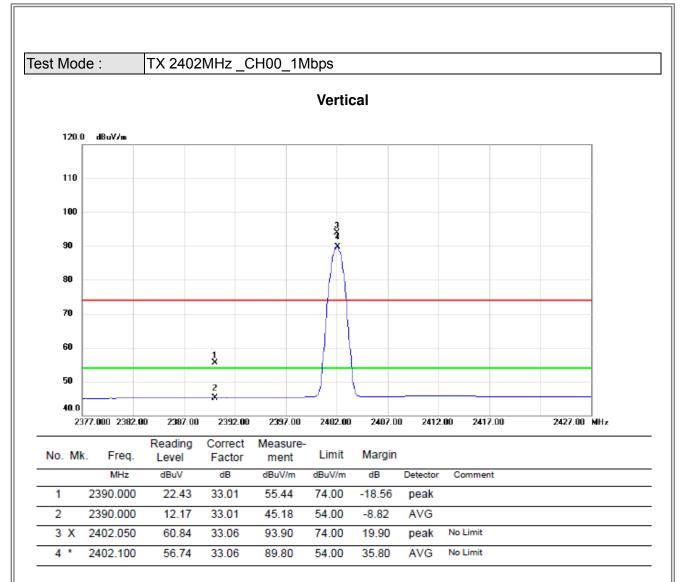




## ATTACHMENT D - RADIATED EMISSION (ABOVE 1000MHZ)

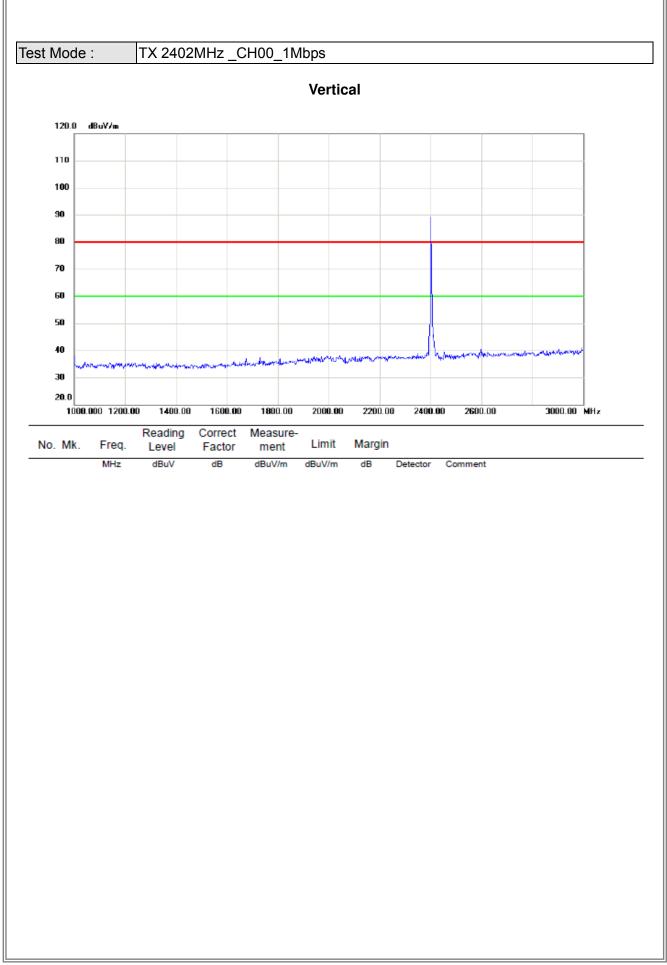






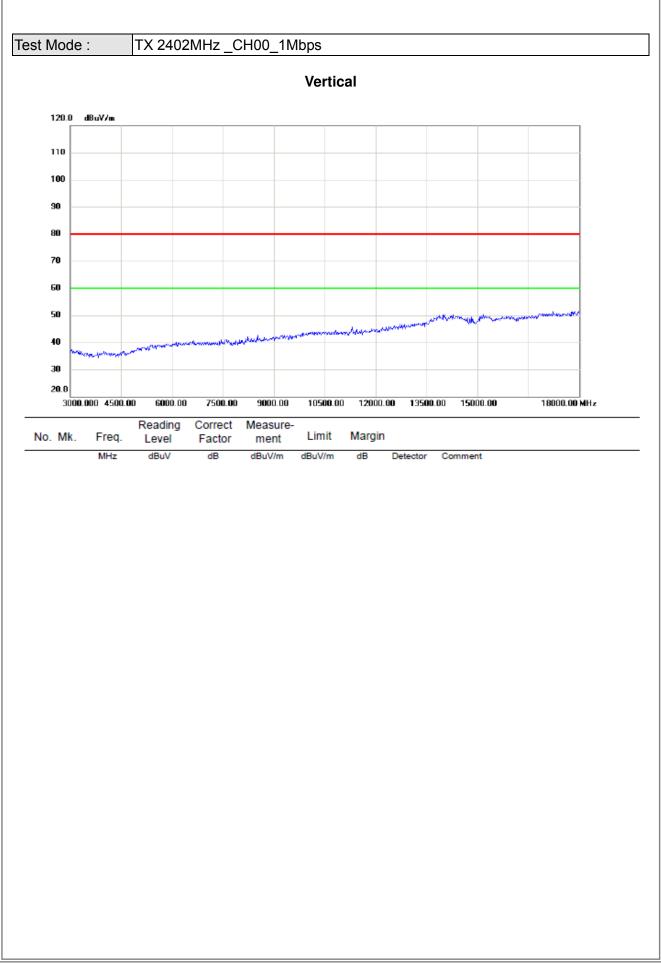






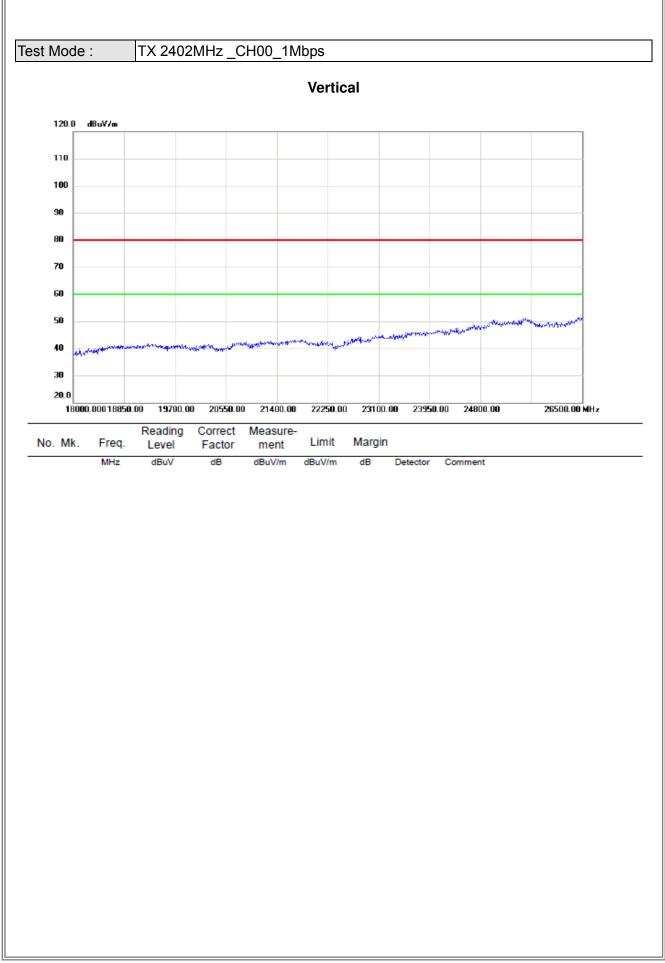






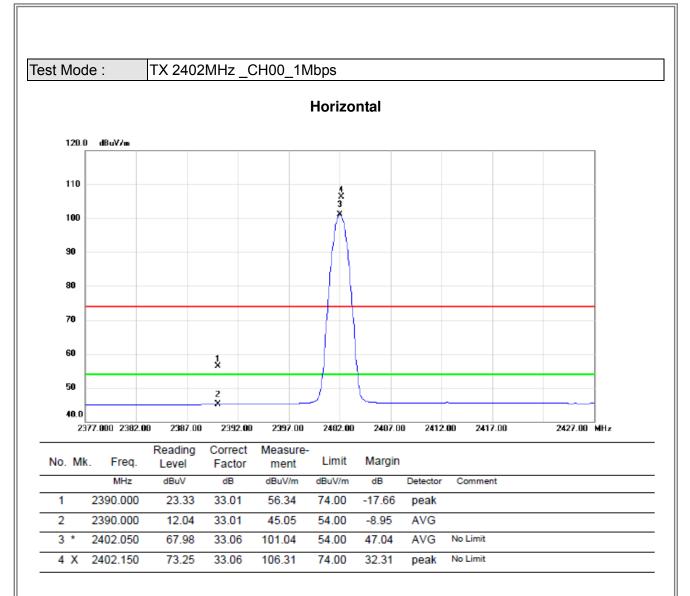






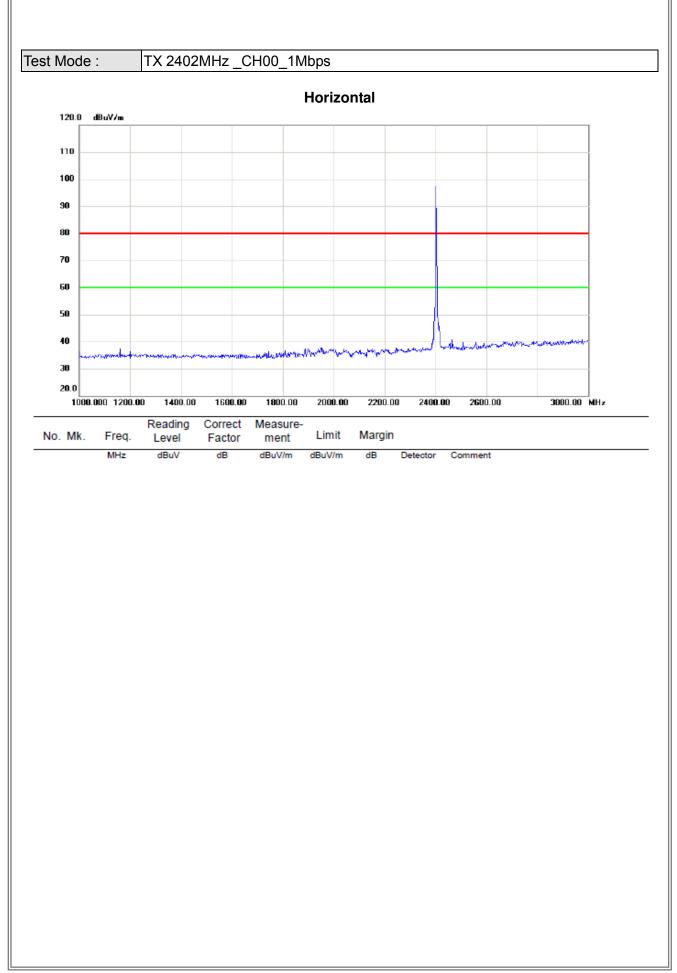






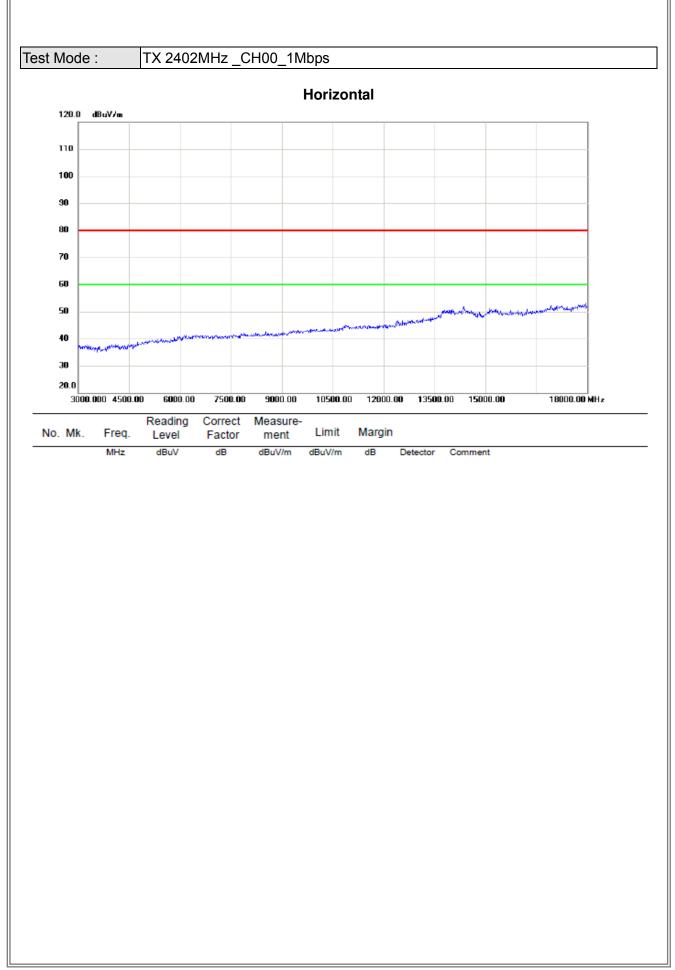






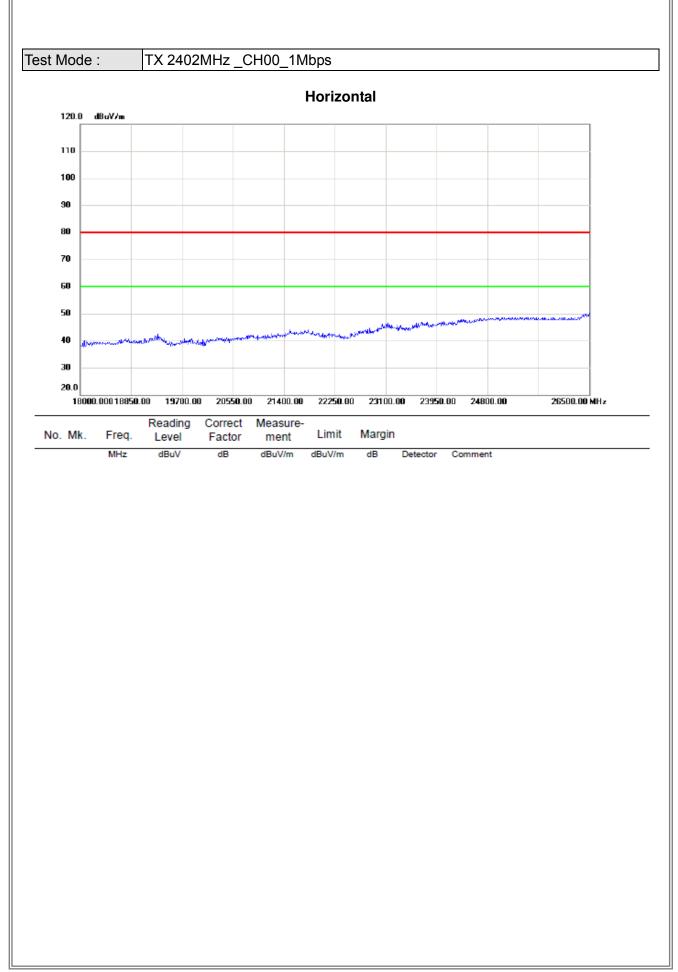






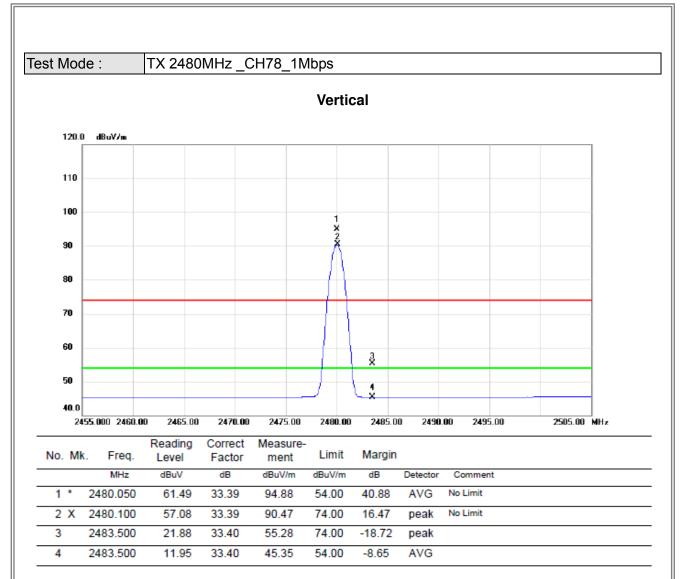






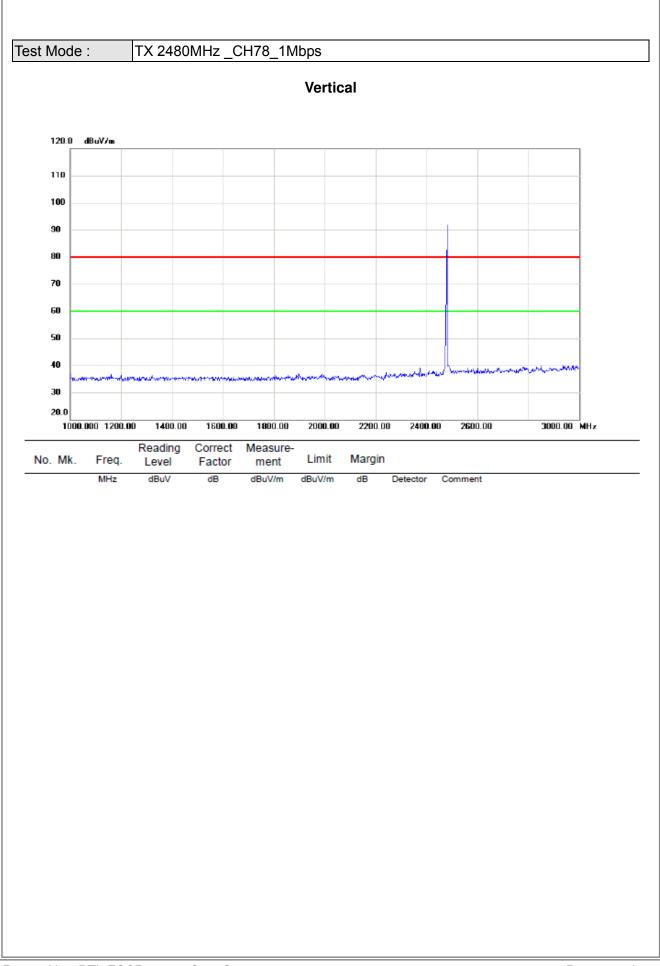






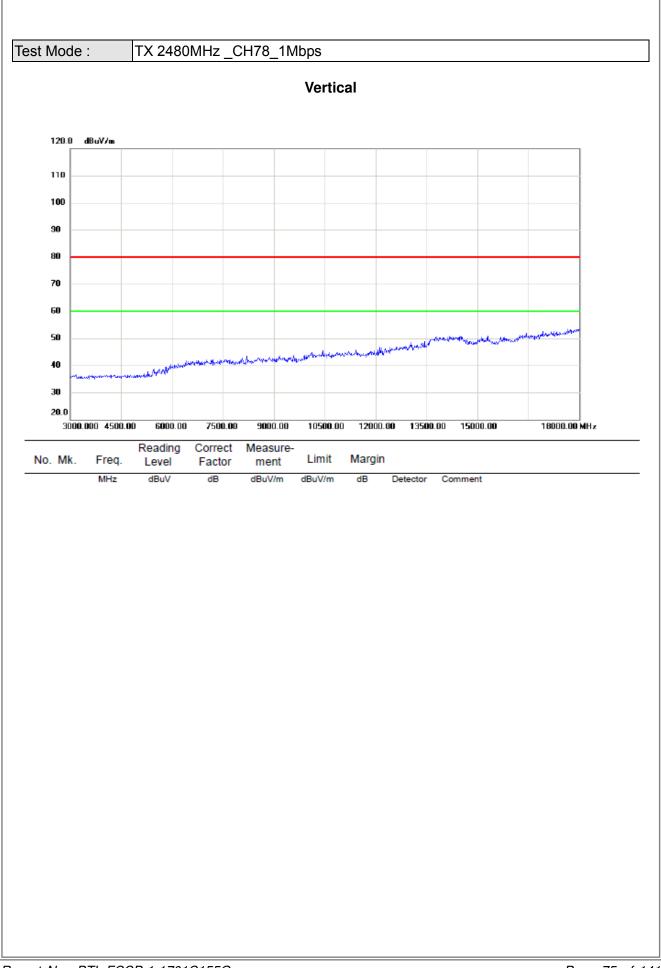






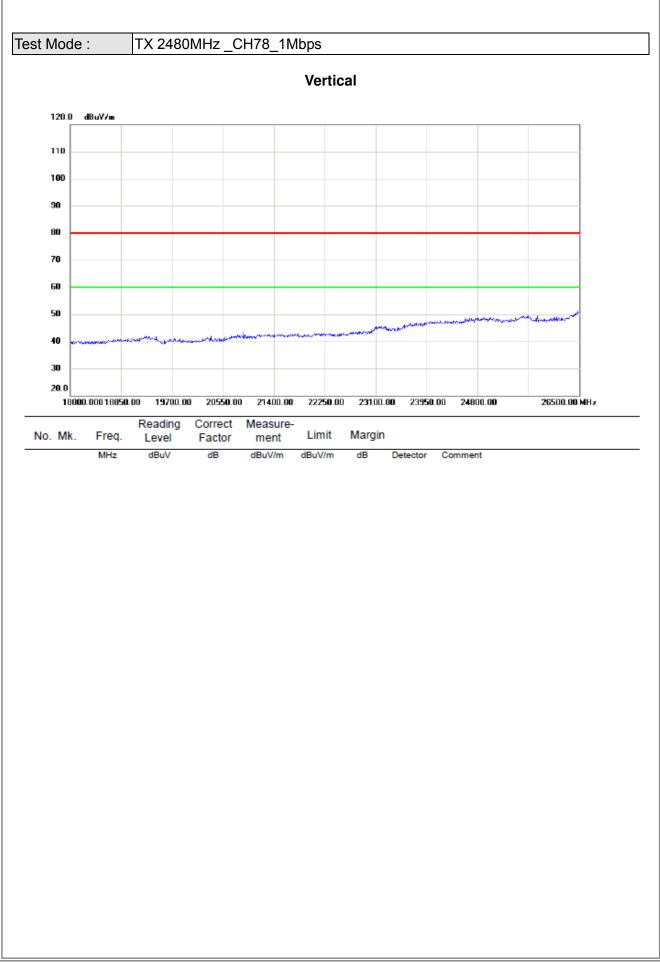






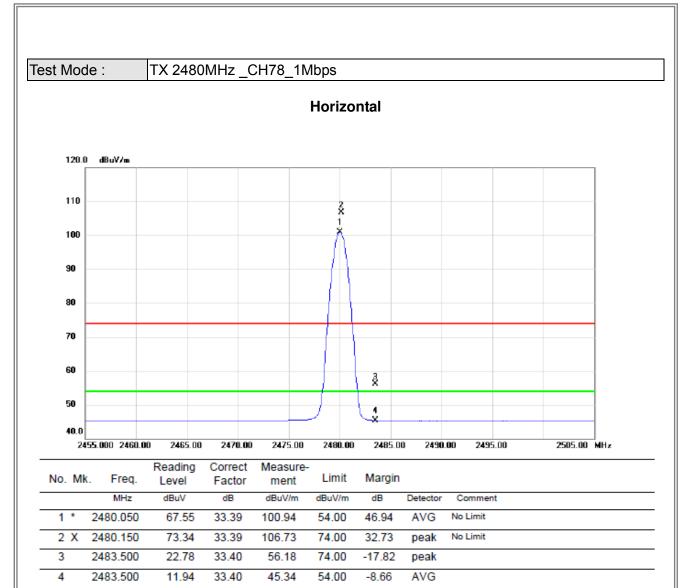






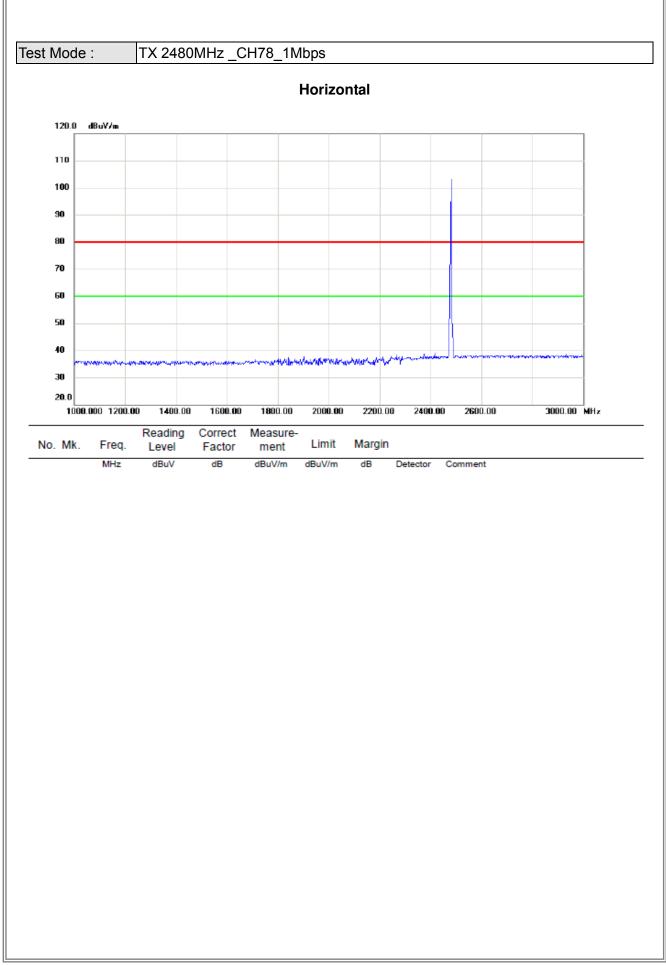






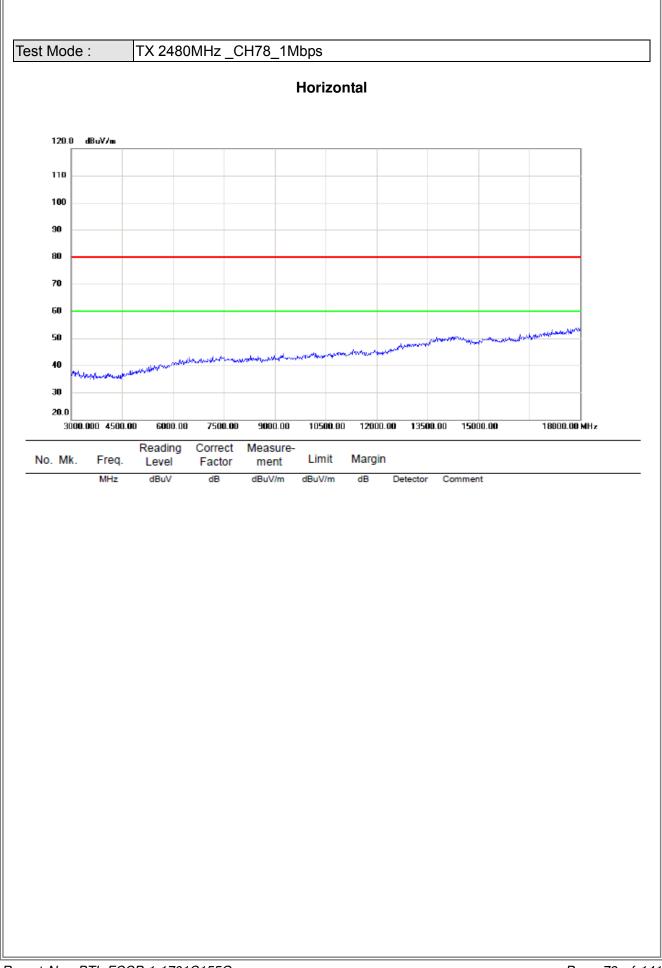






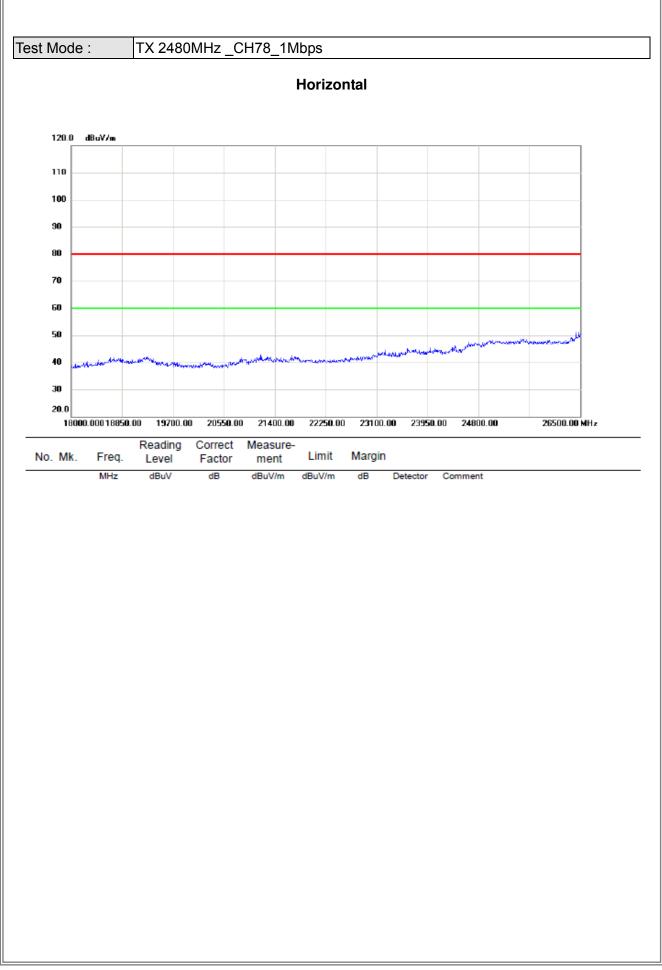






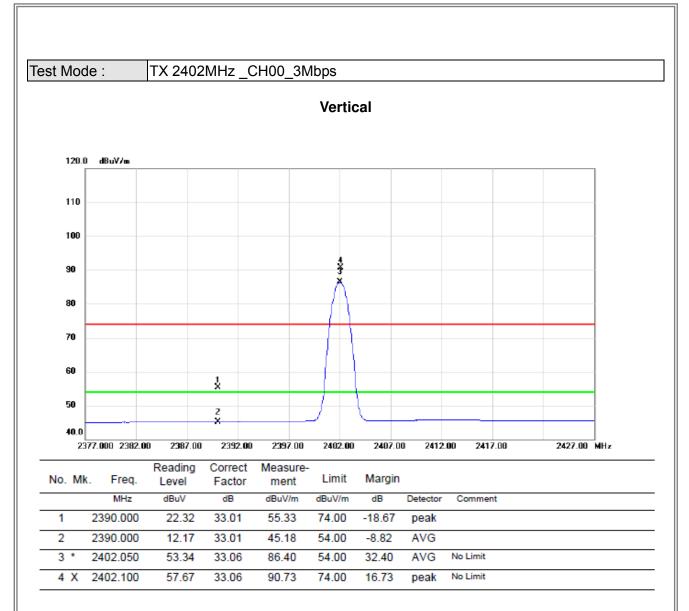






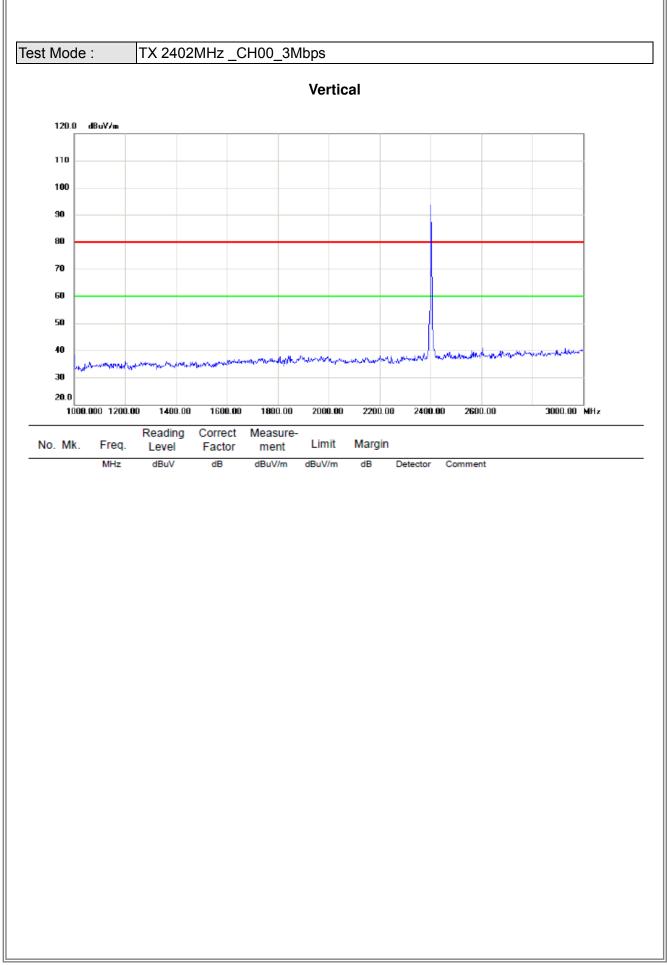






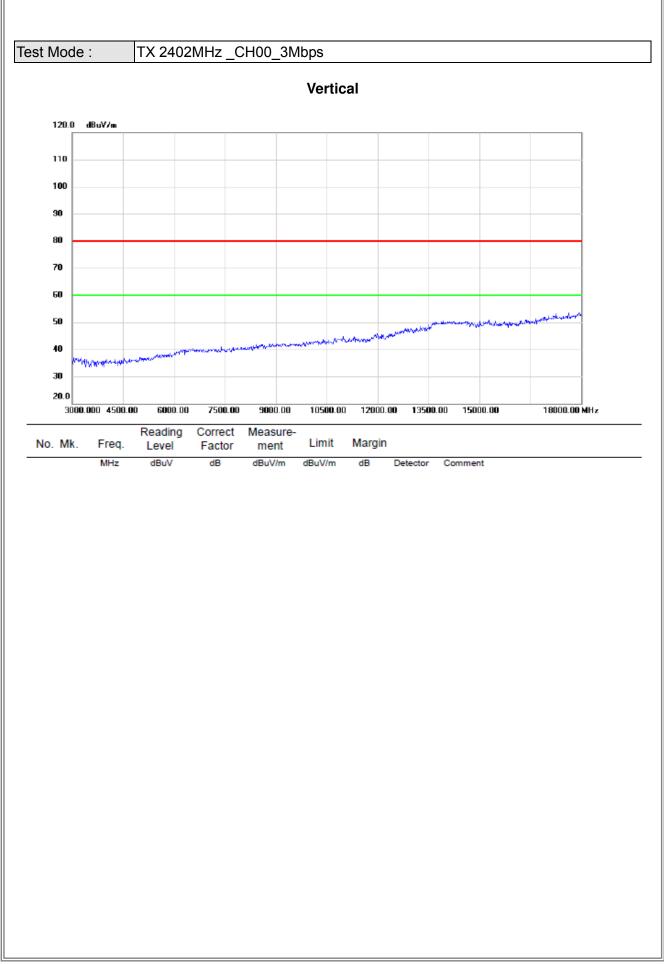






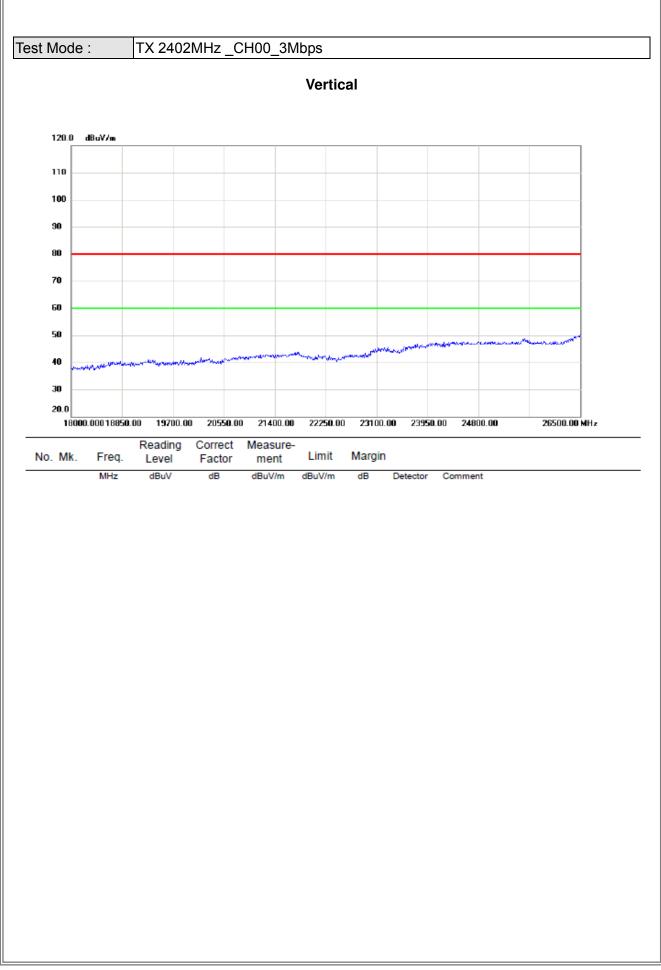






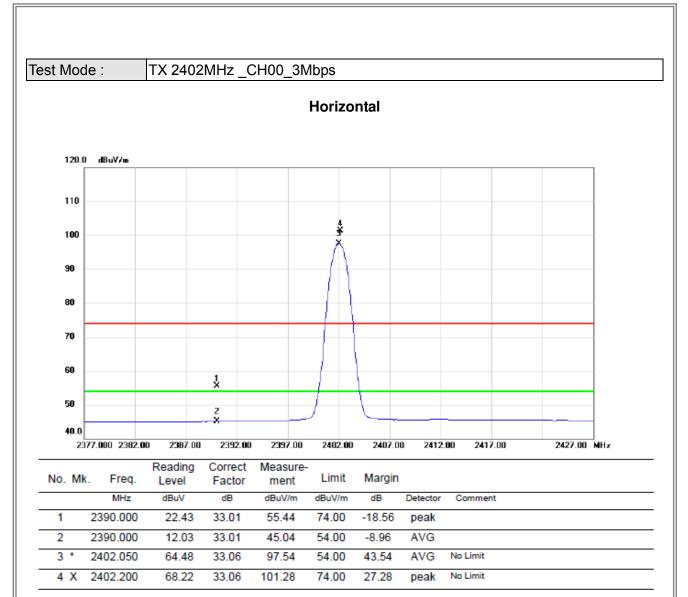






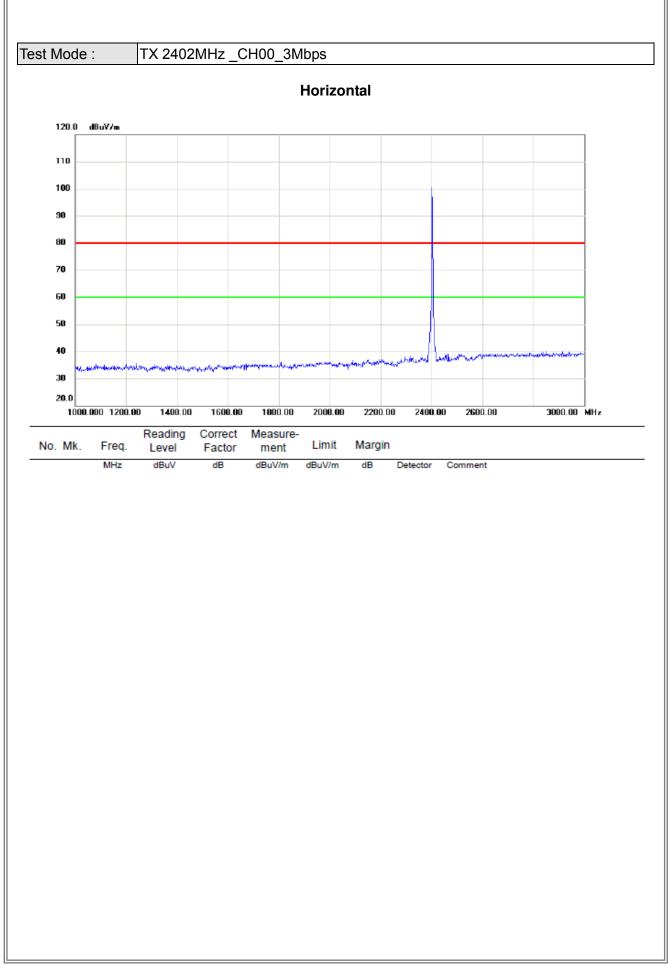






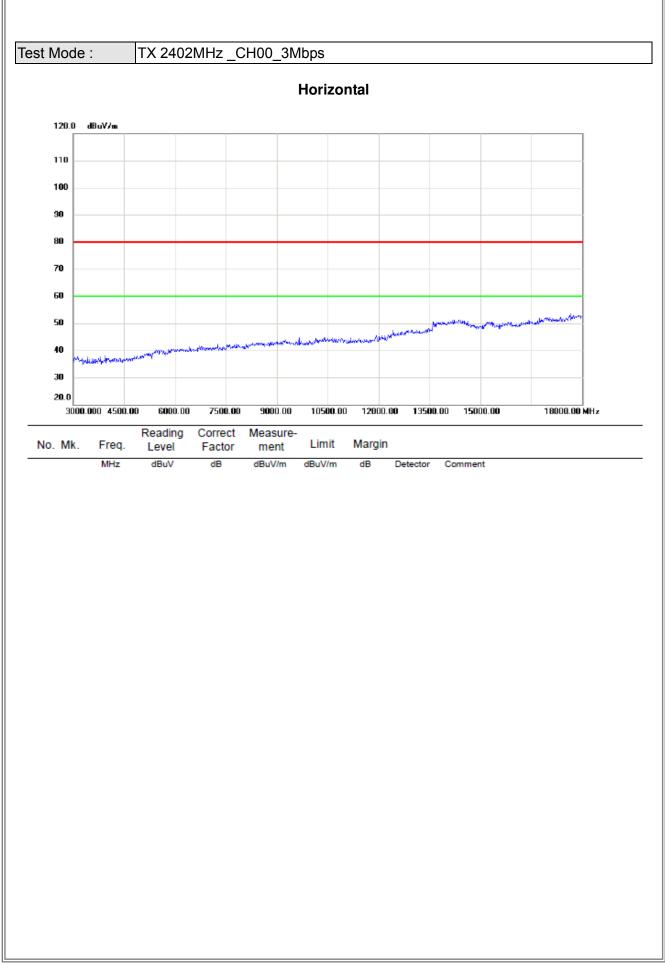






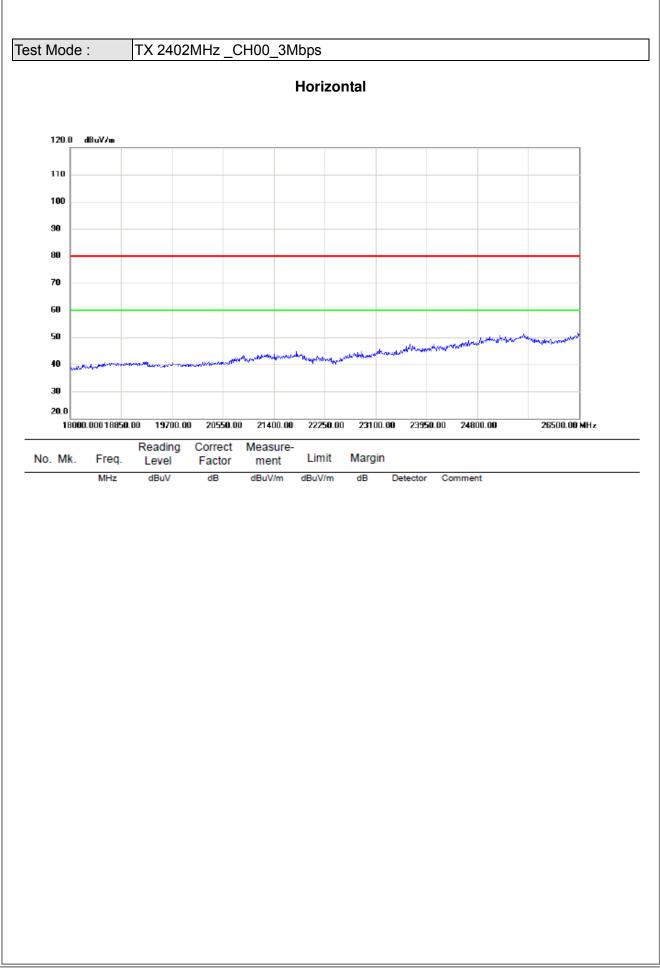






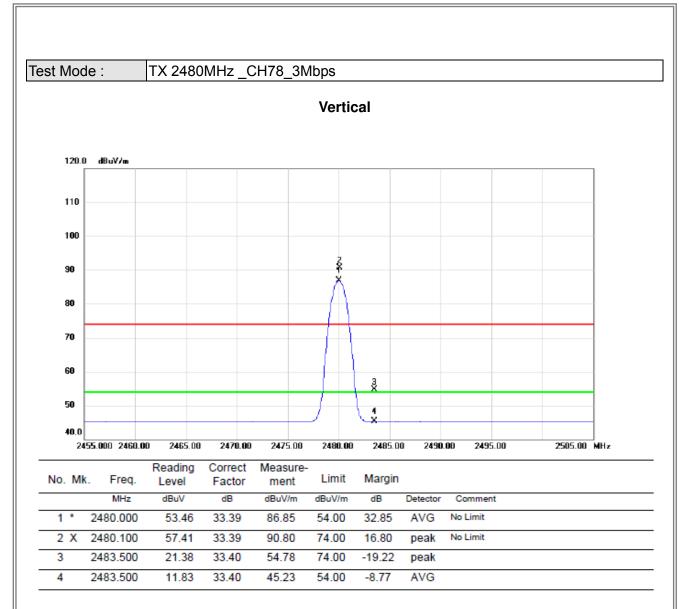






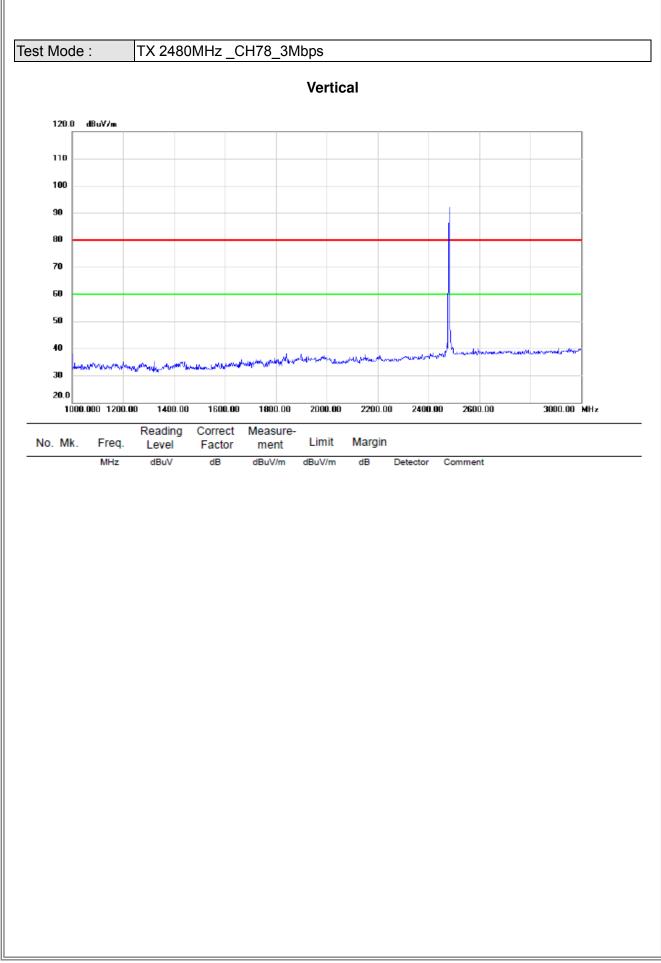






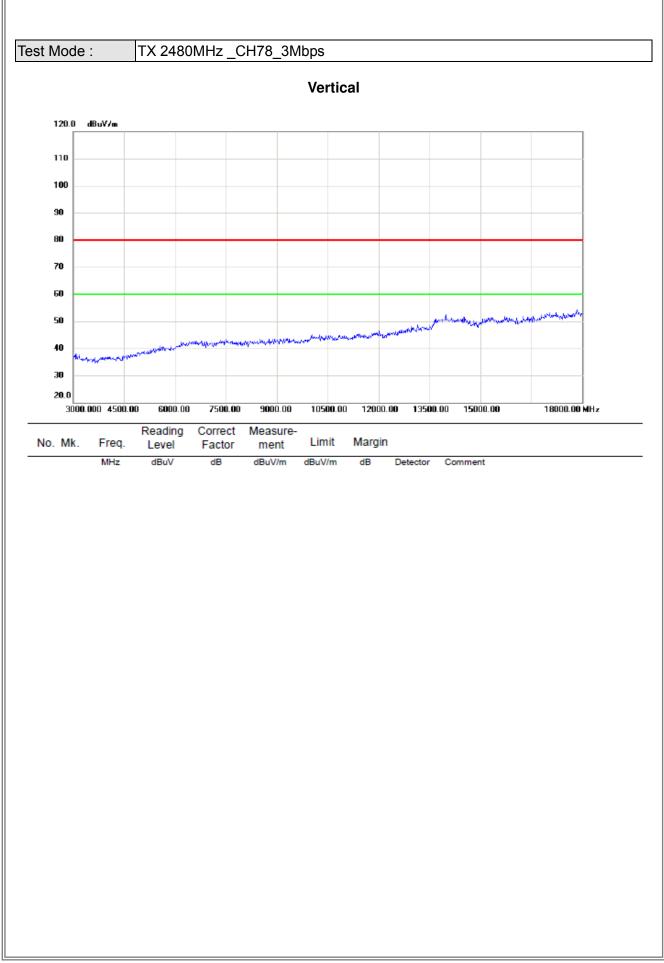






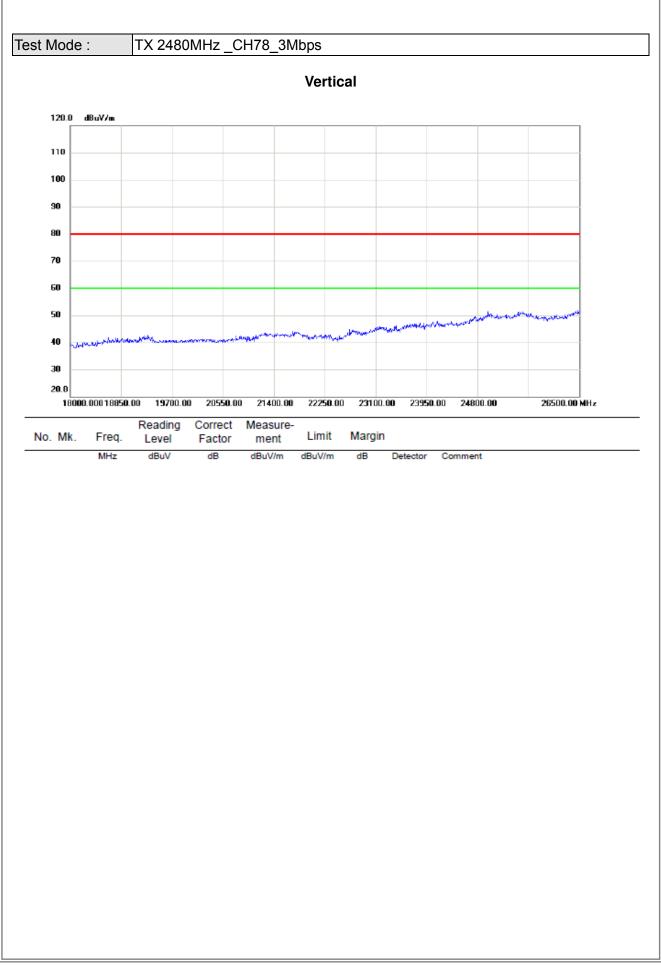






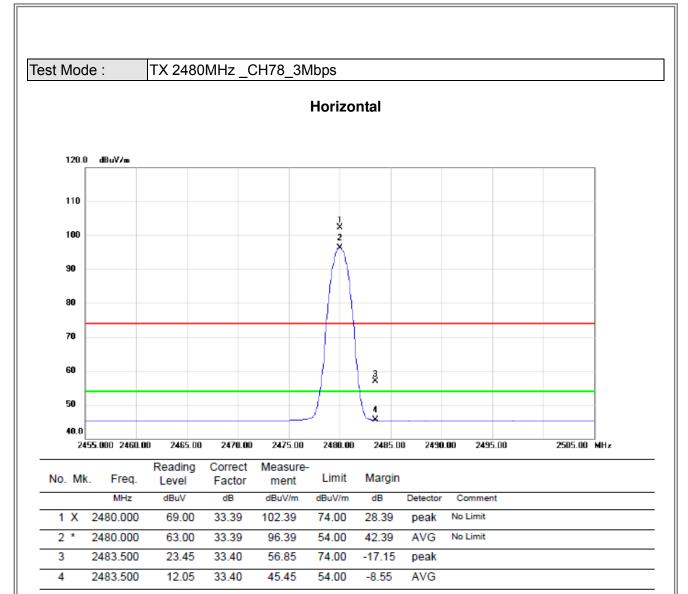






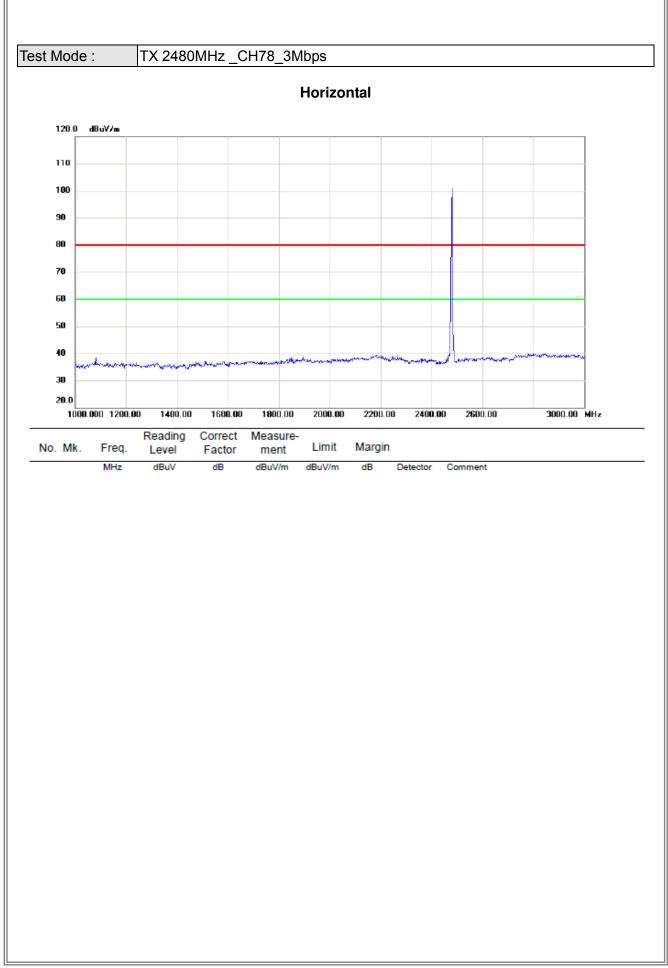






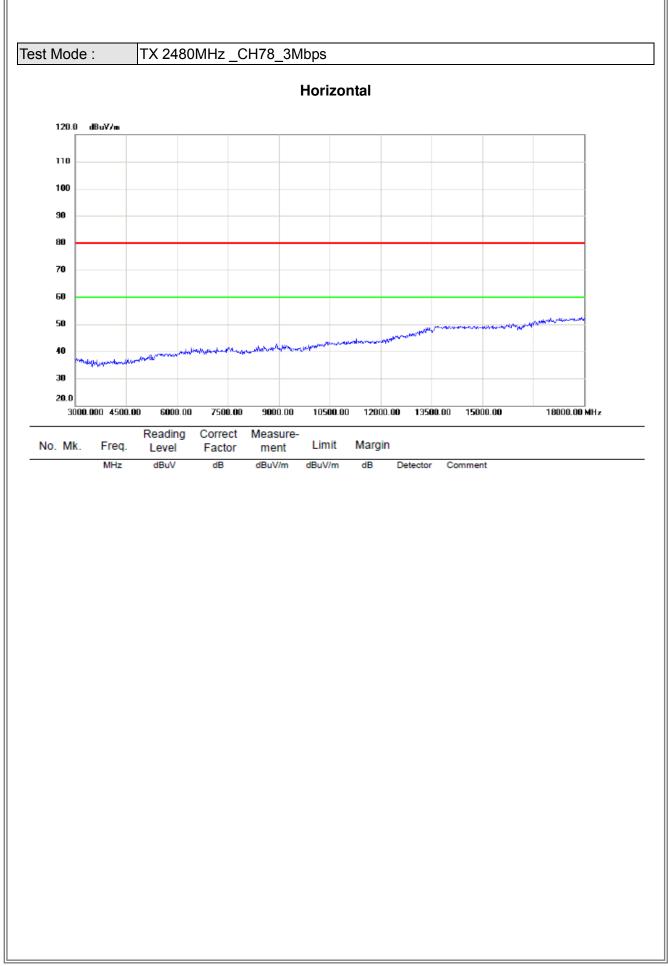






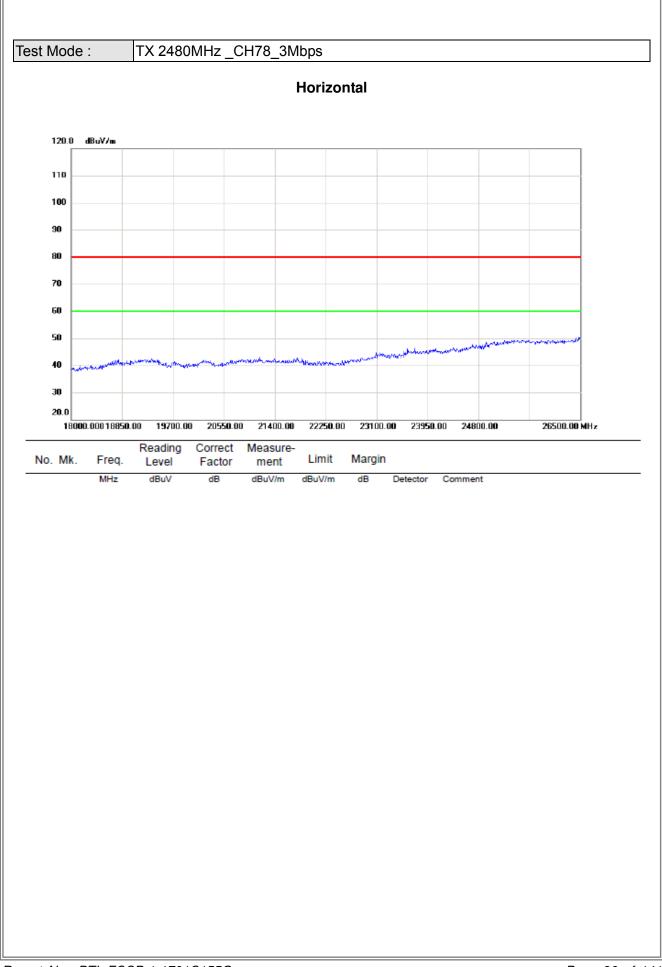








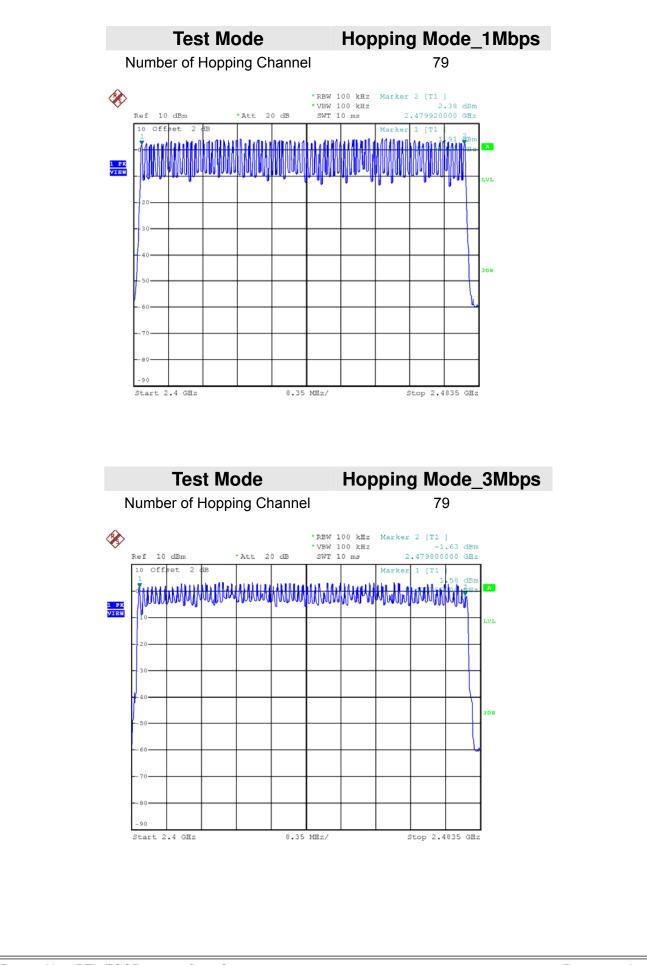






## **ATTACHMENT E - NUMBER OF HOPPING CHANNEL**







## ATTACHMENT F - AVERAGE TIME OF OCCUPANCY

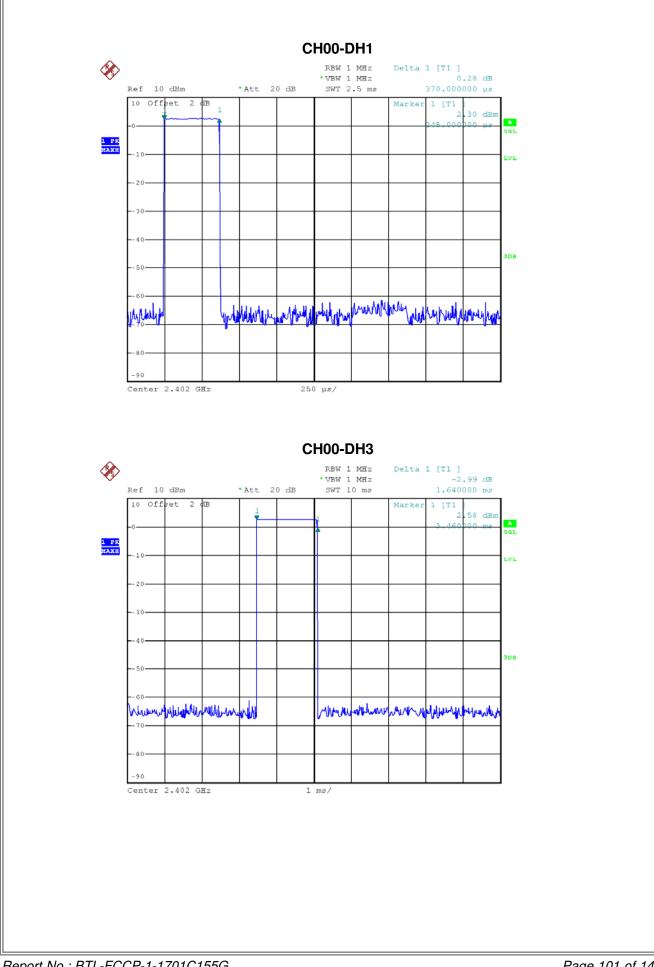




Test Mode :	TX Mode_1Mbps				
Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (s)	Limits (s)	Test Result
DH5	2402	2.8800	0.3072	0.4000	Pass
DH3	2402	1.6400	0.2624	0.4000	Pass
DH1	2402	0.3700	0.1184	0.4000	Pass
DH5	2441	2.8800	0.3072	0.4000	Pass
DH3	2441	1.6200	0.2592	0.4000	Pass
DH1	2441	0.3750	0.1200	0.4000	Pass
DH5	2480	2.8800	0.3072	0.4000	Pass
DH3	2480	1.6200	0.2592	0.4000	Pass
DH1	2480	0.3750	0.1200	0.4000	Pass

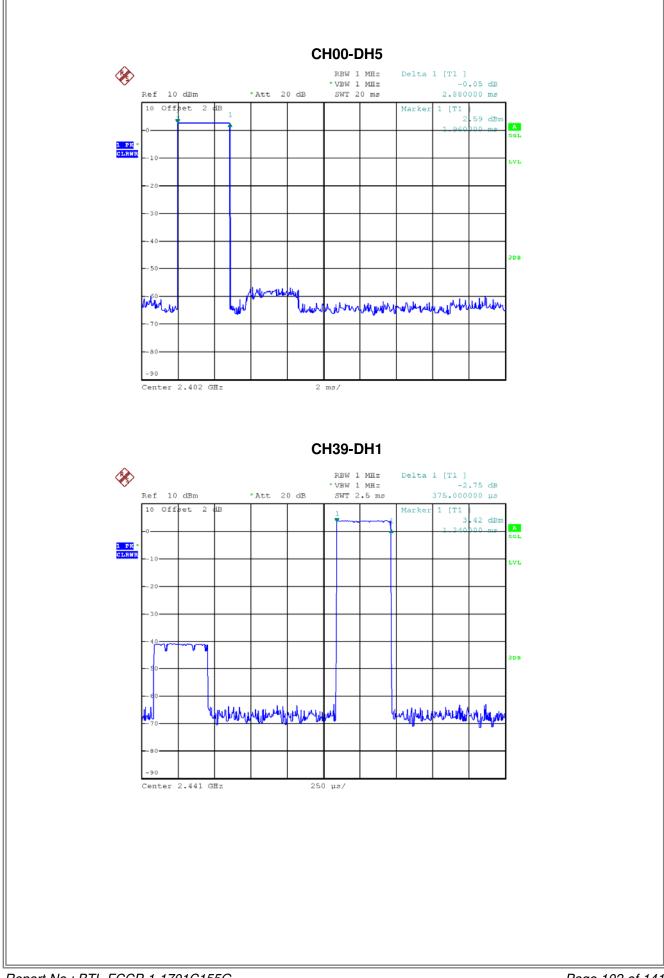






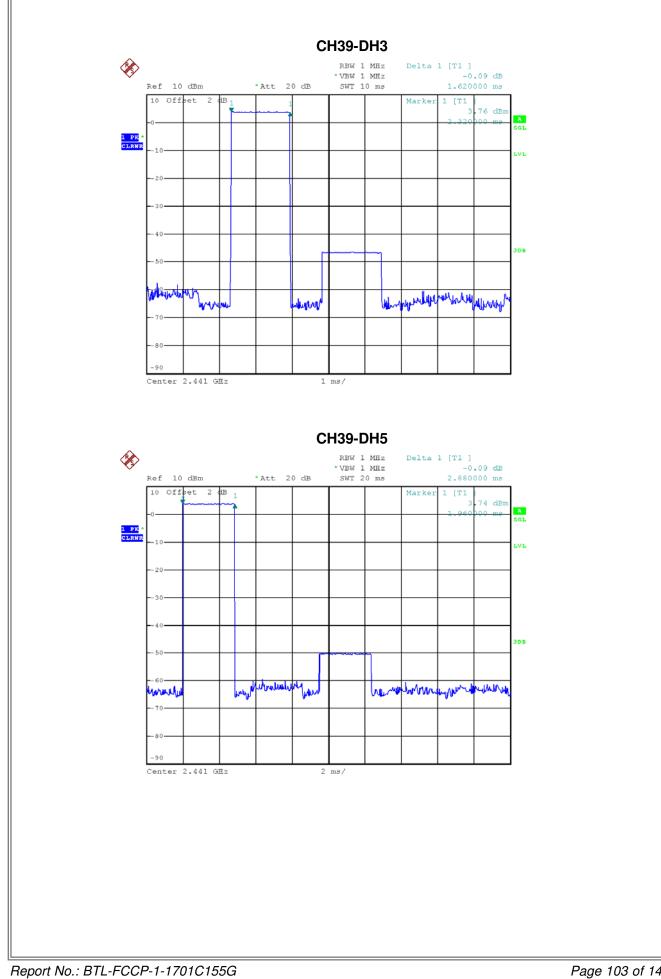






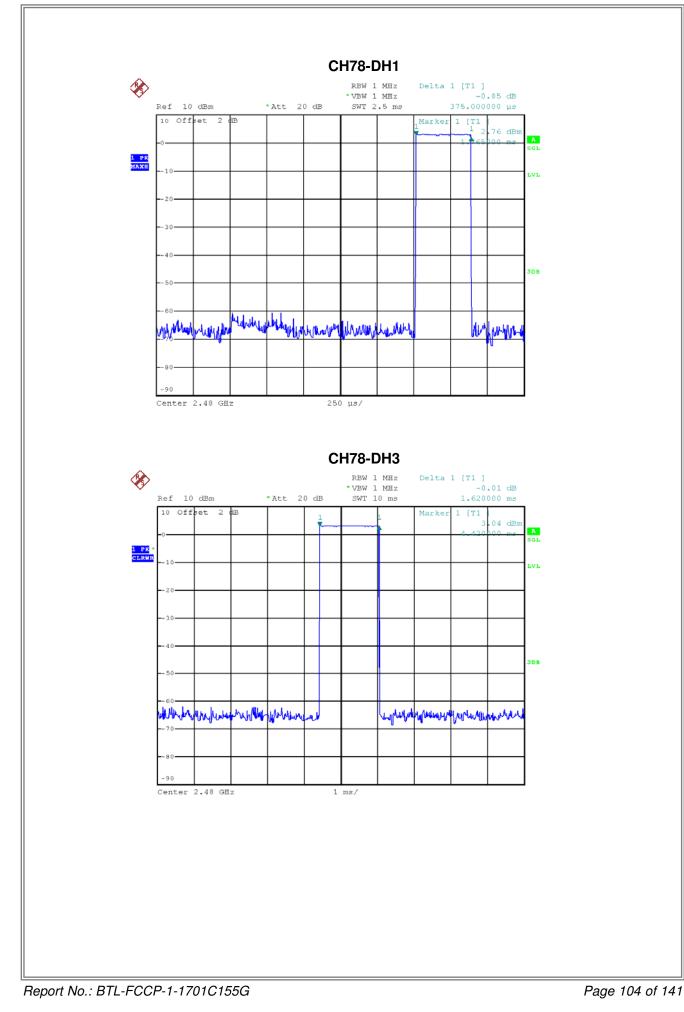






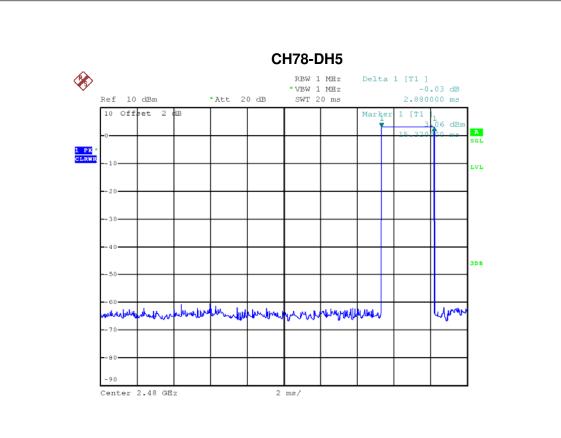
## TL











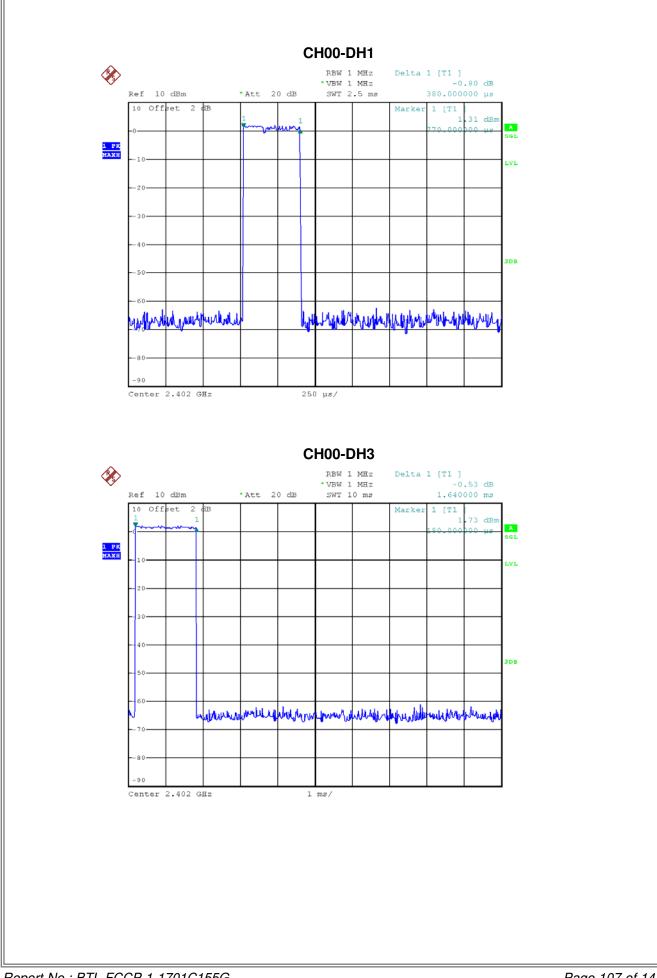




Test Mode :	TX Mode_3Mbps				
Data Packet	Frequency	Pulse Duration(ms)	Dwell Time(s)	Limits(s)	Test Result
DH5	2402	2.8800	0.3072	0.4000	Pass
DH3	2402	1.6400	0.2624	0.4000	Pass
DH1	2402	0.3800	0.1216	0.4000	Pass
DH5	2441	2.8800	0.3072	0.4000	Pass
DH3	2441	1.6400	0.2624	0.4000	Pass
DH1	2441	0.3800	0.1216	0.4000	Pass
DH5	2480	2.8800	0.3072	0.4000	Pass
DH3	2480	1.6400	0.2624	0.4000	Pass
DH1	2480	0.3800	0.1216	0.4000	Pass

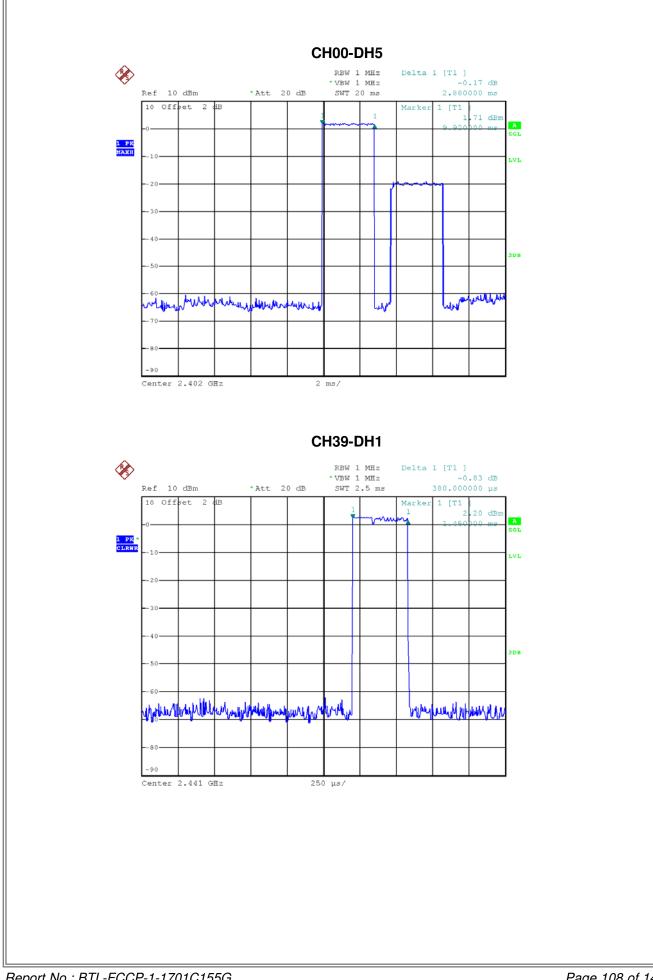






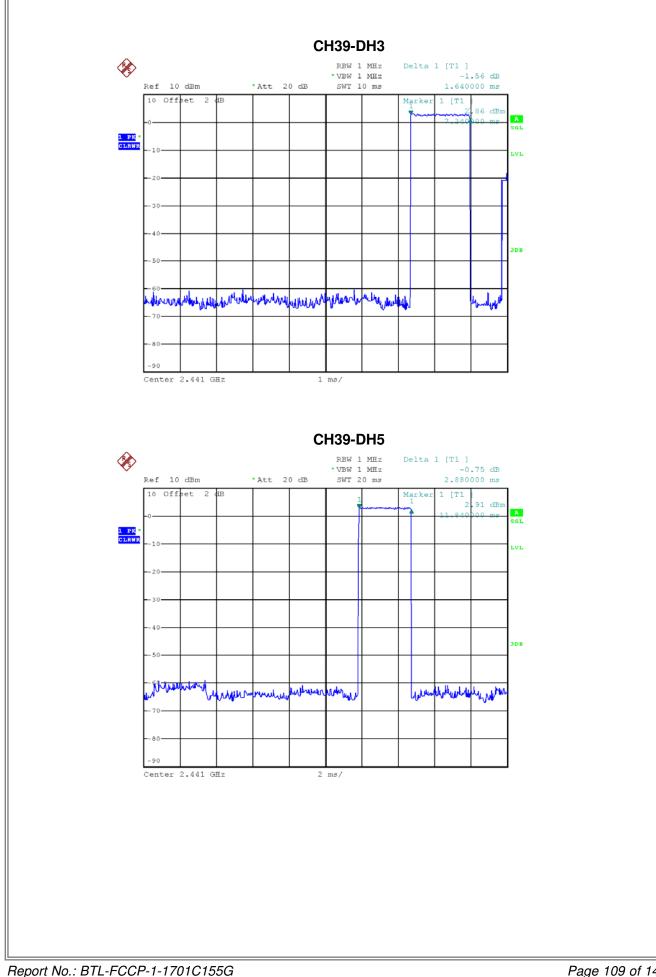
## **B**L





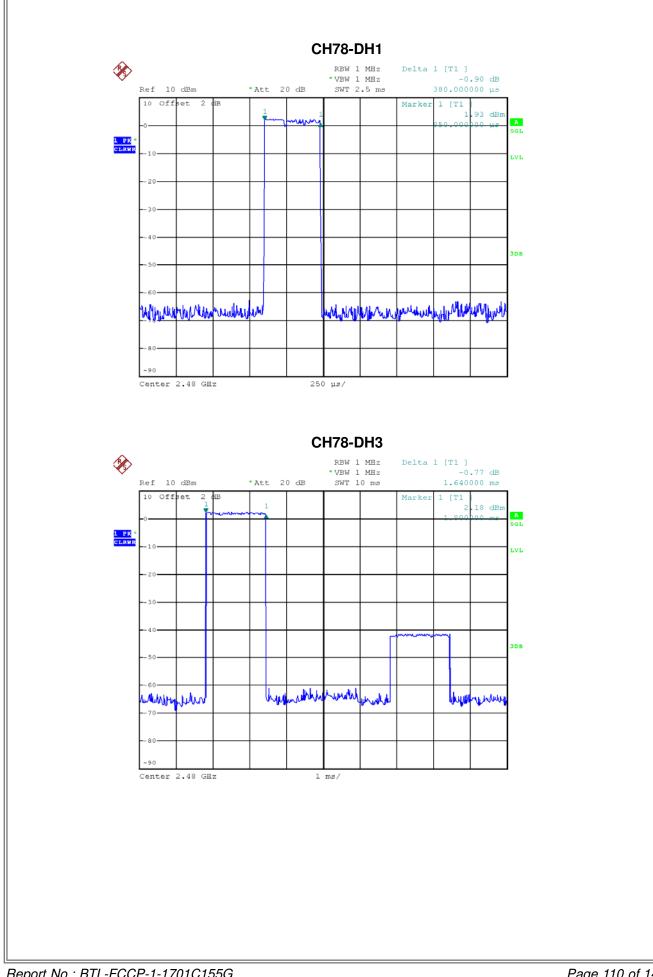






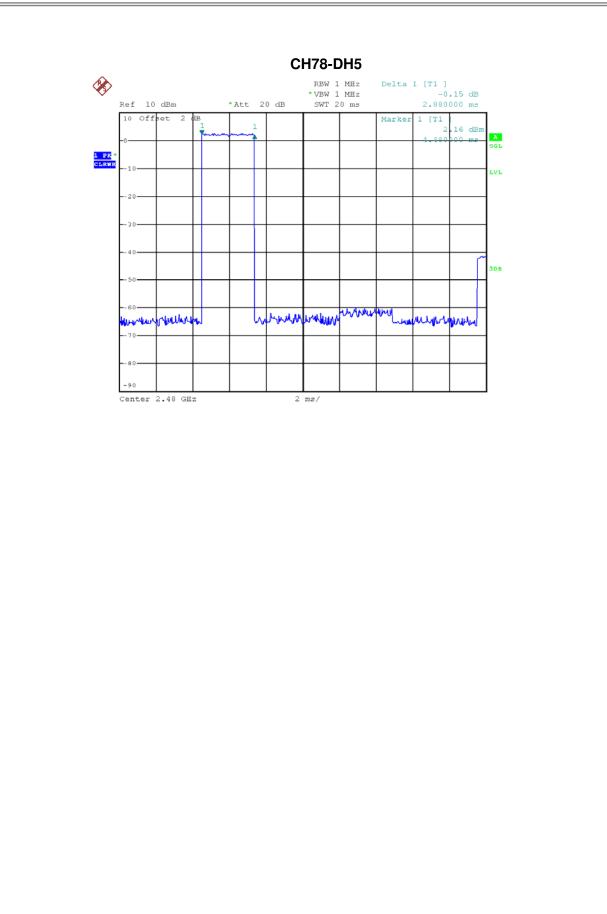
# ЗĨL













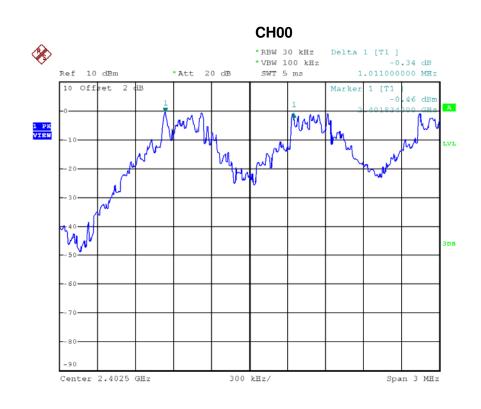


### ATTACHMENT G - HOPPING CHANNEL SEPARATION MEASUREMENT



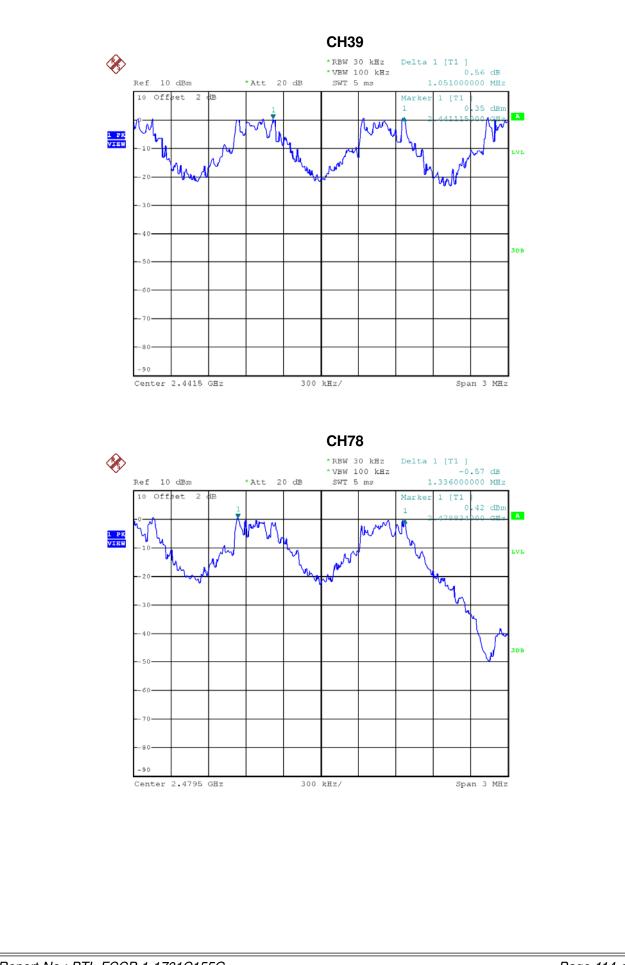


Test Mode : Hopping on _1Mbps				
Frequency (MHz)	Channel Separation (MHz)	2/3 of 20dB Bandwidth (MHz)	Test Result	
2402	1.011	0.689	Pass	
2441	1.051	0.644	Pass	
2480	1.336	0.672	Pass	





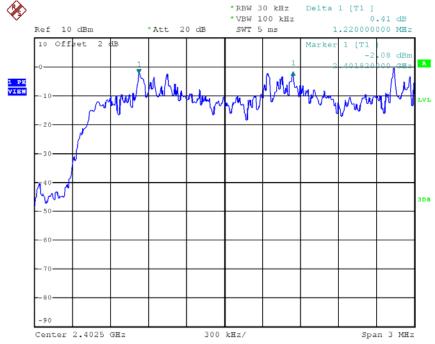






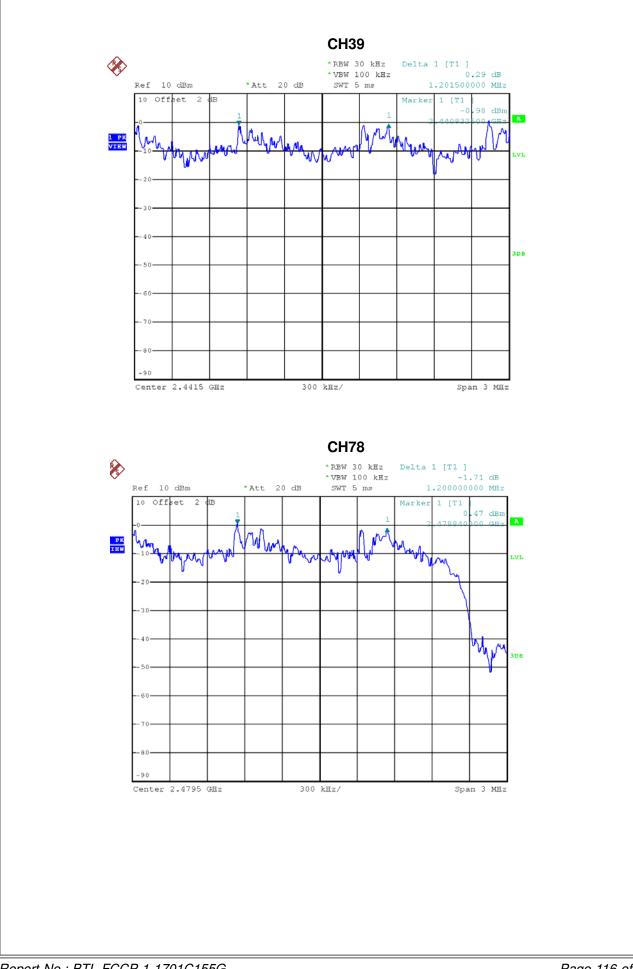


Test Mode :	Hopping on _3Mbps			
Frequency	Channel Separation	2/3 of 20dB Bandwidth	Test Result	
(MHz)	(MHz)	(MHz)	Test Result	
2402	1.220	0.863	Pass	
2441	1.202	0.865	Pass	
2480	1.200	0.859	Pass	
	СН	00		
<b>\$</b>		30 kHz Delta 1 [T1 ] 100 kHz 0.41 dB		
Ref	10 dBm *Att 20 dB SWT Offset 2 dB	5 ms 1.220000000 MHz Marker 1 [T1]		
		-2.08 dBm		









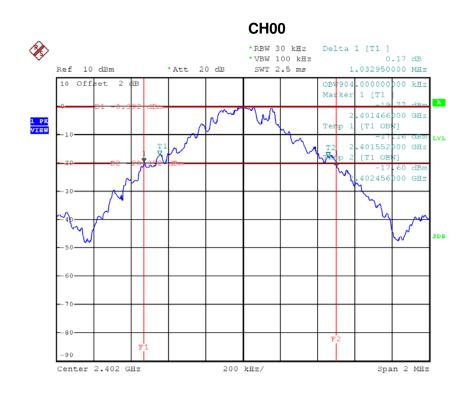


### ATTACHMENT H - BANDWIDTH

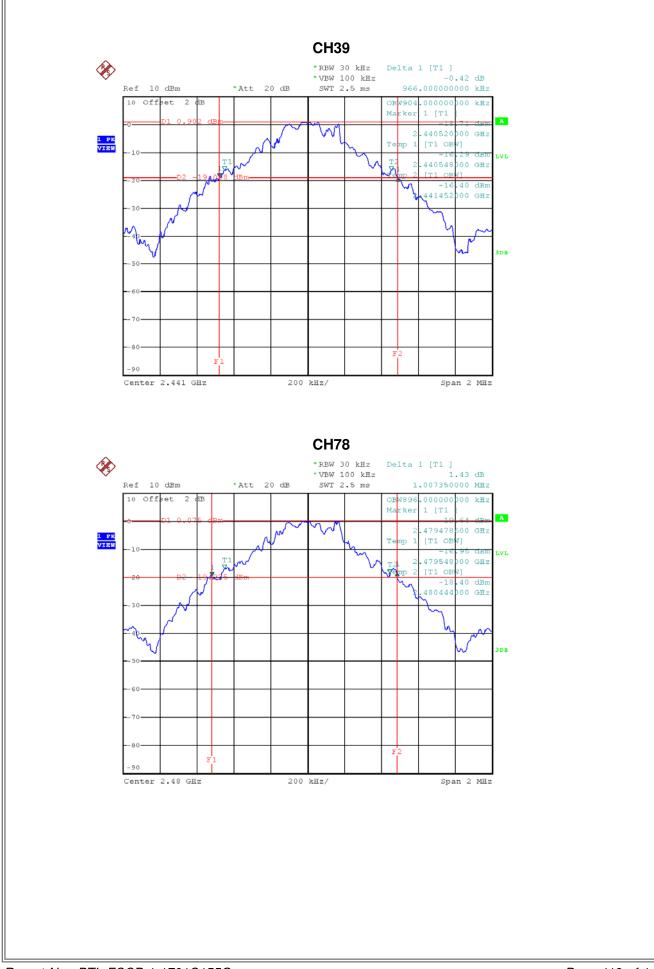




Test Mode : TX Mode _1Mbps				
Frequency	20dB Bandwidth	99% Occupied BW	Test Result	
(MHz)	(MHz)	(MHz)	rest Result	
2402	1.033	0.904	Pass	
2441	0.966	0.904	Pass	
2480	1.007	0.896	Pass	





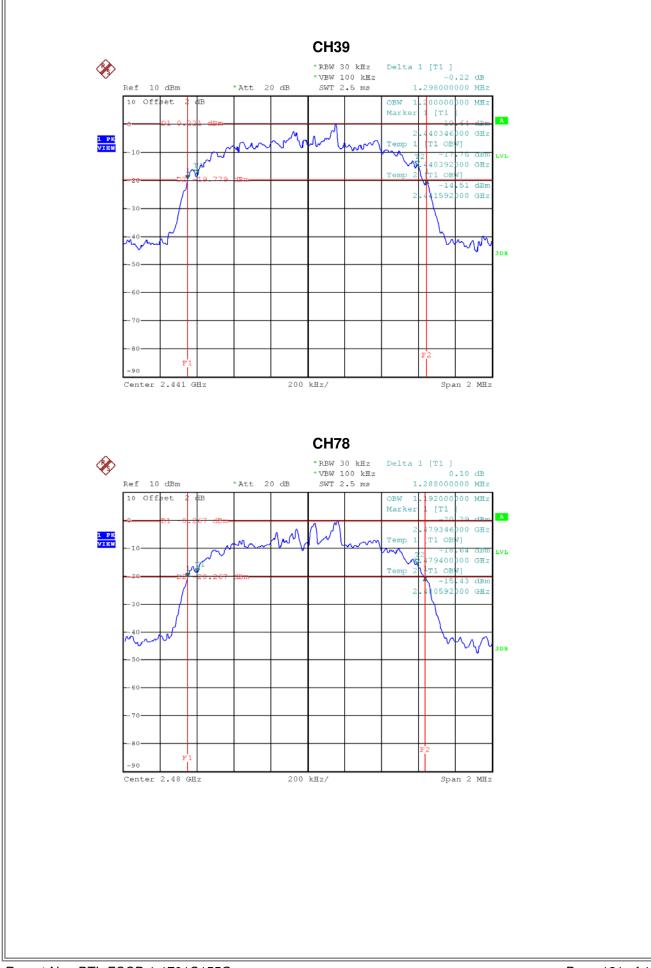






st Mode :	TX Mode _3Mbps		
Frequency	20dB Bandwidth	99% Occupied BW	Test Result
(MHz)	(MHz)	(MHz)	restresuit
2402	1.294	1.188	Pass
2441	1.298	1.200	Pass
2480	1.288	1.192	Pass
- - - - - - - - - 	D1 -1.58 dBm -10 -20 -D2 -21.58 dBm -30 -40 -50 -60 -70 -80	2.401354000 GHz Temp 1 [T1 OBV] 	
	.90 F1	F2	





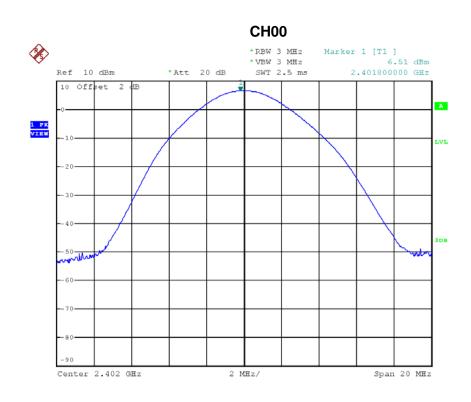


# **ATTACHMENT I - PEAK OUTPUT POWER**



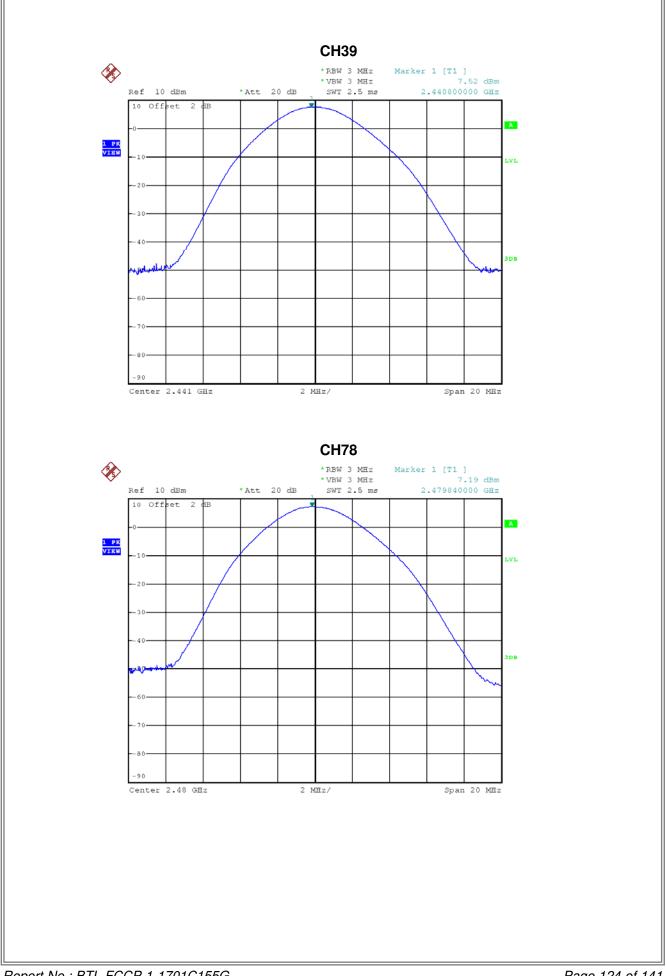


Test Mode :	TX Mode _1Mb	ps			
Frequency	Conducted Power	Conducted Power	Max. Limit	Max. Limit	Test Result
(MHz)	(dBm)	(W)	(dBm)	(W)	Test Result
2402	6.51	0.0045	30.00	1.00	Pass
2441	7.52	0.0056	30.00	1.00	Pass
2480	7.19	0.0052	30.00	1.00	Pass





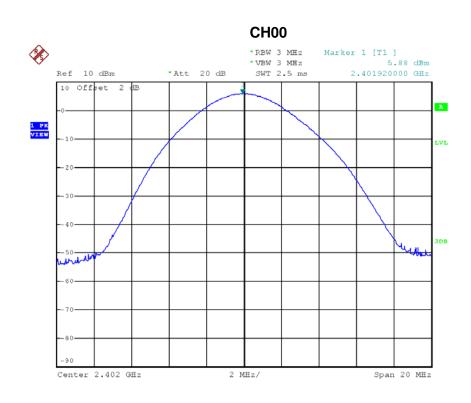






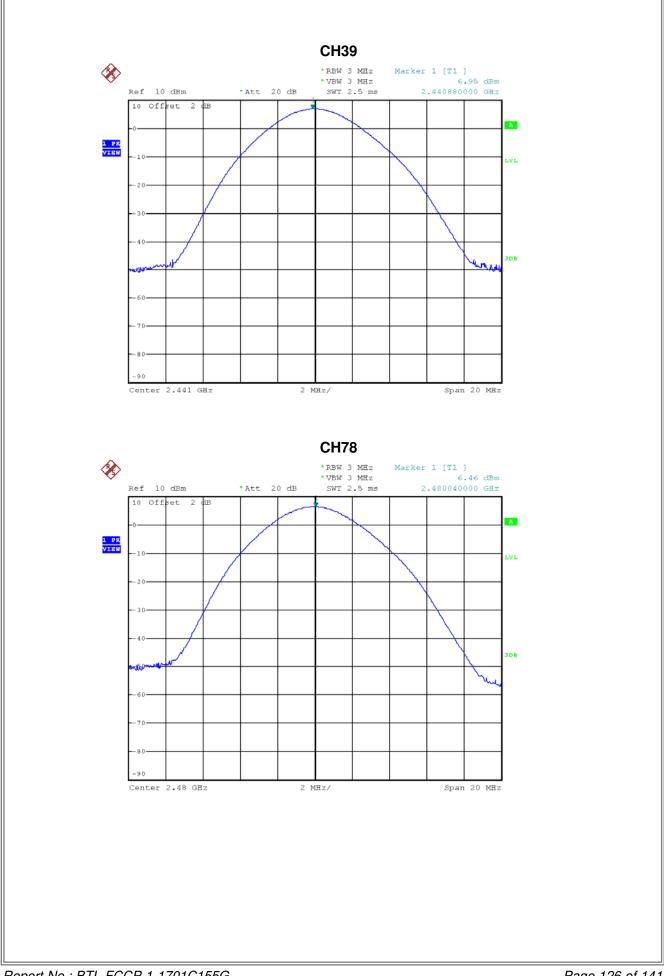


Test Mode :	TX Mode _3Mbp	os			
Frequency	Conducted Power	Conducted Power	Max. Limit	Max. Limit	Test Result
(MHz)	(dBm)	(W)	(dBm)	(W)	Test Result
2402	5.88	0.0039	30.00	1.00	Pass
2441	6.95	0.0050	30.00	1.00	Pass
2480	6.46	0.0044	30.00	1.00	Pass













### ATTACHMENT J - ANTENNA CONDUCTED SPURIOUS EMISSION





