FCC Radio Test Report

FCC ID: RWO-RZ060128

This report concerns (check one): ☒**Original Grant** ☐**Class II Change**

Project No.	:	1409C205
Equipment	:	Gaming Controller
Model Name	:	RZ06-0128
Applicant	:	Razer Inc.
Address	:	2035 Corte Del Nogal, Suite 101. Carlsbad California 92011. USA

Date of Receipt	:	Sep. 24, 2014
Date of Test	:	Sep. 24, 2014~ Oct. 09, 2014
Issued Date	:	Oct. 10, 2014
Tested by	:	BTL Inc.

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Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with the standards traceable to National Measurement Laboratory (**NML**) of **CHINA**, or National Institute of Standards and Technology (**NIST**) of **U.S.A.**

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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- 1409C205	Original Issue.	Oct. 10, 2014

1. CERTIFICATION

Equipment	:	Gaming Controller
Brand Name	:	RAZER
Model Name	:	RZ06-0128
Applicant		Razer Inc.
Manufacturer	:	Razer (Asia-Pacific) Pte Ltd
Address	:	514 Chai Chee Lane #07-01 ~ 06 Singapore 469029
Factory	:	RAZER TECHNOLOGY AND DEVELOPMENT (SHENZHEN) CO., LTD
Address	:	East Wing, 3rd Floor, Block 2, Phase 1 of Vision Shenzhen Business Park Keji South Road, Hi-Tech Industrial Park, Shenzhen 518057, China
Date of Test	:	Sep. 24, 2014~ Oct. 09, 2014
Test Sample	:	ENGINEERING SAMPLE
Standard(s)	:	FCC Part15, Subpart C: 2013 (15.247) / ANSI C63.4 : 2009 / FCC Public Notice DA 00-705, March 30, 2000.

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- 1409C205) 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): 47 CFR Part 15, Subpart C: 2013;			
Standard(s) Section **FCC**	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 (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) According to FCC Public Notice DA 00-705, March 30, 2000.

2.1 TEST FACILITY

The test facilities used to collect the test data in this report is **DG-C02/DG-CB03** at the location of No.3,Jinshagang 1st Road, Shixia, Dalang Town, Dong Guan, Guangdong, China.523792
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 reported uncertainty of measurement **y** ± **U**，where expended uncertainty **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)	Note
DG-C02	CISPR	150 KHz ~ 30MHz	3.40	

B. Radiated Measurement :

Test Site	Method	Measurement Frequency Range	Ant. H / V	U，(dB)	Note
DG-CB03	CISPR	9KHz~30MHz	V	3.79	
		9KHz~30MHz	H	3.57	
		30MHz ~ 200MHz	V	3.82	
		30MHz ~ 200MHz	H	3.60	
		200MHz ~ 1,000MHz	V	3.86	
		200MHz ~ 1,000MHz	H	3.94	
		1GHz~18GHz	V	3.12	
		1GHz~18GHz	H	3.68	
		18GHz~40GHz	V	4.15	
		18GHz~40GHz	H	4.14	

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Equipment	Gaming Controller	
Brand Name	RAZER	
Model Name	RZ06-0128	
Model Difference	N/A	
Output Power (Max.)	Operation Frequency	2402~2480 MHz
	Modulation Technology	GFSK(1Mbps)
	Bit Rate of Transmitter	
	Output Power Max.	-2.56 dBm(1Mbps)
Power Source	1# Supplied 2*AA battery 2# Supplied from USB Port	
Power Rating	1# DC 3V 2# DC 5V 500mA	

Note:

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

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

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Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	GainForce Technology Co.,Ltd	AT3216	Chip	N/A	0.5

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)**
Mode 2	Bluetooth

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 2	Bluetooth

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.

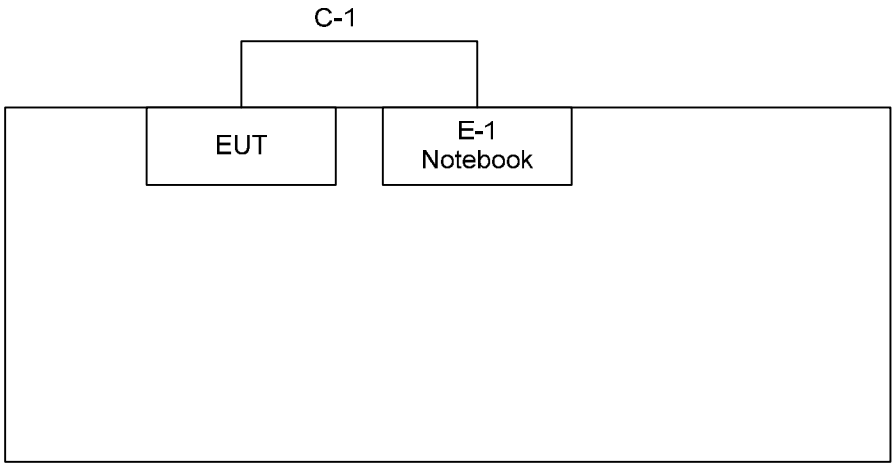
3.3 TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING

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

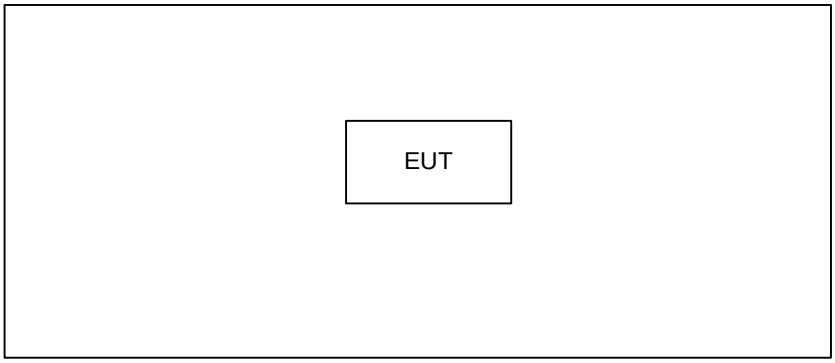
Test Software Version	NA		
Frequency (MHz)	2402	2441	2480
Parameters	NA	NA	NA

3.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Conducted TX Mode:



RadiatedTX Mode:



3.5 DESCRIPTION OF SUPPORT UNITS

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.	Note
E-1	Notebook	DELL	INSPIRON 1420	NA	NA	-

Item	Shielded Type	Ferrite Core	Length	Note
C-1	NO	NO	1.5M	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 Limit (dBμV)	
	Quasi peak	Average
0.15 -0.5	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

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

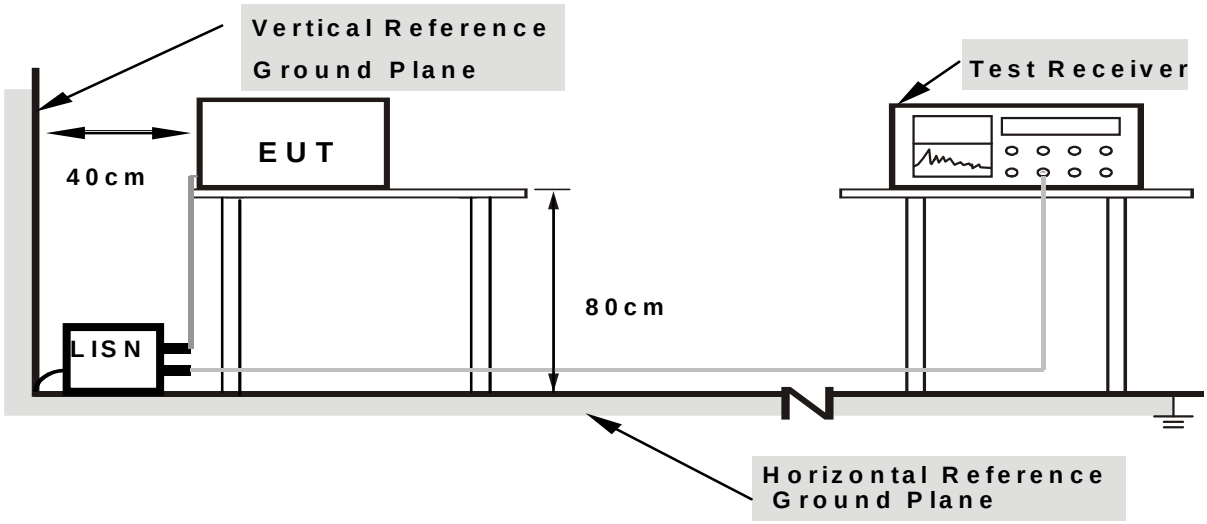
4.1.2 TEST PROCEDURE

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 equipments 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 –Block Diagram of system tested (please refer to 3.4).

4.1.3 DEVIATION FROM TEST STANDARD

No deviation

4.1.4 TEST SETUP



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

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)

20dB in any 100 KHz bandwidth outside the operating frequency band. 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 (MHz)	Field Strength (microvolts/meter)	Measurement Distance (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)

Frequency (MHz)	dB(uV/m) (at 3 meters)	
	Peak	Average
Above 1000	74	54

Notes:

(1) The limit for radiated test was performed according to FCC PART 15C.

(2) The tighter limit applies at the band edges.

(3) Emission level (dBuV/m) =20log Emission level (uV/m).

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW (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

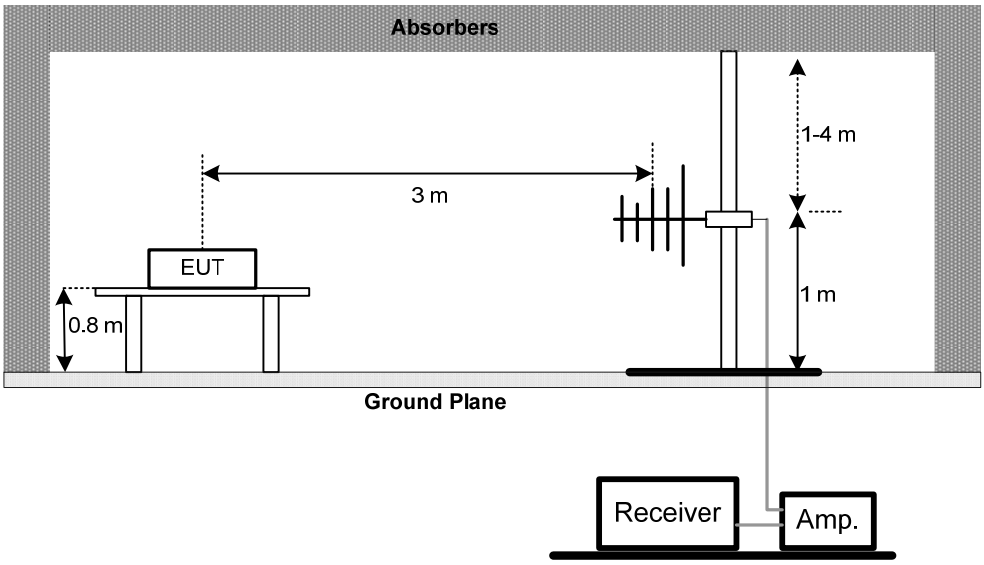
a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
b. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 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 0.8 m; 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. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
f. For the actual test configuration, please refer to the related Item –Block Diagram of system tested (please refer to 3.4).

4.2.3 DEVIATION FROM TEST STANDARD

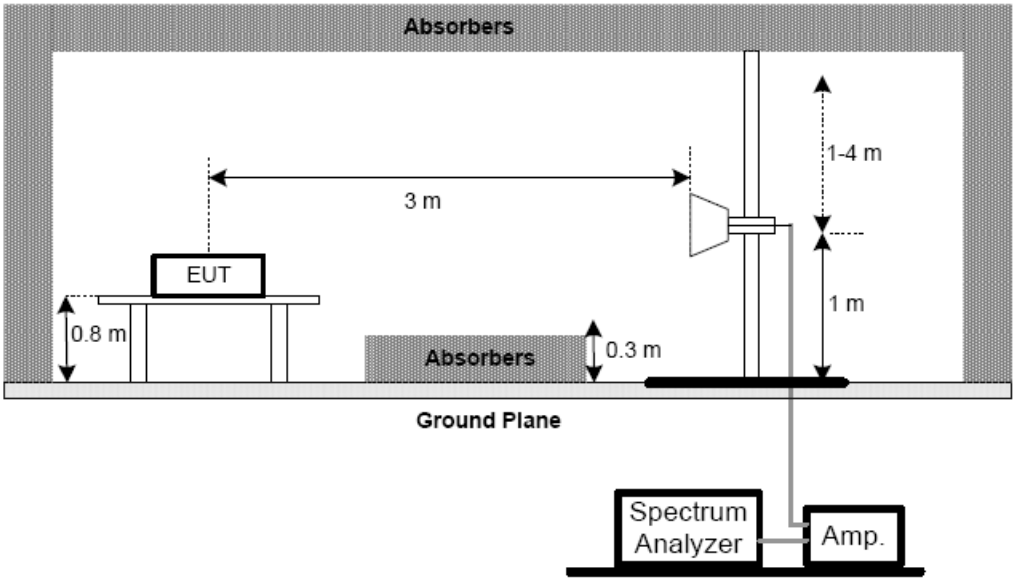
No deviation

4.2.4 TEST SETUP

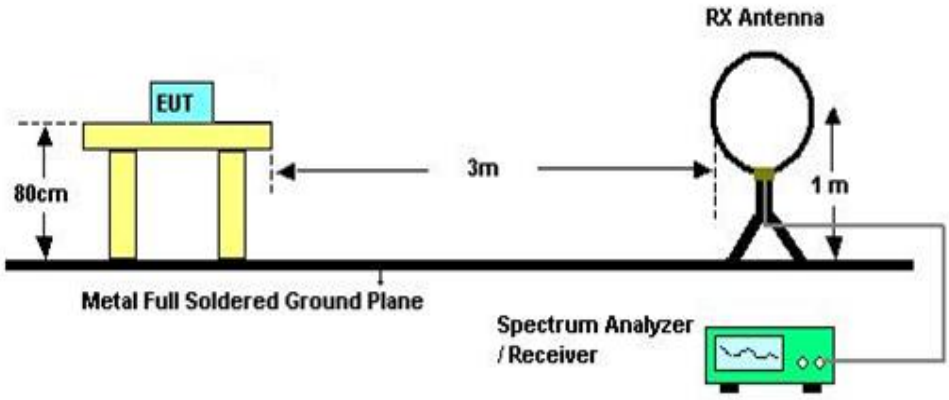
(A) Radiated Emission Test Set-Up Frequency Below 1 GHz



(B) Radiated Emission Test Set-Up Frequency Above 1 GHz



(C) For radiated emissions below 30MHz



4.2.5 EUT OPERATING 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

4.2.6 EUT TEST CONDITIONS

Temperature: 25°C
Relative Humidity: 55%
Test Voltage: DC 3V

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 (BETWEEN 30MHZ TO 1000 MHZ)

Please refer to the Attachment C.

Remark:

(1) Reading in which marked as QP or Peak means measurements by using are Quasi-Peak Mode or Peak Mode with Detector BW=120KHz；SPA setting in RBW=120KHz, VBW =120KHz, Swp. Time = 0.3 sec./MHz.
(2) 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.
(3) Measuring frequency range from 30MHz to 1000MHz.
(4) If the peak scan value lower limit more than 20dB, then this signal data does not show in table.

4.2.9 TEST RESULTS (ABOVE 1000 MHZ)

Please refer to the Attachment D.

Remark:

(1) 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.
(2) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission
(3) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.
(4) EUT Orthogonal Axis:
"X" - denotes Laid on Table；"Y" - denotes Vertical Stand；"Z" - denotes Side Stand
(5) During the measurements above 1 GHz it is taken care of that the EUT is always within the 3 dB cone of radiation BW of the used antenna

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

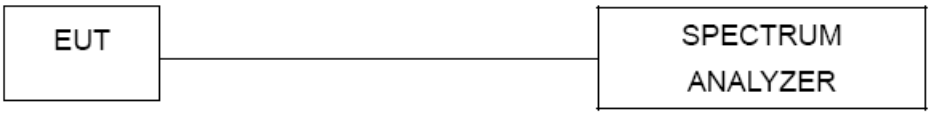
5.1.1 TEST PROCEDURE

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



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: DC 3V

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

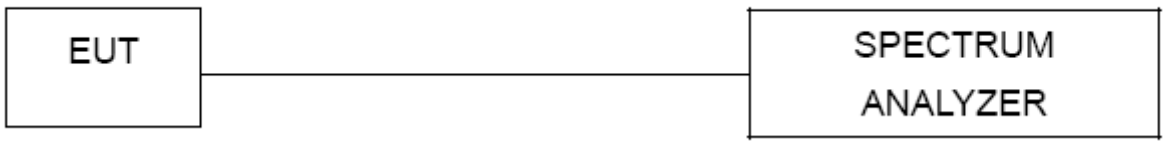
6.1.1 TEST PROCEDURE

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.
f. Measure the maximum time duration of one single pulse.
g. Set the EUT for DH5, DH3 and DH1 packet transmitting.
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: DC 3V

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

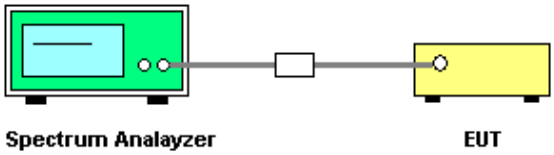
a. The EUT must have its hopping function enabled

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



7.1.4 EUT TEST CONDITIONS

Temperature: 25°C
Relative Humidity: 55%
Test Voltage: DC 3V

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
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

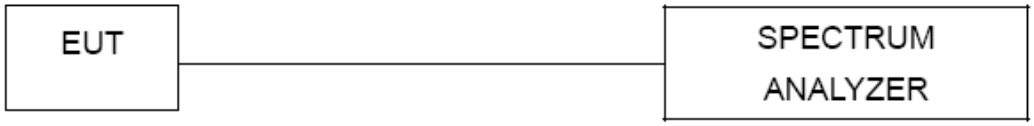
8.1.1 TEST PROCEDURE

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



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: DC 3V

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	2400-2483.5	PASS

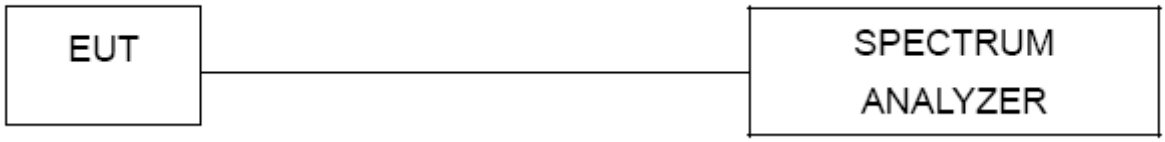
9.1.1 TEST PROCEDURE

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



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: DC 3V

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 intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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 measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

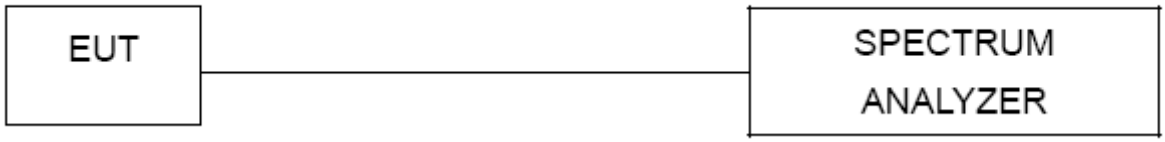
10.1.1 TEST PROCEDURE

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.

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: DC 3V

10.1.6 TEST RESULTS

Please refer to the Attachment J

11. MEASUREMENT INSTRUMENTS LIST

Conducted Emission Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	LISN	EMCO	3816/2	00052765	Mar. 29, 2015
2	LISN	R&S	ENV216	101447	Mar. 29, 2015
3	Test Cable	N/A	C_17	N/A	Mar. 14, 2015
4	EMI TEST RECEIVER	R&S	ESCS30	833364/017	Mar. 29, 2015
5	50Ω Terminator	SHX	TF2-3G-A	08122902	Mar. 29, 2015

Radiated Emission Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Antenna	Schwarbeck	VULB9160	9160-3232	Mar. 29, 2015
2	Amplifier	HP	8447D	2944A09673	Mar. 29, 2015
3	Test Receiver	R&S	ESCI	100382	Mar. 29, 2015
4	Test Cable	N/A	C-01_CB03	N/A	Jul. 01, 2015
5	Antenna	ETS	3115	00075789	Mar. 29, 2015
6	Amplifier	Agilent	8449B	3008A02274	Mar. 29, 2015
7	Spectrum	Agilent	E4408B	US39240143	Nov. 09, 2014
8	Test Cable	HUBER+SUHNER	C-45	N/A	Mar. 29, 2015
9	Controller	CT	SC100	N/A	N/A
10	Horn Antenna	EMCO	3115	9605-4803	Mar. 29, 2015
11	Active Loop Antenna	R&S	HFH2-Z2	830749/020	Mar. 29, 2015

Number of Hopping Channel					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP 40	100185	Nov. 11, 2014

Average Time of Occupancy					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP 40	100185	Nov. 11, 2014

Hopping Channel Separation Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP 40	100185	Nov. 11, 2014

Bandwidth					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP 40	100185	Nov. 11, 2014

Peak Output Power					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP 40	100185	Nov. 11, 2014

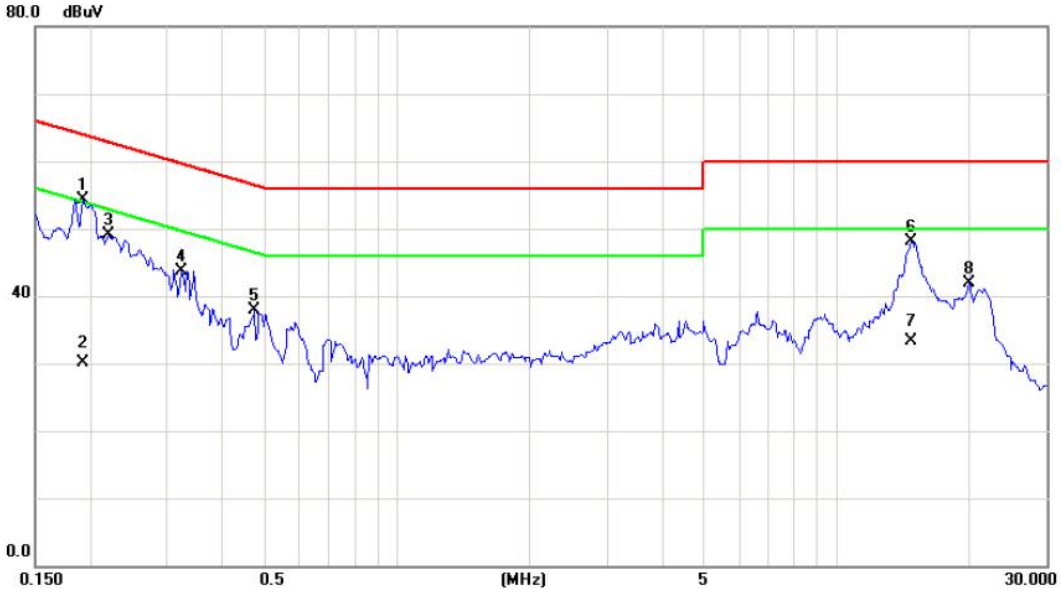
Antenna Conducted Spurious Emission					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP 40	100185	Nov. 11, 2014

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

Test Mode:	TX Mode

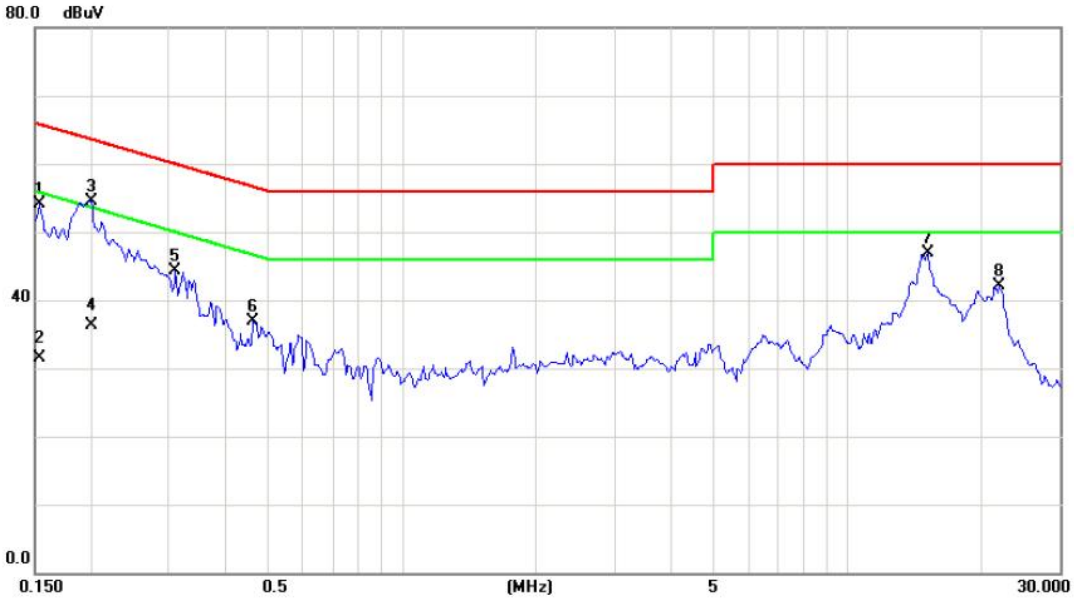
Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1930	44.79	9.54	54.33	63.91	-9.58	peak	
2		0.1930	20.50	9.54	30.04	53.91	-23.87	AVG	
3		0.2203	39.53	9.55	49.08	62.81	-13.73	peak	
4		0.3220	34.14	9.60	43.74	59.66	-15.92	peak	
5		0.4742	28.14	9.69	37.83	56.44	-18.61	peak	
6		14.7970	37.85	10.23	48.08	60.00	-11.92	peak	
7		14.7970	23.00	10.23	33.23	50.00	-16.77	AVG	
8		20.0391	31.45	10.46	41.91	60.00	-18.09	peak	

Test Mode:	TX Mode

Neutral



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1540	44.41	9.63	54.04	65.78	-11.74	peak	
2		0.1540	21.80	9.63	31.43	55.78	-24.35	AVG	
3	*	0.2008	44.81	9.61	54.42	63.58	-9.16	peak	
4		0.2008	26.70	9.61	36.31	53.58	-17.27	AVG	
5		0.3102	34.66	9.62	44.28	59.97	-15.69	peak	
6		0.4625	27.27	9.64	36.91	56.65	-19.74	peak	
7		15.1641	36.68	10.29	46.97	60.00	-13.03	peak	
8		21.8398	31.53	10.58	42.11	60.00	-17.89	peak	

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

Test Mode:	TX Mode

Freq. (MHz)	Ant. 0°/90°	Reading(RA) (dBuV)	Corr.Factor(CF) (dB)	Measured(FS) (dBuV/m)	Limits(QP) (dBuV/m)	Margin (dB)	Note
0.0094	0°	3.74	24.97	28.71	108.18	-79.46	AVG
0.0094	0°	4.43	24.97	29.40	128.18	-98.77	PK
0.0237	0°	1.64	24.07	25.71	100.11	-74.40	AVG
0.0237	0°	0.28	24.07	24.35	120.11	-95.76	PK
0.0318	0°	1.39	23.55	24.94	97.56	-72.61	AVG
0.0318	0°	0.86	23.55	24.41	117.56	-93.14	PK
0.0429	0°	1.52	22.85	24.37	94.96	-70.59	AVG
0.0429	0°	0.37	22.85	23.22	114.96	-91.74	PK
0.4912	0°	5.39	19.82	25.21	73.78	-48.57	QP
1.7156	0°	4.37	19.53	23.90	69.54	-45.64	QP

Freq. (MHz)	Ant. 0°/90°	Reading(RA) (dBuV)	Corr.Factor(CF) (dB)	Measured(FS) (dBuV/m)	Limits(QP) (dBuV/m)	Margin (dB)	Note
0.0094	90°	9.13	24.30	33.43	128.18	-94.75	AVG
0.0094	90°	9.07	24.30	33.37	148.18	-114.81	PK
0.0237	90°	4.36	24.07	28.43	120.11	-91.68	AVG
0.0237	90°	4.97	24.07	29.04	140.11	-111.07	PK
0.0318	90°	3.24	23.55	26.79	117.56	-90.76	AVG
0.0318	90°	1.70	23.55	25.25	137.56	-112.30	PK
0.0429	90°	1.52	22.85	24.37	114.96	-90.59	AVG
0.0429	90°	0.97	22.85	23.82	134.96	-111.14	PK
0.4912	90°	10.22	19.82	30.04	73.78	-43.74	QP
1.7156	90°	9.47	19.53	29.00	69.54	-40.54	QP

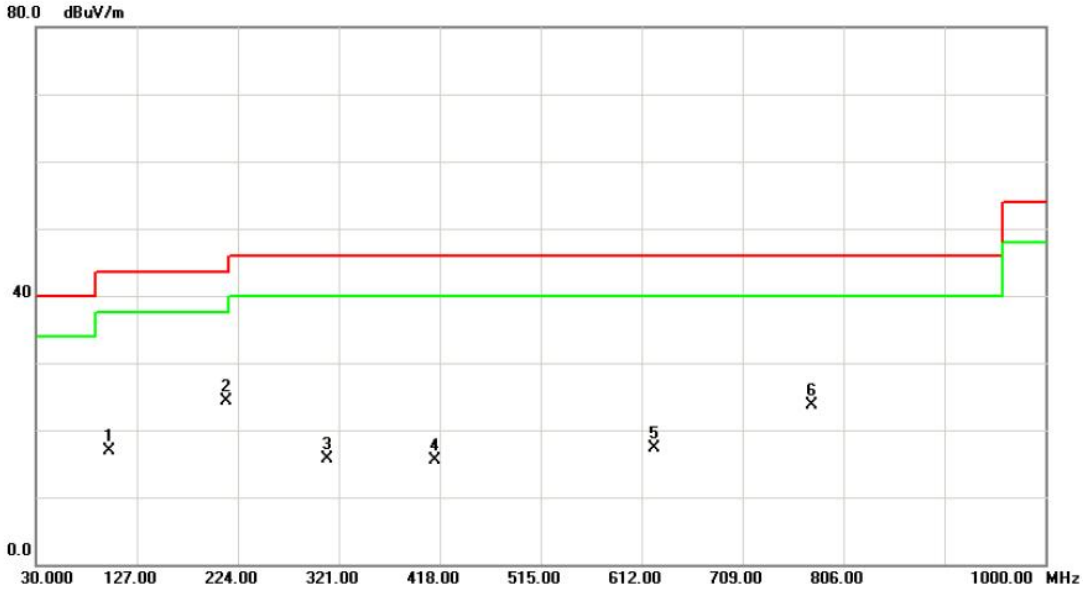
Remark:

(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.

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

Test Mode:	TX 2402MHz _CH00_1Mbps

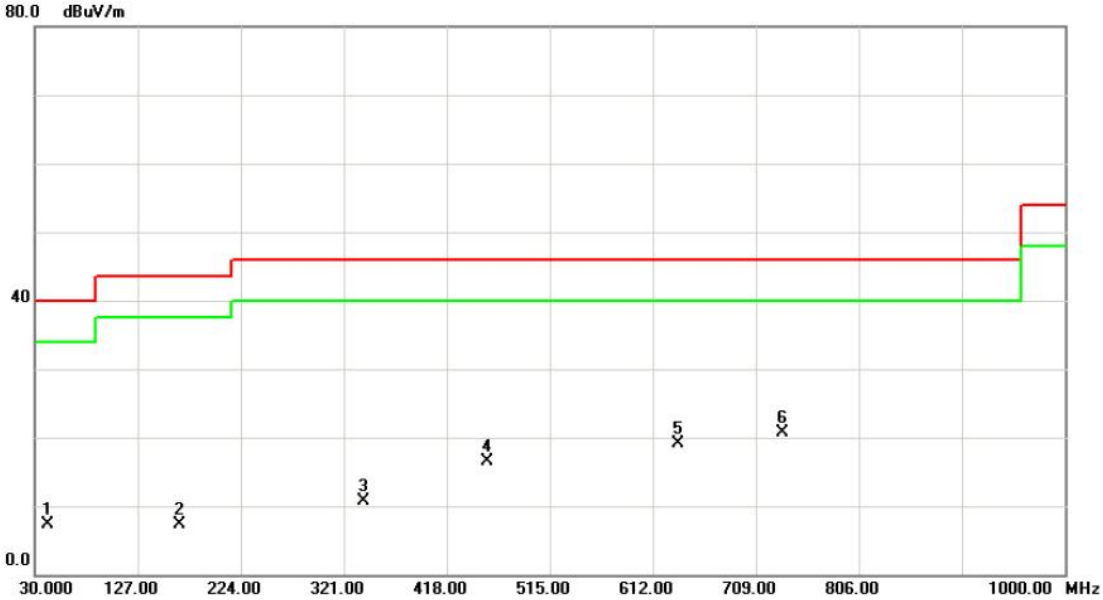
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		99.8400	41.96	-25.14	16.82	43.50	-26.68	peak	
2	*	212.3600	44.96	-20.73	24.23	43.50	-19.27	peak	
3		309.3600	32.98	-17.36	15.62	46.00	-30.38	peak	
4		413.1500	30.57	-14.98	15.59	46.00	-30.41	peak	
5		623.6400	31.26	-14.03	17.23	46.00	-28.77	peak	
6		775.9300	30.49	-6.69	23.80	46.00	-22.20	peak	

Test Mode:	TX 2402MHz _CH00_1Mbps

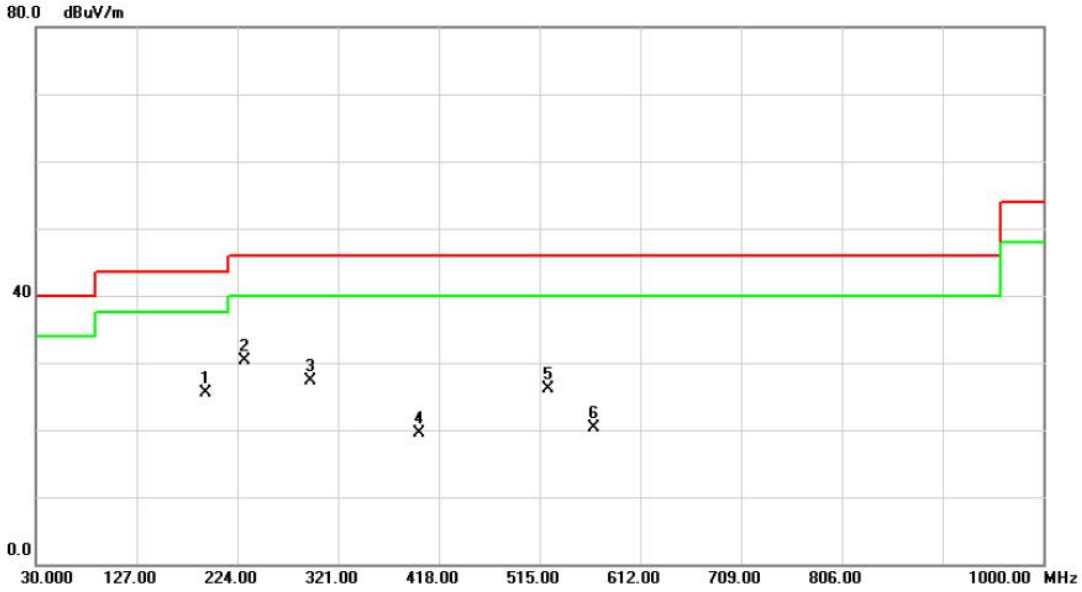
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		41.6400	28.05	-20.69	7.36	40.00	-32.64	peak	
2		165.8000	29.09	-21.69	7.40	43.50	-36.10	peak	
3		339.4300	30.45	-19.76	10.69	46.00	-35.31	peak	
4		455.8300	29.86	-13.38	16.48	46.00	-29.52	peak	
5		636.2500	29.45	-10.38	19.07	46.00	-26.93	peak	
6	*	734.2200	29.04	-8.30	20.74	46.00	-25.26	peak	

Test Mode:	TX 2441MHz _CH39_1Mbps

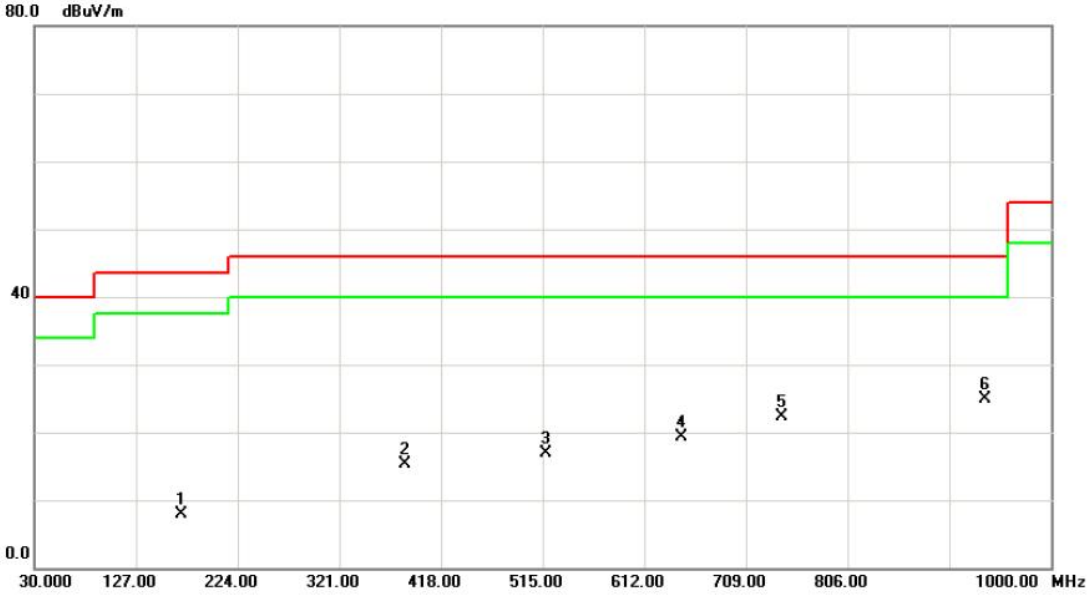
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		192.9600	46.46	-21.05	25.41	43.50	-18.09	peak	
2	*	230.7900	48.21	-17.99	30.22	46.00	-15.78	peak	
3		294.8100	43.77	-16.44	27.33	46.00	-18.67	peak	
4		399.5700	33.62	-14.05	19.57	46.00	-26.43	peak	
5		523.7300	40.68	-14.55	26.13	46.00	-19.87	peak	
6		567.3800	34.32	-14.06	20.26	46.00	-25.74	peak	

Test Mode:	TX 2441MHz _CH39_1Mbps

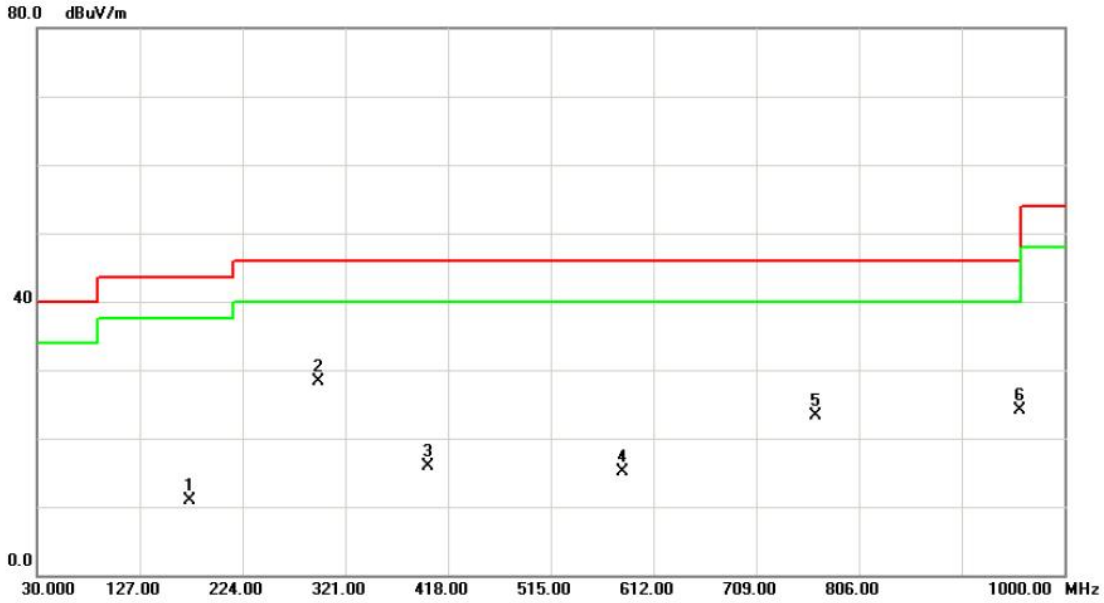
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		170.6500	28.95	-20.98	7.97	43.50	-35.53	peak	
2		384.0500	31.63	-16.32	15.31	46.00	-30.69	peak	
3		517.9100	29.97	-13.05	16.92	46.00	-29.08	peak	
4		647.8900	29.65	-10.27	19.38	46.00	-26.62	peak	
5		742.9500	30.17	-7.91	22.26	46.00	-23.74	peak	
6	*	936.9500	30.49	-5.67	24.82	46.00	-21.18	peak	

Test Mode:	TX 2480MHz _CH78_1Mbps

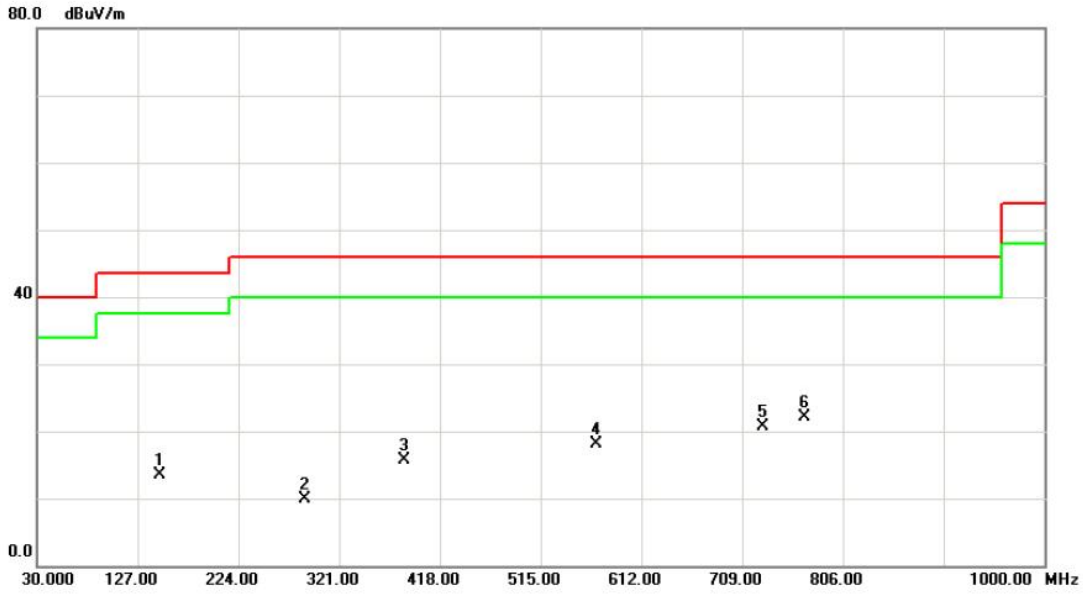
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		174.5300	29.33	-18.34	10.99	43.50	-32.51	peak	
2	*	295.7800	44.80	-16.54	28.26	46.00	-17.74	peak	
3		398.6000	29.96	-14.08	15.88	46.00	-30.12	peak	
4		582.9000	29.32	-14.25	15.07	46.00	-30.93	peak	
5		765.2600	30.06	-6.70	23.36	46.00	-22.64	peak	
6		957.3200	29.14	-5.05	24.09	46.00	-21.91	peak	

Test Mode:	TX 2480MHz _CH78_1Mbps

Horizontal

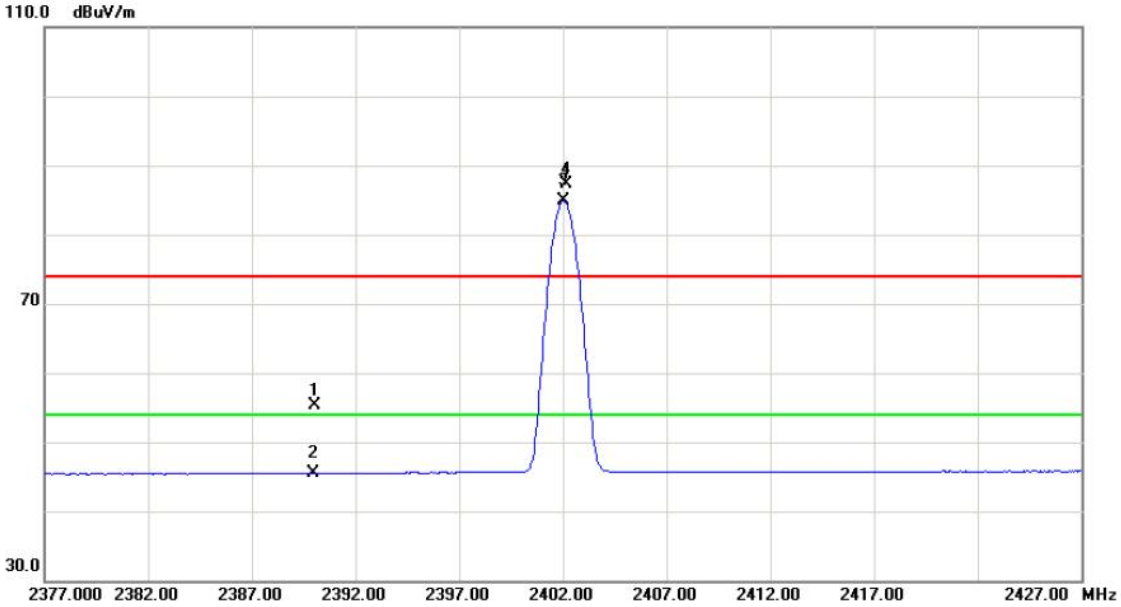


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		148.3400	36.91	-23.33	13.58	43.50	-29.92	peak	
2		288.0200	28.84	-19.01	9.83	46.00	-36.17	peak	
3		384.0500	32.01	-16.32	15.69	46.00	-30.31	peak	
4		568.3500	30.54	-12.50	18.04	46.00	-27.96	peak	
5		729.3700	29.45	-8.66	20.79	46.00	-25.21	peak	
6	*	769.1400	30.21	-8.18	22.03	46.00	-23.97	peak	

ATTACHMENT D - RADIATED EMISSION (ABOVE 1000MHZ)

Orthogonal Axis :	X
Test Mode :	TX 2402MHz _CH00_1Mbps

Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2390.000	23.46	31.88	55.34	74.00	-18.66	peak	
2		2390.000	13.64	31.88	45.52	54.00	-8.48	AVG	
3	*	2402.050	53.00	31.89	84.89	54.00	30.89	AVG	no limit
4	X	2402.150	55.33	31.89	87.22	74.00	13.22	peak	no limit

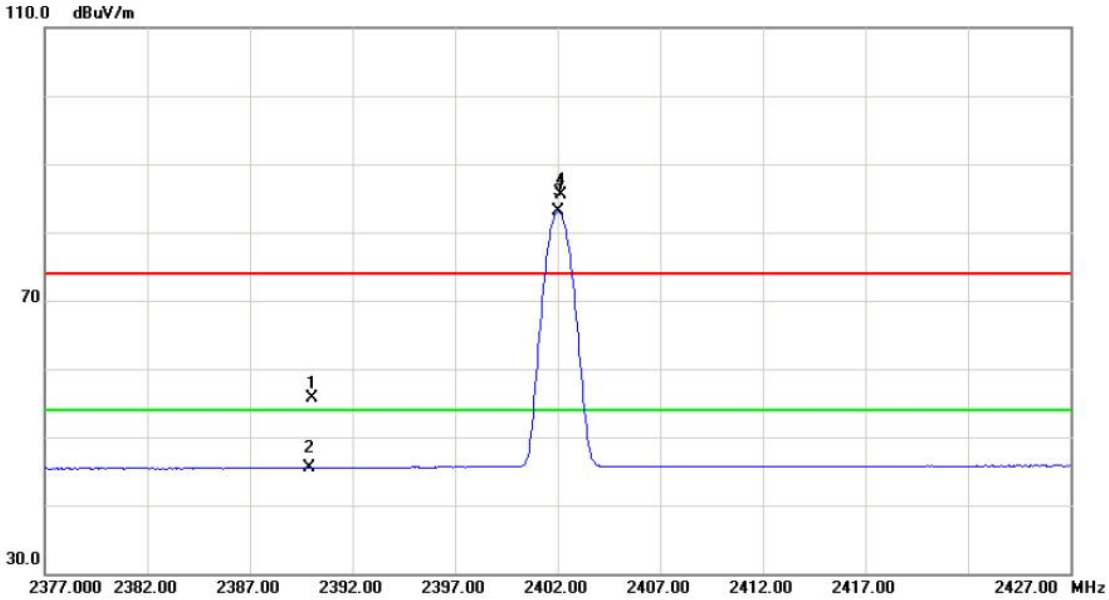
Orthogonal Axis :	X
Test Mode :	TX 2402MHz _CH00_1Mbps

Vertical

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	4803.780	27.71	3.58	31.29	54.00	-22.71	AVG	
2		4803.900	38.58	3.58	42.16	74.00	-31.84	peak	

Orthogonal Axis :	X
Test Mode :	TX 2402MHz _CH00_1Mbps

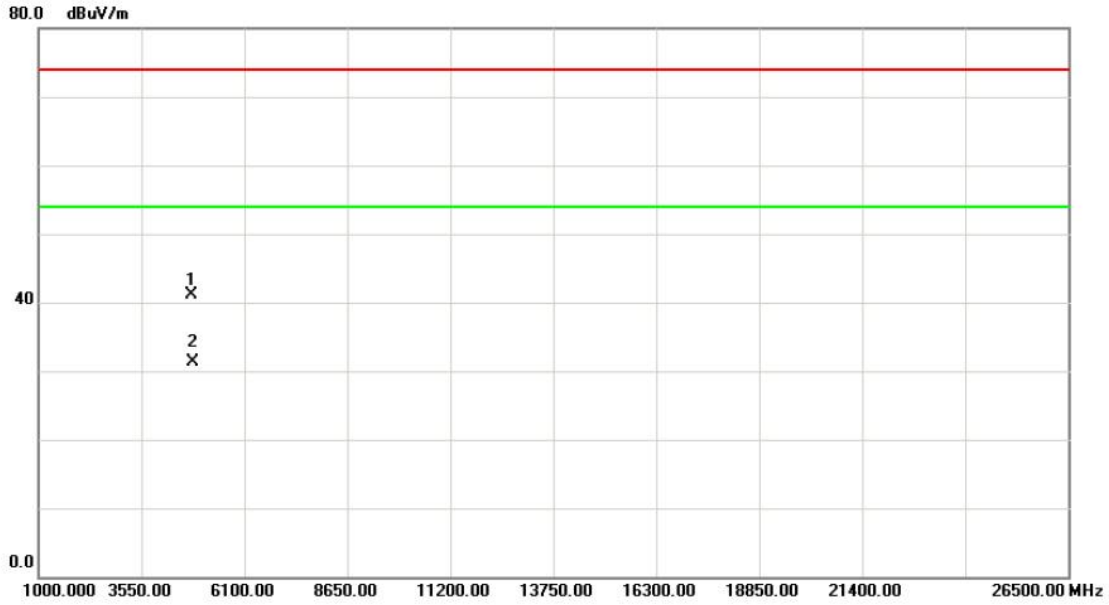
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2390.000	23.85	31.88	55.73	74.00	-18.27	peak	
2		2390.000	13.58	31.88	45.46	54.00	-8.54	AVG	
3	*	2402.050	51.14	31.89	83.03	54.00	29.03	AVG	no limit
4	X	2402.150	53.55	31.89	85.44	74.00	11.44	peak	no limit

Orthogonal Axis :	X
Test Mode :	TX 2402MHz _CH00_1Mbps

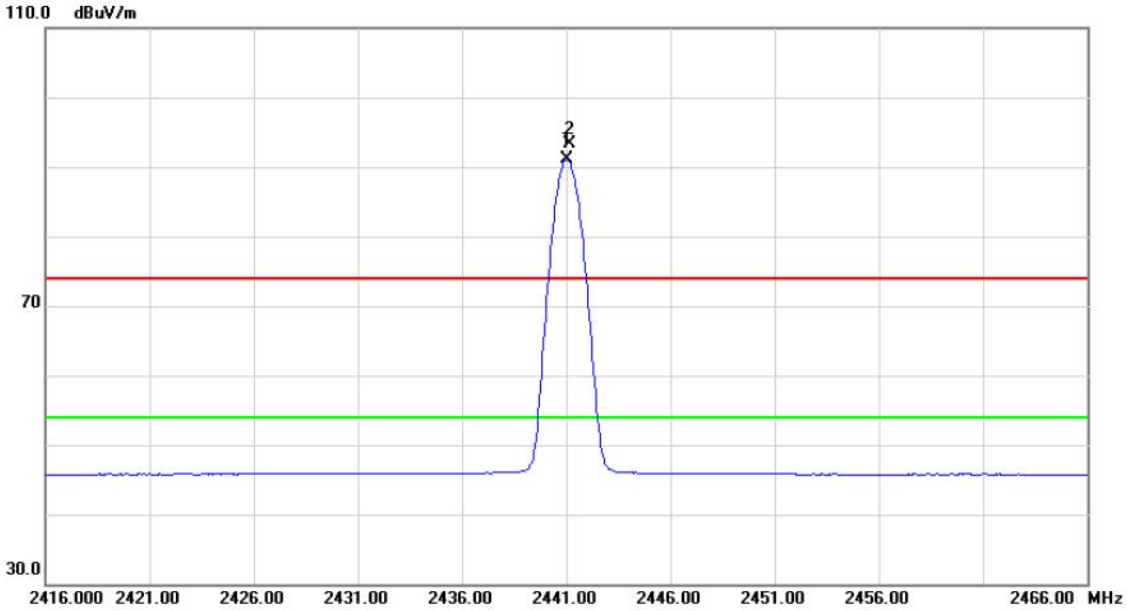
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4803.360	37.52	3.58	41.10	74.00	-32.90	peak	
2	*	4804.180	27.77	3.58	31.35	54.00	-22.65	AVG	

Orthogonal Axis :	X
Test Mode :	TX 2441MHz _CH39_1Mbps

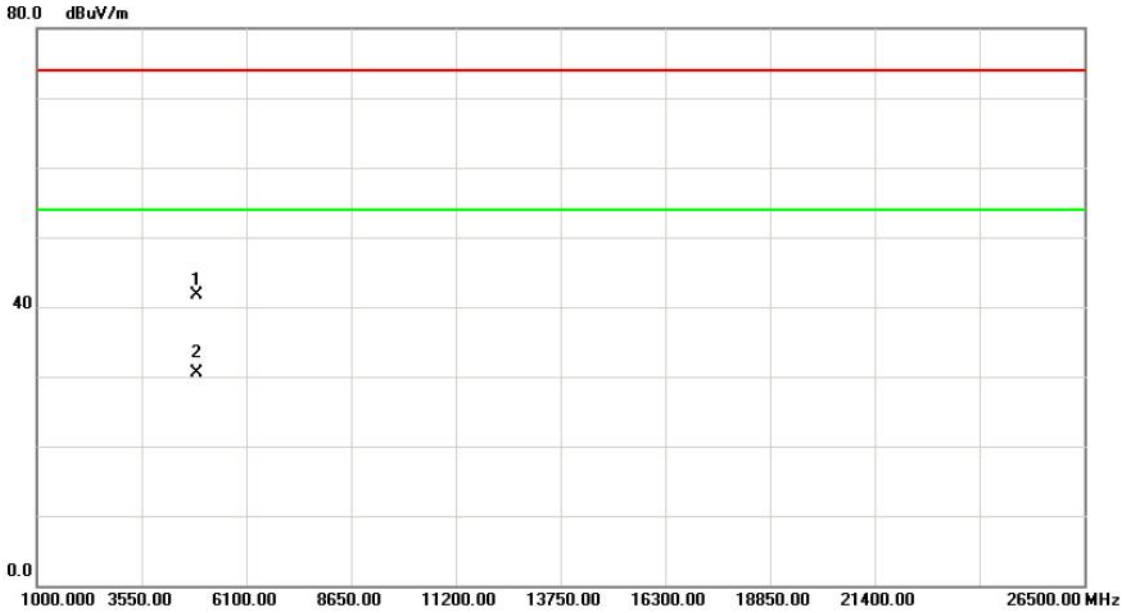
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	2441.000	59.15	31.95	91.10	54.00	37.10	AVG	no limit
2	X	2441.150	61.38	31.95	93.33	74.00	19.33	peak	no limit

Orthogonal Axis :	X
Test Mode :	TX 2441MHz _CH39_1Mbps

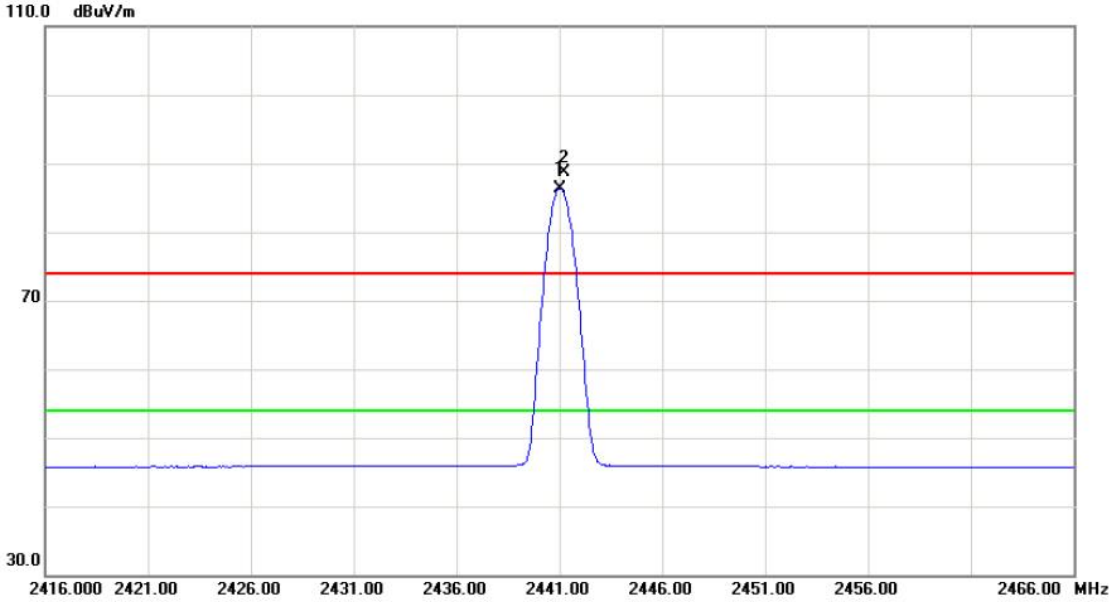
Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		4883.140	37.93	3.73	41.66	74.00	-32.34	peak	
2	*	4883.680	26.68	3.73	30.41	54.00	-23.59	AVG	

Orthogonal Axis :	X
Test Mode :	TX 2441MHz _CH39_1Mbps

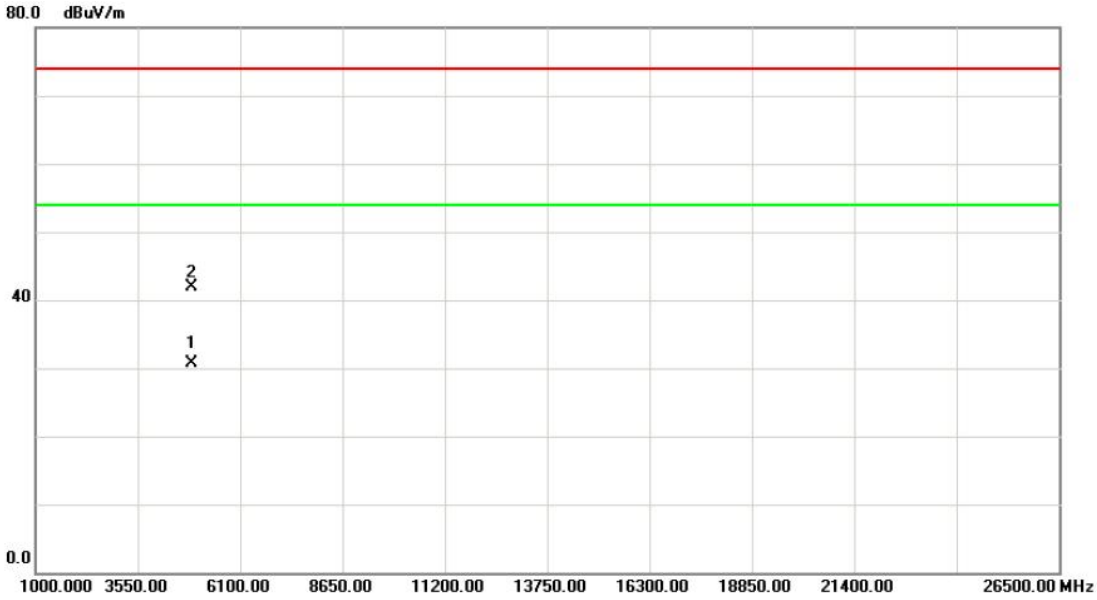
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	2441.000	54.45	31.95	86.40	54.00	32.40	AVG	no limit
2	X	2441.200	56.79	31.95	88.74	74.00	14.74	peak	no limit

Orthogonal Axis :	X
Test Mode :	TX 2441MHz _CH39_1Mbps

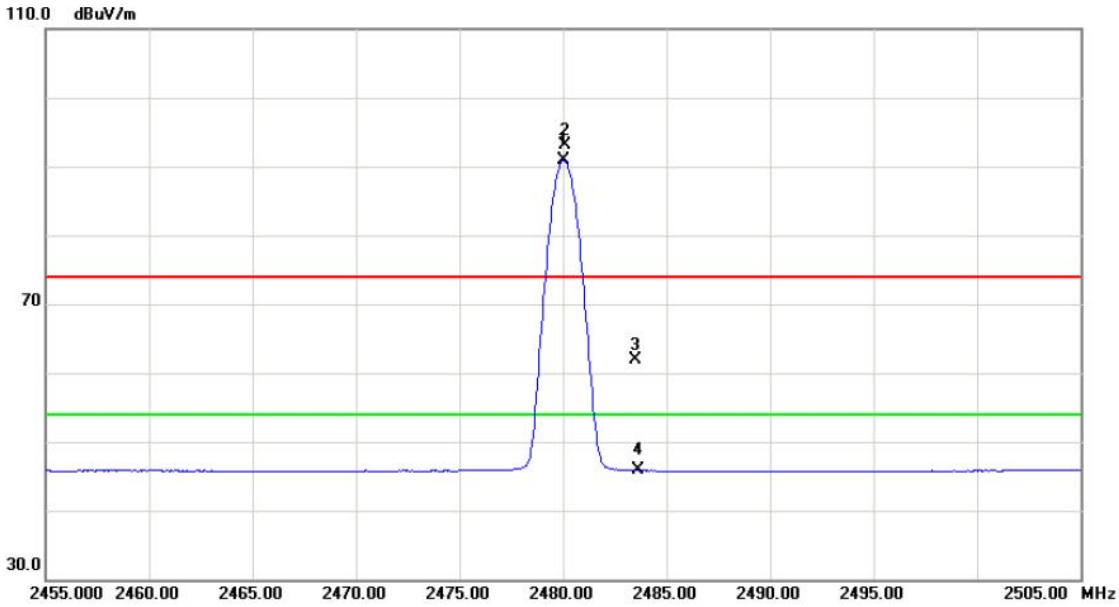
Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	4879.260	27.03	3.73	30.76	54.00	-23.24	AVG	
2		4883.680	38.16	3.73	41.89	74.00	-32.11	peak	

Orthogonal Axis :	X
Test Mode :	TX 2480MHz _CH78_1Mbps

Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	2480.050	58.89	32.00	90.89	54.00	36.89	AVG	no limit
2	X	2480.100	61.13	32.00	93.13	74.00	19.13	peak	no limit
3		2483.500	29.99	32.01	62.00	74.00	-12.00	peak	
4		2483.500	13.81	32.01	45.82	54.00	-8.18	AVG	

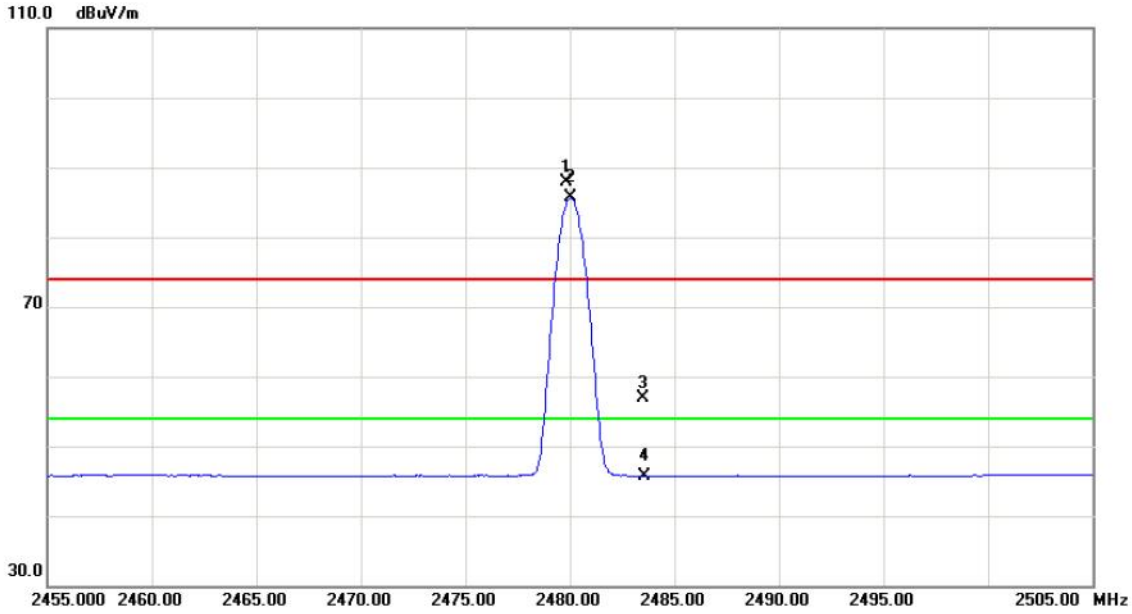
Orthogonal Axis :	X
Test Mode :	TX 2480MHz _CH78_1Mbps

Vertical

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	4965.320	27.41	3.88	31.29	54.00	-22.71	AVG	
2		4965.560	38.34	3.88	42.22	74.00	-31.78	peak	

Orthogonal Axis :	X
Test Mode :	TX 2480MHz _CH78_1Mbps

Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	X	2479.850	55.93	32.00	87.93	74.00	13.93	peak	no limit
2	*	2480.050	53.61	32.00	85.61	54.00	31.61	AVG	no limit
3		2483.500	24.84	32.01	56.85	74.00	-17.15	peak	
4		2483.500	13.75	32.01	45.76	54.00	-8.24	AVG	

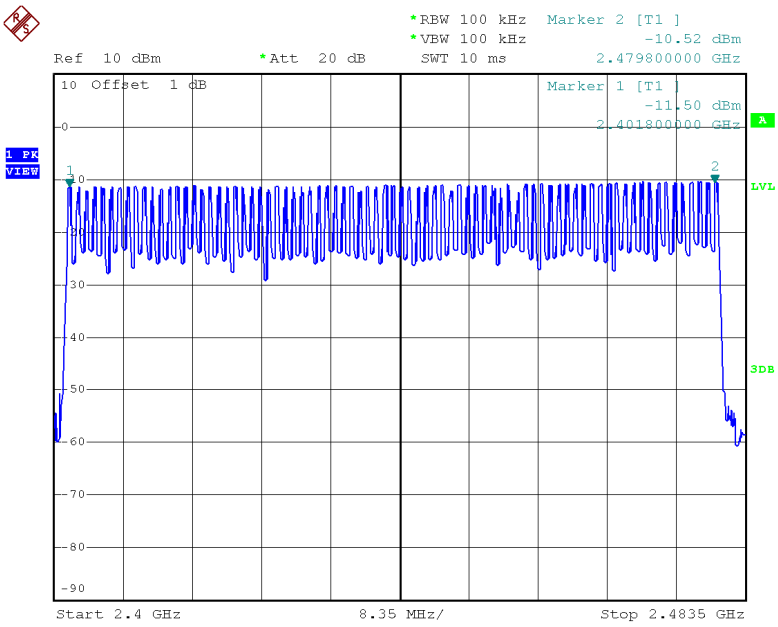
Orthogonal Axis :	X
Test Mode :	TX 2480MHz _CH78_1Mbps

Horizontal

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	4962.980	27.39	3.88	31.27	54.00	-22.73	AVG	
2		4964.620	38.45	3.88	42.33	74.00	-31.67	peak	

ATTACHMENT E - NUMBER OF HOPPING CHANNEL

Test Mode	Hopping Mode_1Mbps
Number of Hopping Channel	79



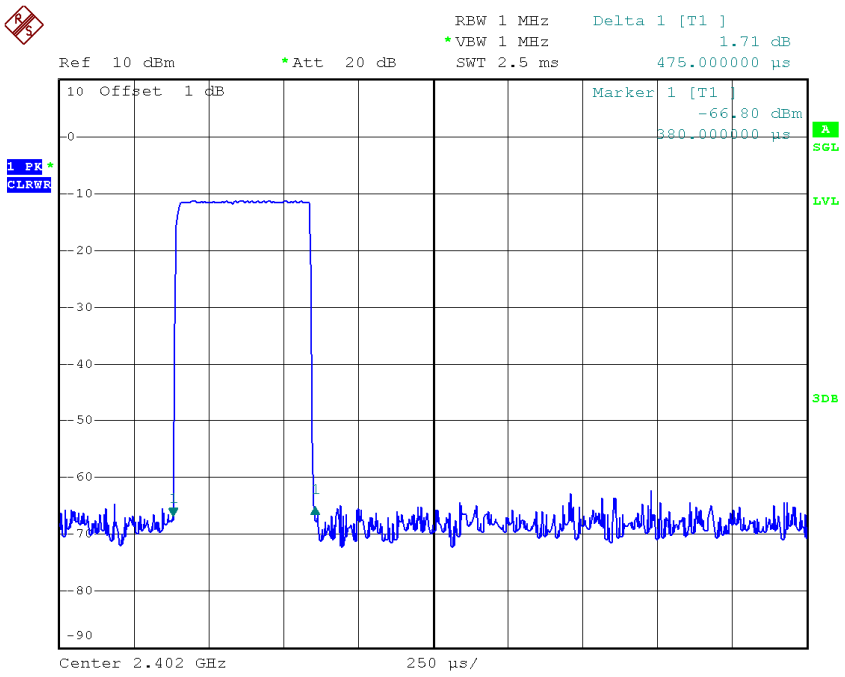
Date: 8.OCT.2014 12:07:16

ATTACHMENT F - AVERAGE TIME OF OCCUPANCY

Test Mode :	TX Mode_1Mbps

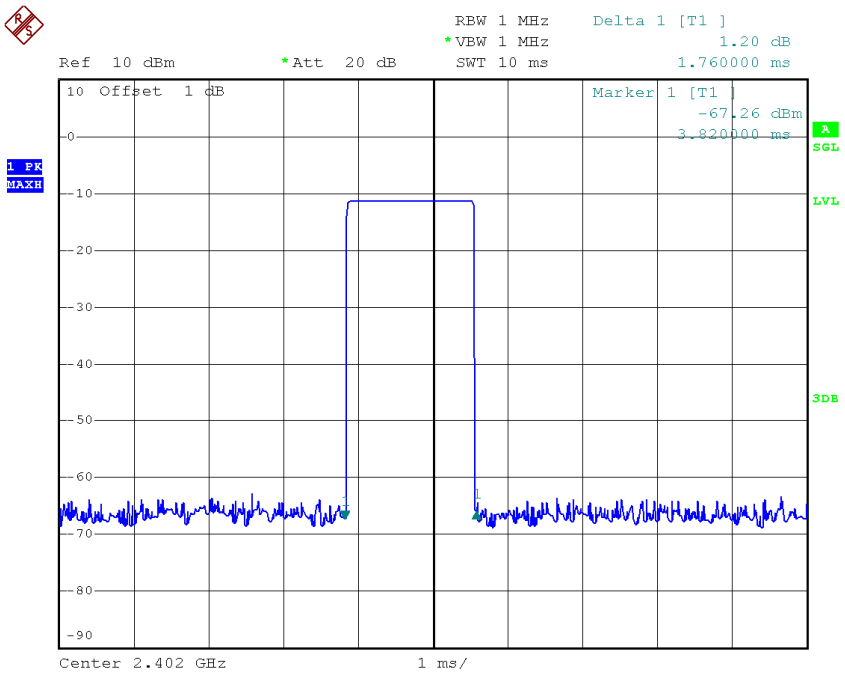
Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (s)	Limits (s)	Test Result
DH5	2402	3.0400	0.3243	0.4000	Complies
DH3	2402	1.7600	0.2816	0.4000	Complies
DH1	2402	0.4750	0.1520	0.4000	Complies
DH5	2441	3.0800	0.3285	0.4000	Complies
DH3	2441	1.7600	0.2816	0.4000	Complies
DH1	2441	0.4700	0.1504	0.4000	Complies
DH5	2480	3.0800	0.3285	0.4000	Complies
DH3	2480	1.7600	0.2816	0.4000	Complies
DH1	2480	0.4750	0.1520	0.4000	Complies

CH00-DH1



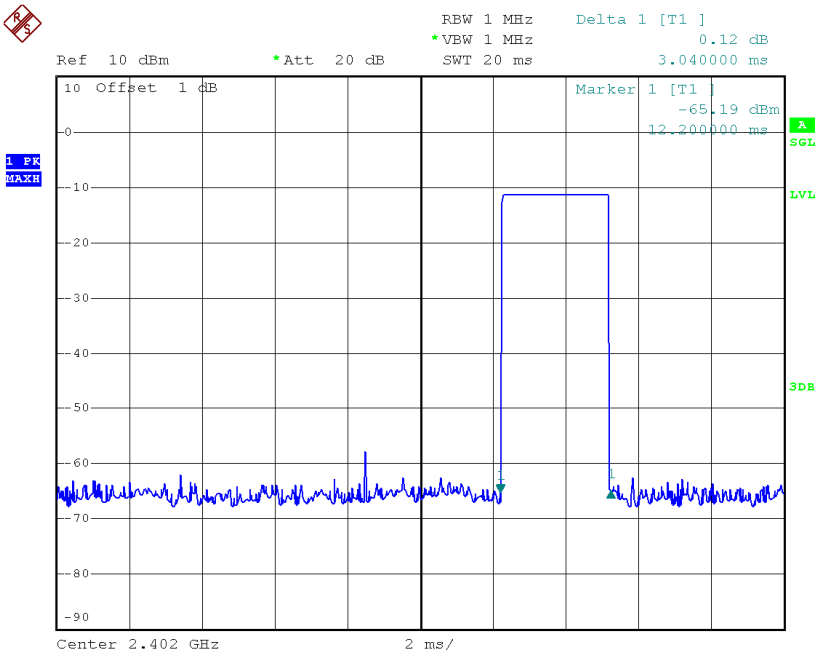
Date: 8.OCT.2014 11:58:13

CH00-DH3



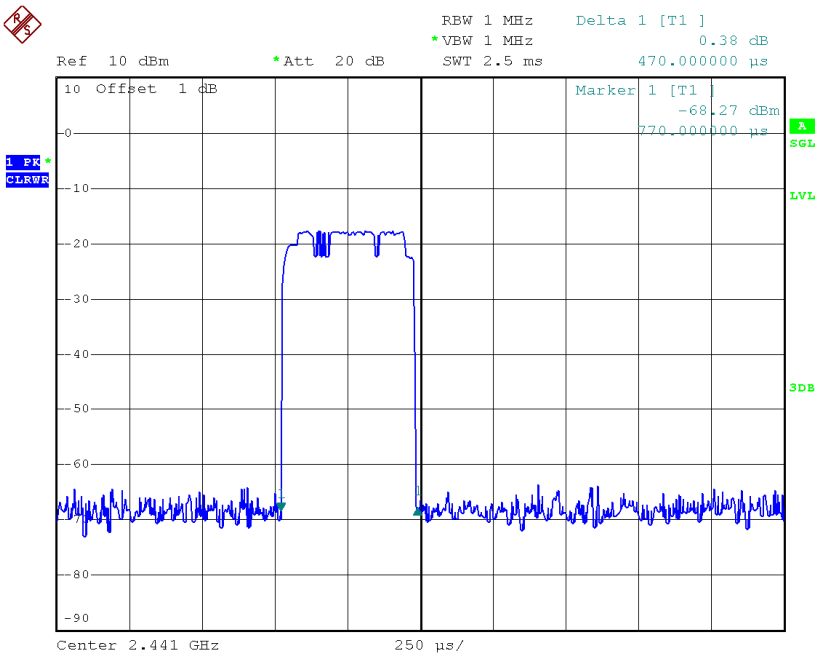
Date: 8.OCT.2014 14:10:10

CH00-DH5



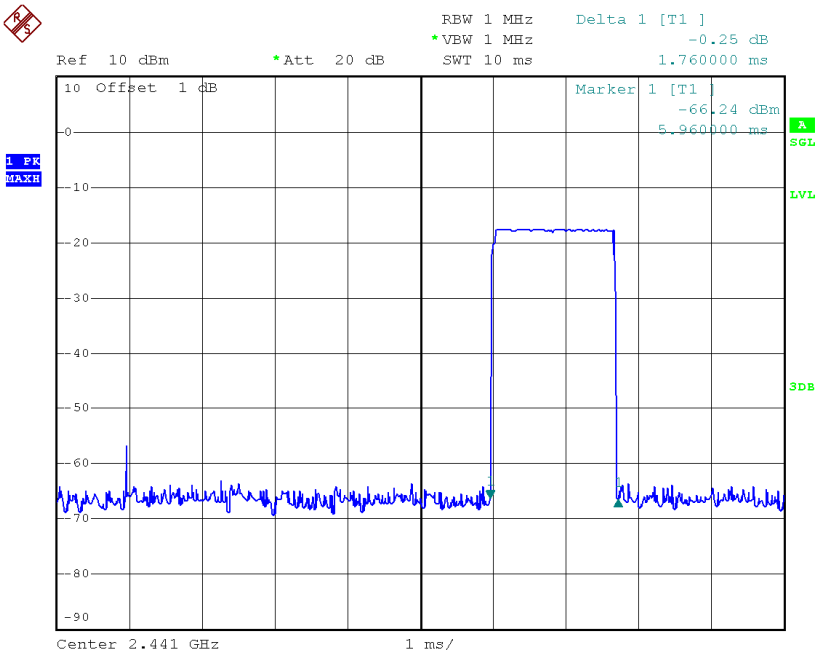
Date: 8.OCT.2014 14:16:00

CH39-DH1



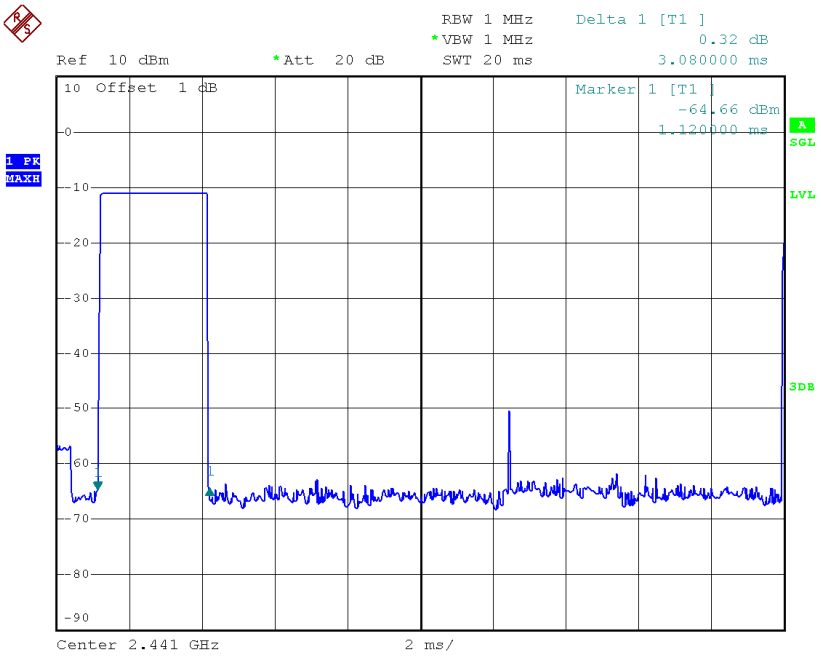
Date: 8.OCT.2014 11:59:57

CH39-DH3



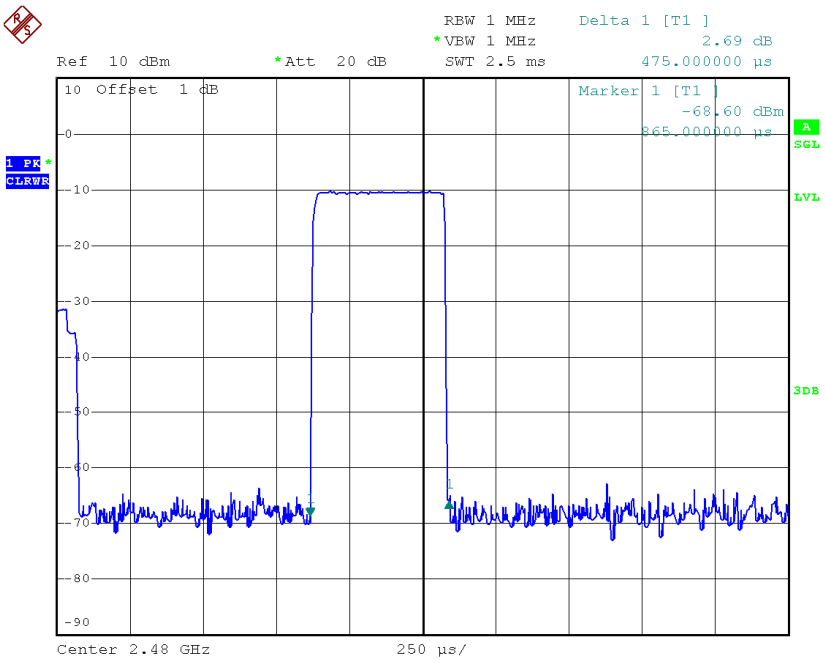
Date: 8.OCT.2014 14:10:55

CH39-DH5



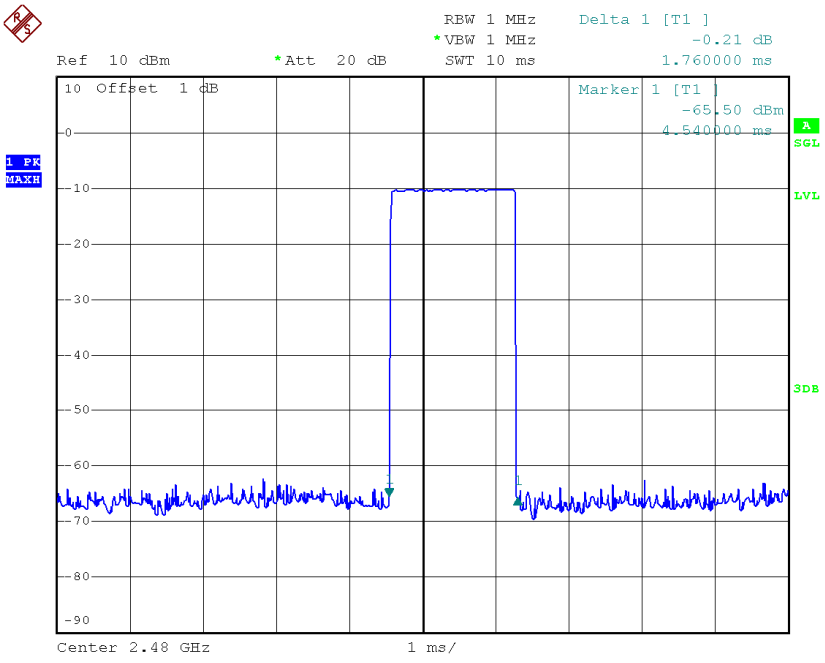
Date: 8.OCT.2014 14:16:44

CH78-DH1



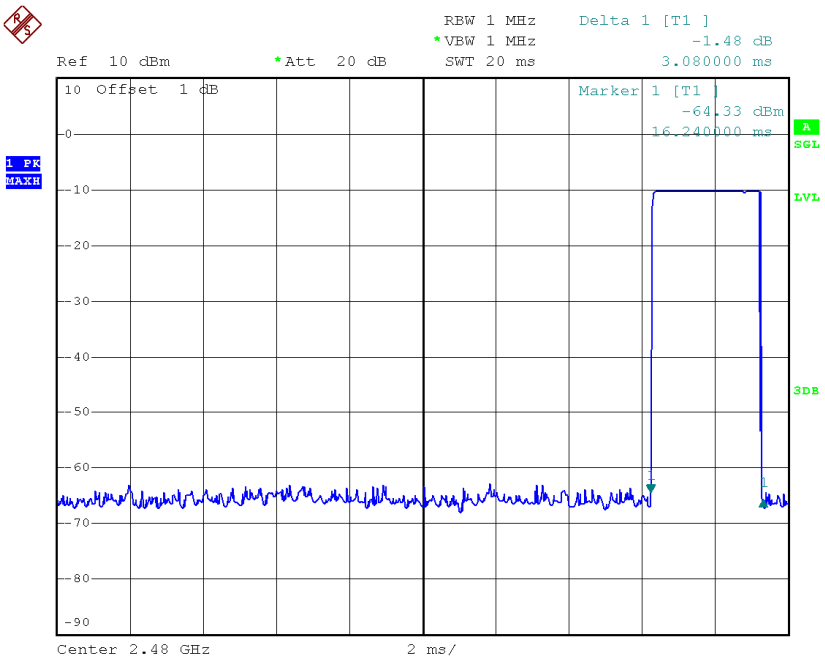
Date: 8.OCT.2014 12:00:52

CH78-DH3



Date: 8.OCT.2014 14:11:25

CH78-DH5



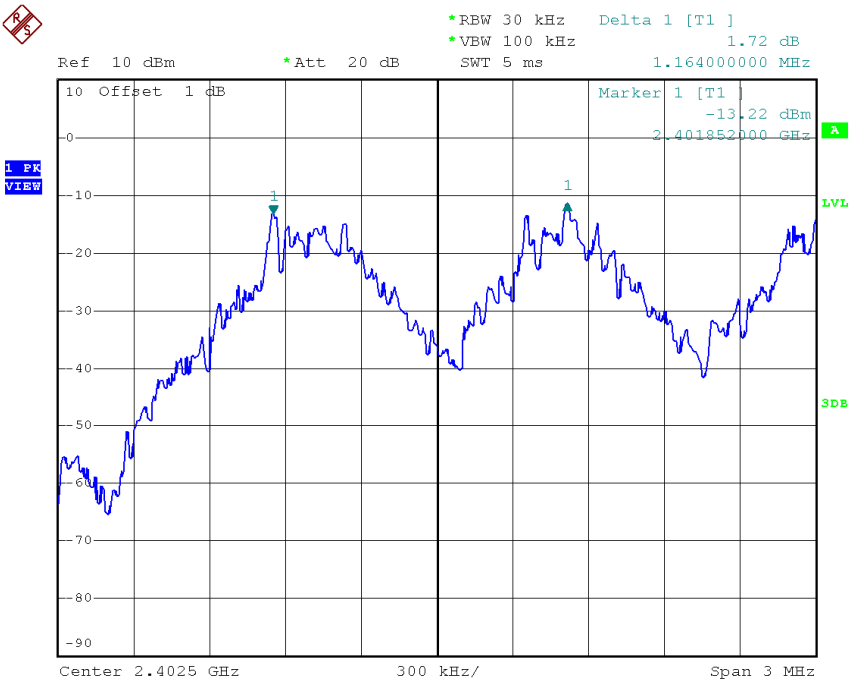
Date: 8.OCT.2014 14:17:25

ATTACHMENT G - HOPPING CHANNEL SEPARATION MEASUREMENT

Test Mode :	Hopping on _1Mbps

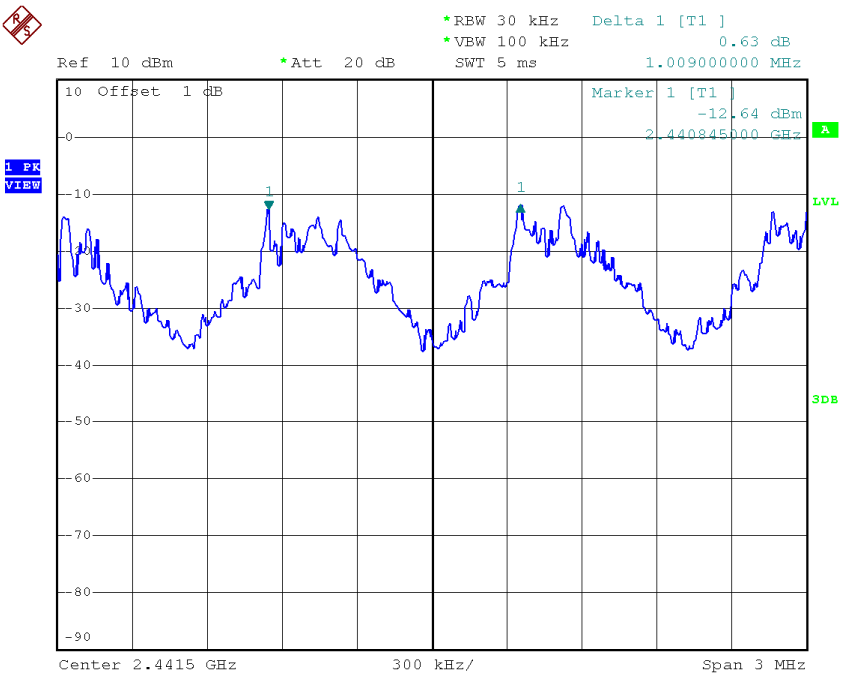
Frequency (MHz)	Channel Separation (MHz)	2/3 of 20dB Bandwidth (MHz)	Test Result
2402	1.164	0.613	Complies
2441	1.009	0.635	Complies
2480	0.834	0.630	Complies

CH00



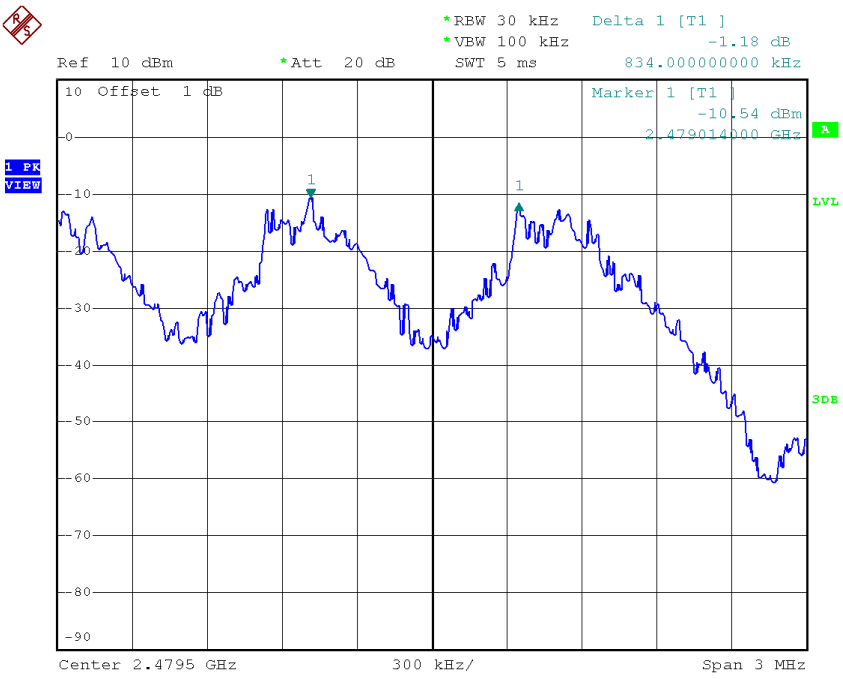
Date: 8.OCT.2014 12:03:01

CH39



Date: 8.OCT.2014 12:04:10

CH78



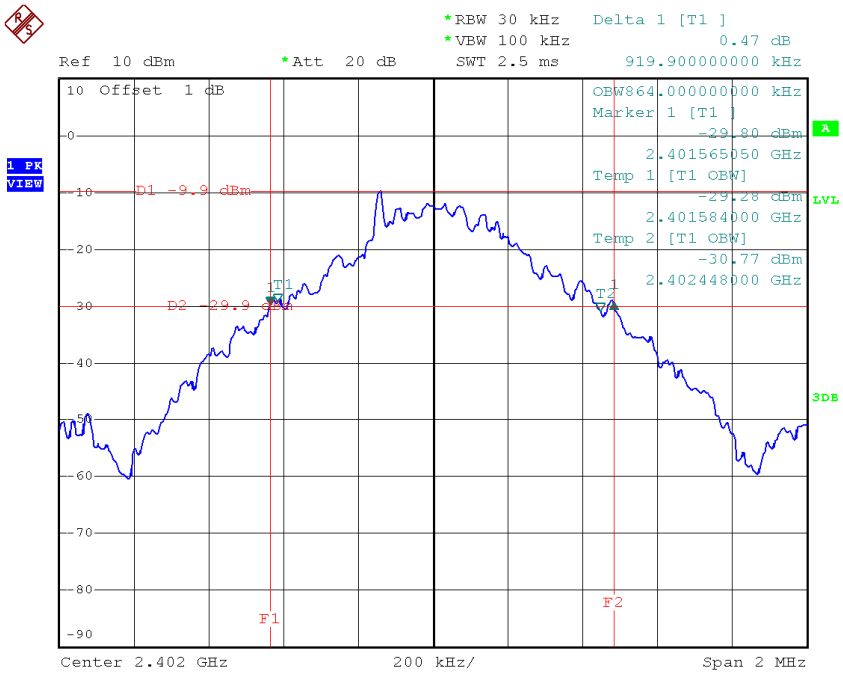
Date: 8.OCT.2014 12:05:14

ATTACHMENT H - BANDWIDTH

Test Mode :	TX Mode _1Mbps

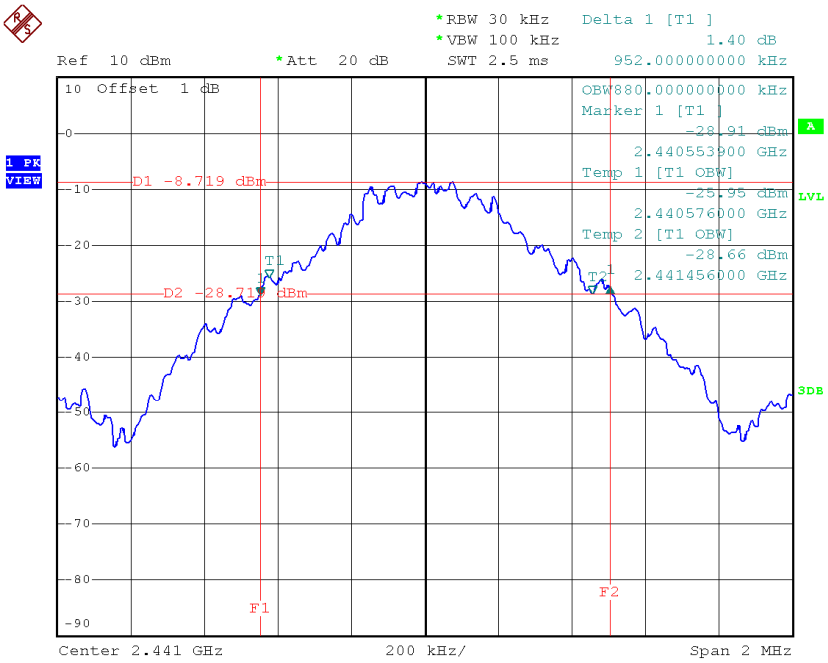
Frequency (MHz)	20dB Bandwidth (MHz)	99% Occupied BW (MHz)	Test Result
2402	0.920	0.864	Complies
2441	0.952	0.880	Complies
2480	0.945	0.872	Complies

CH00



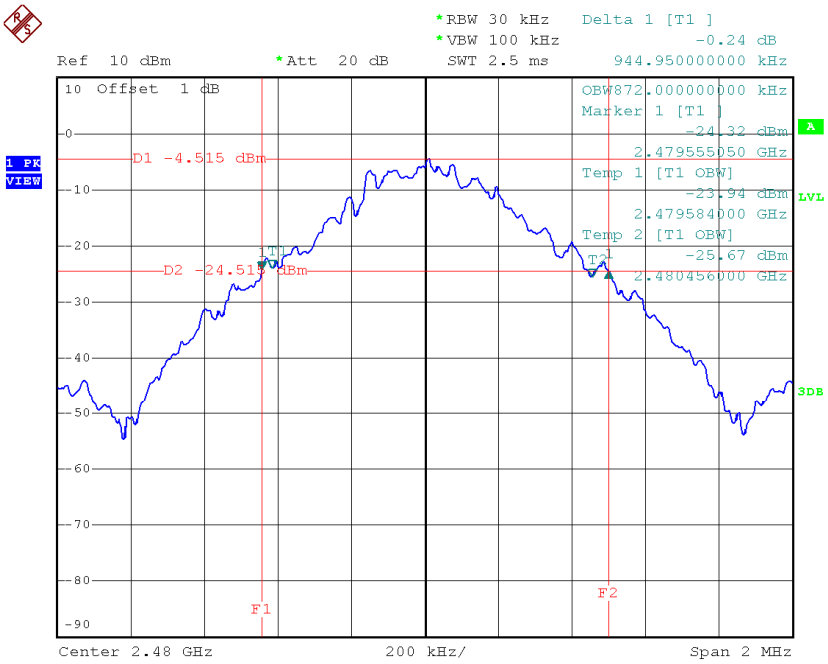
Date: 8.OCT.2014 11:39:36

CH39



Date: 8.OCT.2014 11:40:15

CH78



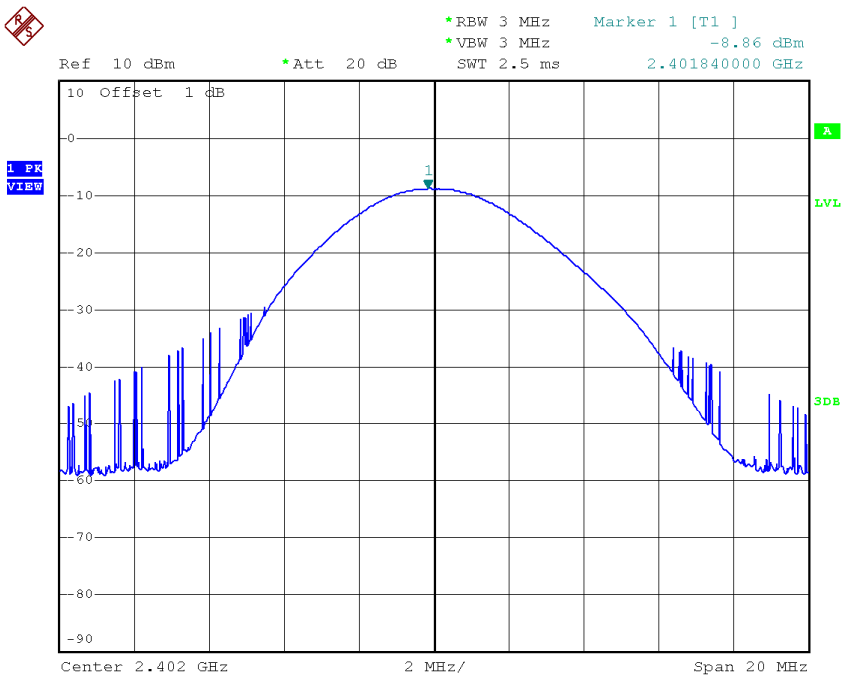
Date: 8.OCT.2014 11:40:43

ATTACHMENT I - PEAK OUTPUT POWER

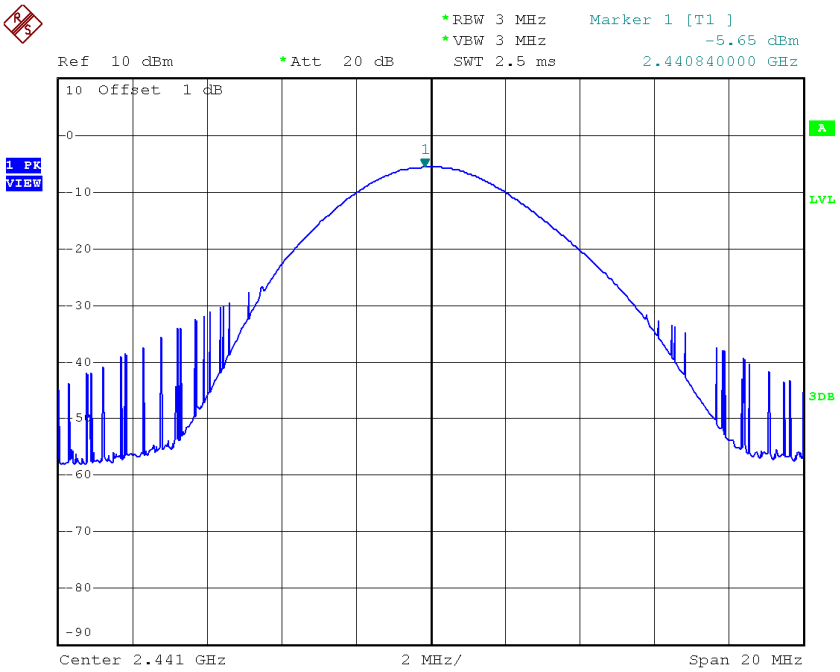
Test Mode :	TX Mode _1Mbps

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (Watt)	Max. Limit (dBm)	Max. Limit (Watt)	Test Result
2402	-8.86	0.0001	30.00	1.0000	Complies
2441	-5.65	0.0003	30.00	1.0000	Complies
2480	-2.56	0.0006	30.00	1.0000	Complies

CH00

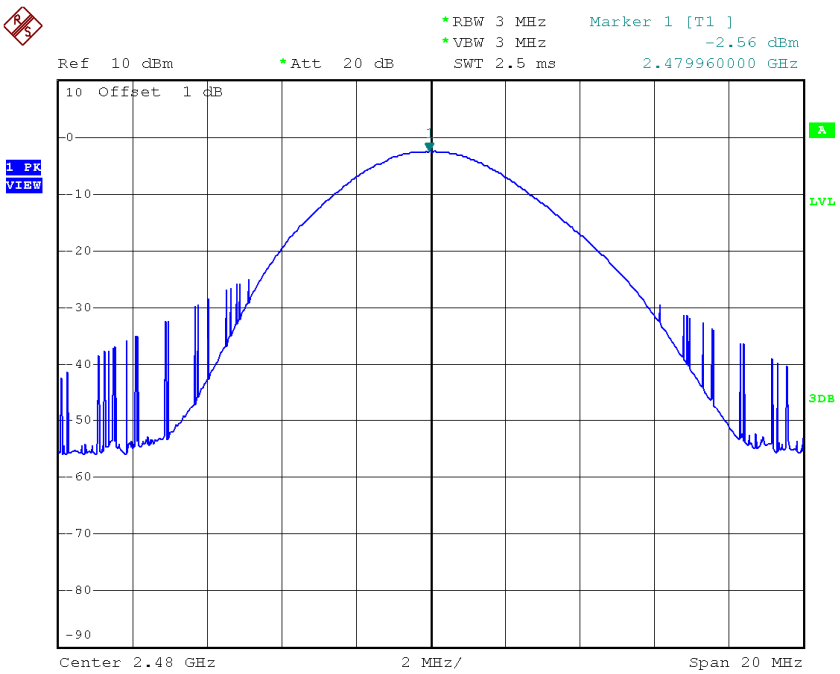


CH39



Date: 8.OCT.2014 11:40:20

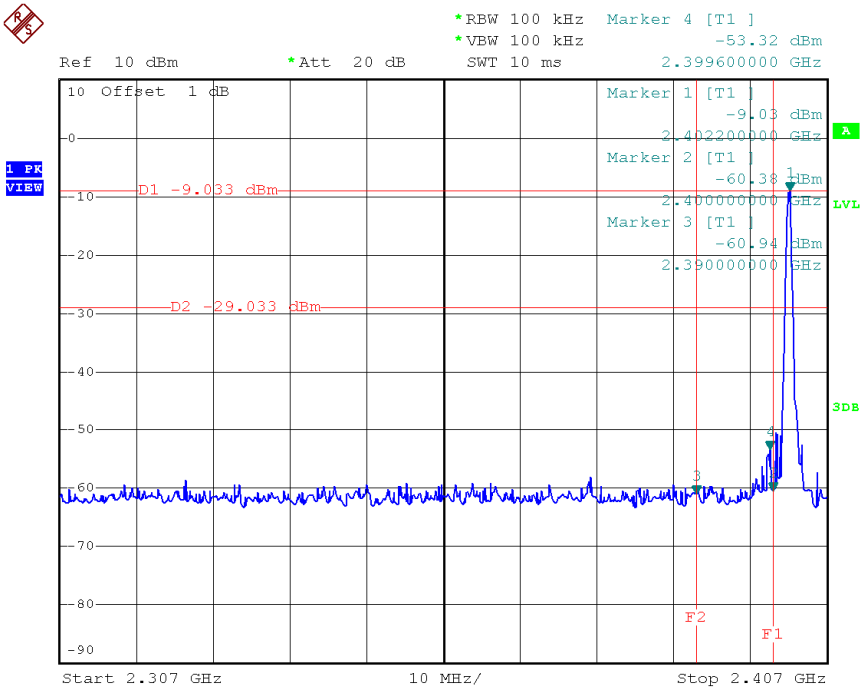
CH78



Date: 8.OCT.2014 11:40:56

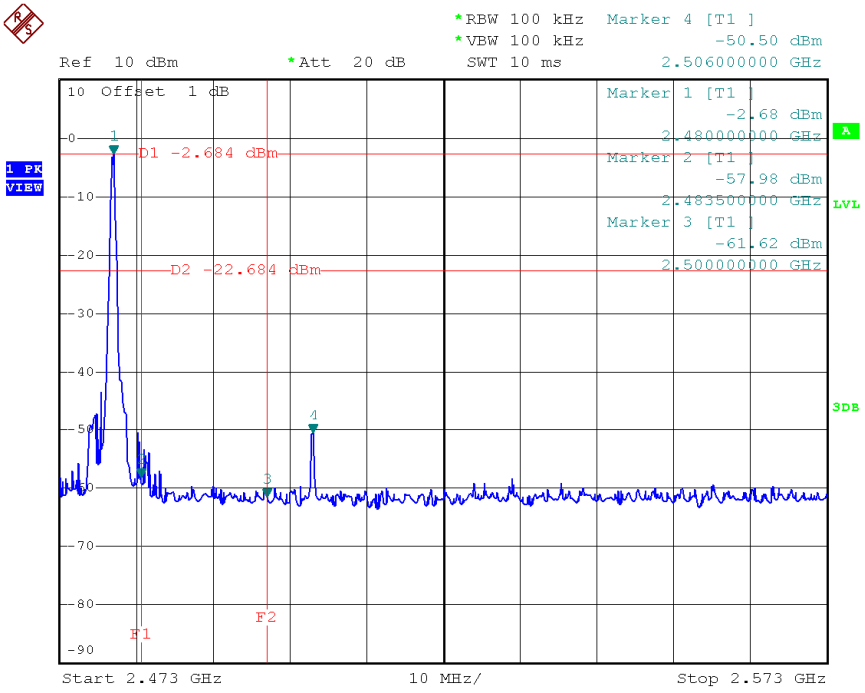
ATTACHMENT J - ANTENNA CONDUCTED SPURIOUS EMISSION

CH00 (Lower)_1Mbps



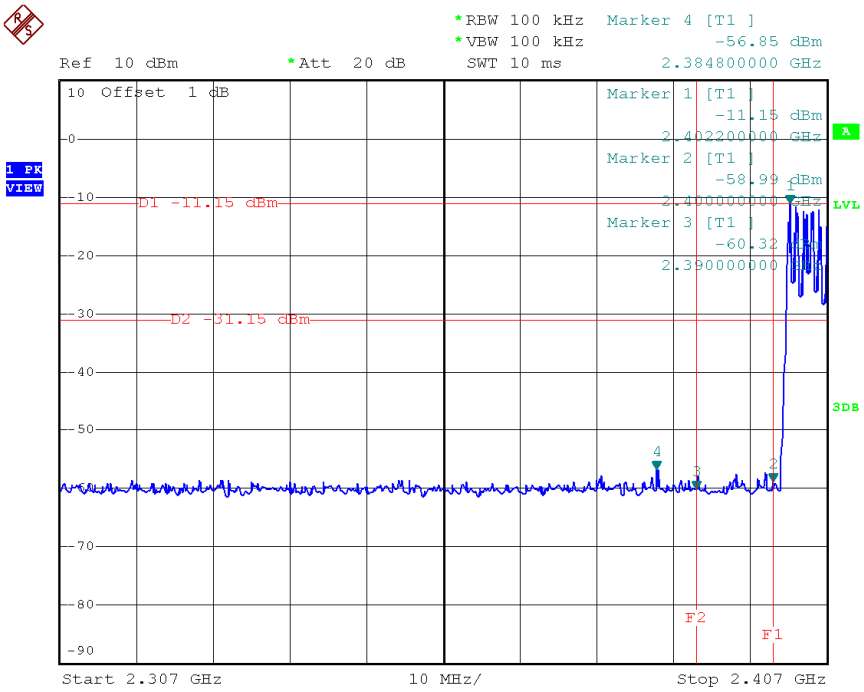
Date: 8.OCT.2014 11:39:43

CH78 (Upper) _1Mbps



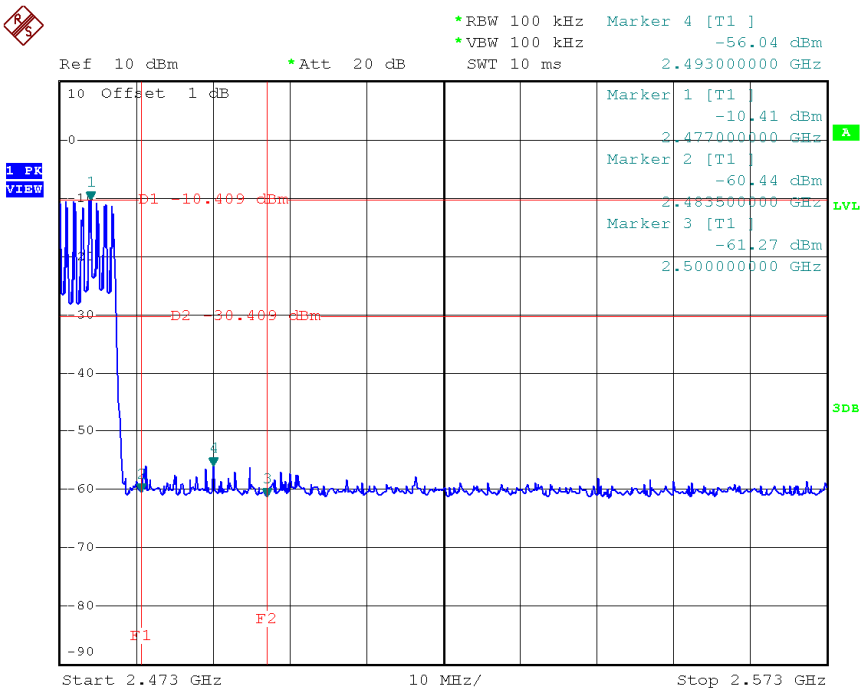
Date: 8.OCT.2014 11:40:50

CH00 Hopping on mode (Lower)_1Mbps



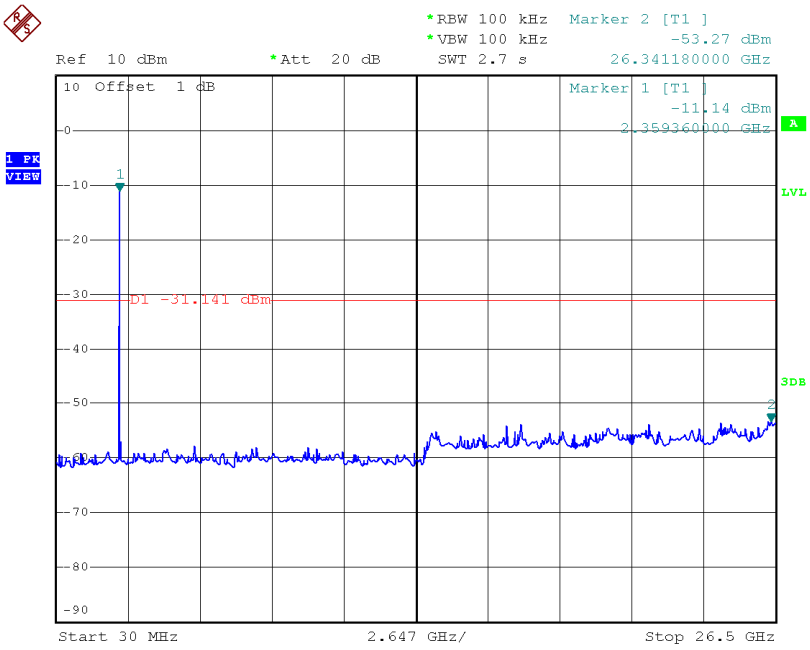
Date: 8.OCT.2014 12:09:38

CH78 Hopping on mode (Upper) _1Mbps



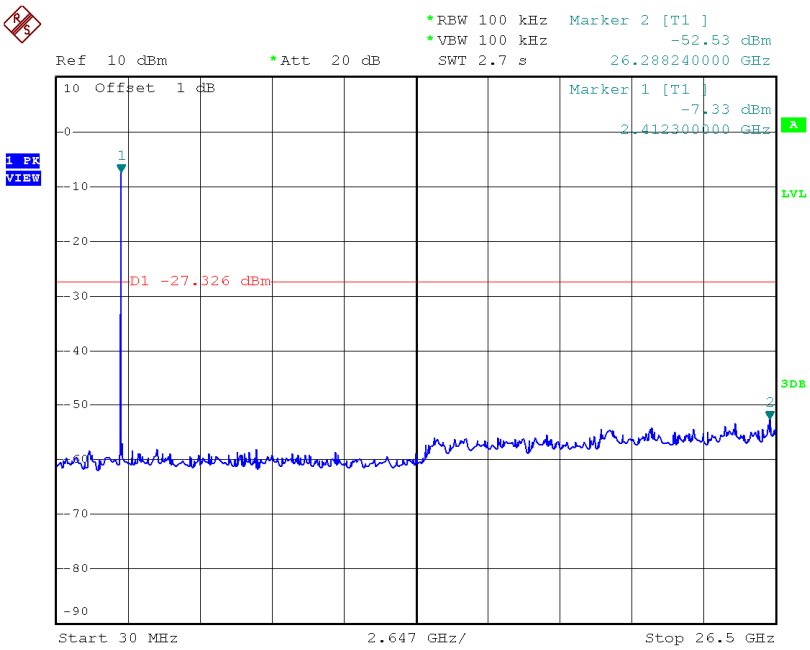
Date: 8.OCT.2014 12:11:57

CH00 (10 Harmonic of the frequency) _1Mbps



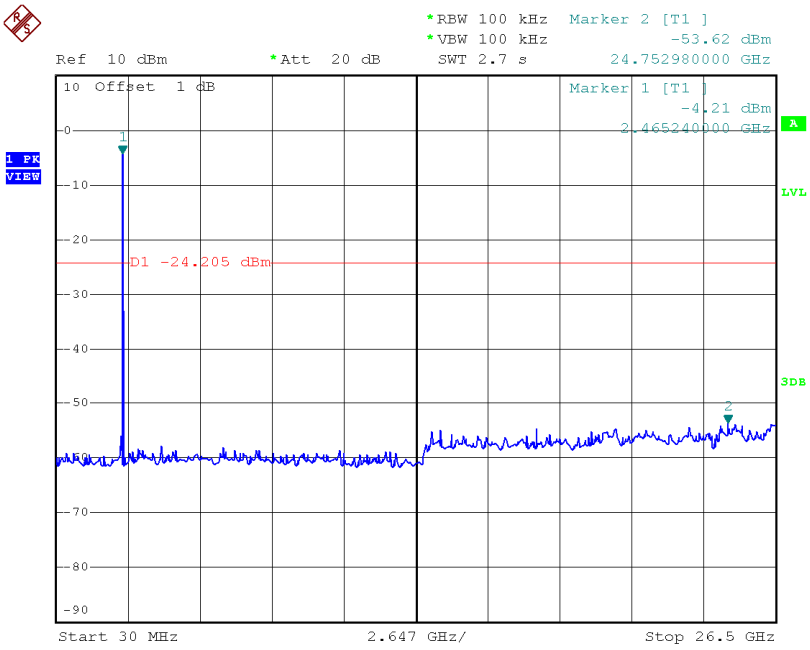
Date: 8.OCT.2014 11:39:26

CH39 (10 Harmonic of the frequency) _1Mbps



Date: 8.OCT.2014 11:40:04

CH78 (10 Harmonic of the frequency) _1Mbps



Date: 8.OCT.2014 11:41:06