S T S LAB

RADIO TEST REPORT

Report No.:STS2002171W23

Issued for

Winmate Inc.

9F, No.111-6, Shing-De Rd., San-Chung Dist., New Taipei City, 24158, Taiwan, R.O.C

Product Name:	Rugged Tablet PC
Brand Name:	Winmate
Model Name:	M133WK
Series Model:	M133WK-DW, M133XXXXXXXXXXX (Where X can be A-Z,a-z ,0-9, “-”, Blank or Slash)
FCC ID:	PX9M133WK001
Test Standard:	FCC Part 15.247 RSS-247 Issue 2, February 2017

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TEST RESULT CERTIFICATION

Applicant's Name ..... : Winmate Inc.

Address ..... : 9F, No.111-6, Shing-De Rd., San-Chung Dist., New Taipei City, 24158, Taiwan, R.O.C

Manufacture's Name ..... : Winmate Inc.

Address ..... : 9F, No.111-6, Shing-De Rd., San-Chung Dist., New Taipei City, 24158, Taiwan, R.O.C

Product Description

Product Name ..... : Rugged Tablet PC

Brand Name ..... : Winmate

Model Name..... : M133WK

Series Model ..... : M133WK-DW, M133XXXXXXXXXXX
(Where X can be A-Z,a-z ,0-9, "-", Blank or Slash)

Test Standards ..... : FCC Part15.247
RSS-247 Issue 2, February 2017
RSS-Gen Issue 5 ,March 2019

Test Procedure.....: ANSI C63.10-2013

This device described above has been tested by STS, the test results show that the equipment under test (EUT) is in compliance with the FCC/IC requirements. And it is applicable only to the tested sample identified in the report.
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Date of Test..... :

Date of receipt of test item..... : 24 Feb. 2020

Date (s) of performance of tests..... : 24 Feb. 2020 ~ 28 Apr. 2020

Date of Issue ..... : 29 Apr. 2020

Test Result ..... : **Pass**

Testing Engineer : Chris Chen
(Chris Chen)

Technical Manager : Sean She
(Sean she)

Authorized Signatory : Vita Li
(Vita Li)

TESTING CONSULTING SOLUTION CERTIFICATION STS APPROVAL

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Revision History

Rev.	Issue Date	Report No.	Effect Page	Contents
00	29 Apr. 2020	STS2002171W23	ALL	Initial Issue

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:
KDB 558074 D01 15.247 Meas Guidance v05r02.

FCC Part 15.247,Subpart C RSS-247 Issue 2			
Standard Section	Test Item	Judgment	Remark
15.207 RSS-Gen 8.8	Conducted Emission	PASS	--
15.247 (a)(2) RSS-Gen 6.7 RSS-247 5.2 a)	6dB&99% Bandwidth	PASS	--
15.247 (b)(3) RSS-247 5.4 d)	Output Power	PASS	--
15.247 (c) RSS-Gen 8.9 8.10	Radiated Spurious Emission	PASS	--
15.247 (d) RSS-247 5.5 RSS-Gen 8.9 8.10	Conducted Spurious & Band Edge Emission	PASS	--
15.247 (e) RSS-247 5.2 b)	Power Spectral Density	PASS	--
15.205 RSS-Gen 8.9 8.10	Restricted Band Edge Emission	PASS	--
Part 15.247(d)/part 15.209(a) RSS-247 5.5 RSS-Gen 8.9 8.10	Band Edge Emission	PASS	--
15.203 RSS-Gen 6.8	Antenna Requirement	PASS	--
RSS-Gen 6.11 8.11	Frequency Stability	PASS	--

NOTE:

(1) 'N/A' denotes test is not applicable in this Test Report.

(2) All tests are according to ANSI C63.10-2013.

1.1 TEST FACTORY

SHENZHEN STS TEST SERVICES CO., LTD
Add. : A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China

FCC test Firm Registration Number: 625569

IC test Firm Registration Number: 12108A

A2LA Certificate No.: 4338.01

1.2 MEASUREMENT UNCERTAINTY

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 %.

No.	Item	Uncertainty
1	RF output power, conducted	±0.68dB
2	Unwanted Emissions, conducted	±2.988dB
3	All emissions, radiated 30-1GHz	±6.7dB
4	All emissions, radiated 1G-6GHz	±5.5dB
5	All emissions, radiated>6G	±5.8dB
6	Conducted Emission (9KHz-150KHz)	±4.43dB
7	Conducted Emission (150KHz-30MHz)	±5dB

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Rugged Tablet PC
Trade Name	Winmate
Model Name	M133WK
Series Model	M133WK-DW, M133XXXXXXXXXXX (Where X can be A-Z,a-z ,0-9, "-", Blank or Slash)
Model Difference	Only for marketing purpose
Product Description	The EUT is a Rugged Tablet PC Operation Frequency: 802.11b/g/n 20: 2412~2462 MHz 802.11n(40MHz):2422~2452MHz Modulation Type: 802.11b(DSSS):CCK,DQPSK,DBPSK 802.11g(OFDM):BPSK,QPSK,16-QAM,64-QAM 802.11n(OFDM):BPSK,QPSK,16-QAM,64-QAM Number of Channel: 802.11b/g/n20: 11CH 802.11n 40: 7CH Antenna Designation: PIFA AntennaGain (dBi): Antenna number: 2 Antenna A gain : 1.46dBi Antenna B gain : 3.21dBi MIMO technology Directional gain=5.39dBi Please refer to the Note 3. Duty Cycle: >98%
Channel List	Please refer to the Note 2.
Adapter	Input: AC 100-240V, 1.7A, 50-60Hz Output: DC 19V, 3.42A
Battery	Rated Voltage: 15.4V Charge Limit: 17.6V Capacity: 5900mAh
Hardware version number	M133DA-100
Software versionnumber	20.90.0
Connecting I/O Port(s)	Please refer to the Note 1.

802.11b/g : SISO mode only, 802.11n H20 /H40: MIMO mode only.

Note:

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

2.

Operation Frequency of channel			
802.11b/g/n(20MHz)		Channel List for 802.11n(40MHz)	
Channel	Frequency	Channel	Frequency
01	2412	03	2422
02	2417	04	2427
03	2422	05	2432
04	2427	06	2437
05	2432	07	2442
06	2437	08	2447
07	2442	09	2452
08	2447		
09	2452		
10	2457		
11	2462		

Note:
In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, themiddle frequency, and the highest frequency of channel were selected to perform the test, and the selectedchannel see below:
Carrier Frequency Channel

2.4GHz Test Frequency:

For 802.11b/g/n (HT20)		For 802.11n (HT40)	
Channel	Freq.(MHz)	Channel	Freq.(MHz)
01	2412	03	2422
06	2437	06	2437
11	2462	09	2452

3. Emissions Testing of Transmitters with Multiple Outputs in the Same Band.
For devices having two outputs driving a cross-polarized pair of antennas, see Attachment 662911 D02 of this publication for additional guidance.
d) *Unequal antenna gains, with equal transmit powers.* For antenna gains given by G1, G2, …, GN dBi
(i) If transmit signals are *correlated*, then Directional gain = 10 log[$(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2$ /NANT] dBi [Note the "20"s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]
(ii) If all transmit signals are *completely uncorrelated*, then Directional gain = 10 log[$(10^{G1/10} + 10^{G2/10} + \ldots + 10G^{N/10})$/NANT] dBi

Note: If transmit signals are *correlated*, then Directional gain.
Antenna number: 2
Antenna A gain : 1.46dBi
Antenna B gain : 3.21dBi
Total gain=10 log[$(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2$ /NANT] dBi
10*LOG10((10^(1.46/20)+10^(3.21/20))^2/2)=5.39

2.2 DESCRIPTION OF THE TEST MODES

Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Worst Mode	Description	Data Rate
Mode 1	TX IEEE 802.11b CH1	1 Mbps
Mode 2	TX IEEE 802.11b CH6	1 Mbps
Mode 3	TX IEEE 802.11 b CH11	1 Mbps
Mode 4	SISO mode	1 Mbps
Mode 5	TX IEEE 802.11g CH1	6 Mbps
Mode 6	TX IEEE 802.11g CH6	6 Mbps
Mode 7	TX IEEE 802.11g CH11	6 Mbps
Mode 8	SISO mode	6 Mbps
Mode 9	TX IEEE 802.11n HT20 CH1	MCS 0
Mode 10	TX IEEE 802.11n HT20 CH6	MCS 0
Mode 11	TX IEEE 802.11n HT20 CH11	MCS 0
Mode 12	keeping MIMO TX mode	MCS 0
Mode 13	TX IEEE 802.11n HT40 CH3	MCS 0
Mode 14	TX IEEE 802.11n HT40 CH6	MCS 0
Mode 15	TX IEEE 802.11n HT40 CH9	MCS 0
Mode 16	keeping MIMO TX mode	MCS 0

Note:

(1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported.

(2) We have be tested for all avaiable U.S. voltage and frequencies(For 120V,50/60Hz and 240V, 50/60Hz) for which the device is capable of operation, and the worst case of 120V /60Hz is shown in the report.

AC Conducted Emission

Test Case	
AC Conducted Emission	Mode17: Keeping TX + WLAN Link

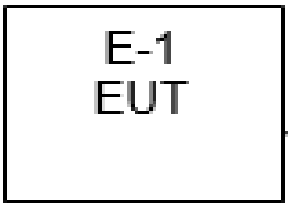
2.3 TEST SOFTWARE AND POWER LEVEL

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level.

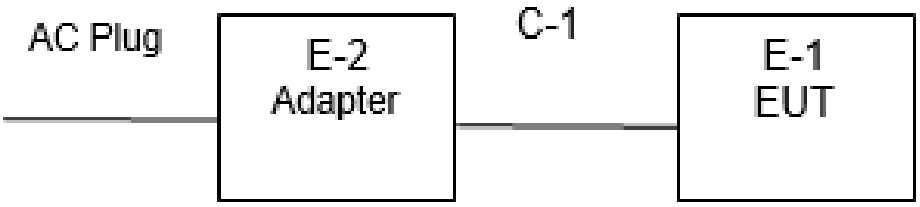
RF Function	Type	Mode Or Modulation type	Ant Gain(dBi)	Power Class	Software For Testing
WIFI(2.4G)	2.4G WIFI	802.11b	An A: 3.21dBi Ant B:1.46dBi MIMO: 5.39dBi	19	DRTU
		802.11g		16	
		802.11n(HT20)		16	
		802.11n(HT40)		16	

2.4 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiation Test Set



conduction Test Set



2.5 DESCRIPTION OF NECESSARY ACCESSORIES AND 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.

Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note
E-2	Adapter	Chicony	A18-065N3A	N/A	N/A
C-1	DC Cable	N/A	110cm	N/A	N/A

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note
N/A	N/A	N/A	N/A	N/A	N/A

Note:

(1) The support equipment was authorized by Declaration of Confirmation.

(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

2.6 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2019.07.29	2020.07.28
Signal Analyzer	Agilent	N9020A	MY51110105	2020.03.05	2021.03.04
Active loop Antenna	ZHINAN	ZN30900C	16035	2018.03.11	2021.03.10
Bilog Antenna	TESEQ	CBL6111D	34678	2017.11.02	2020.11.01
Horn Antenna	SCHWARZBECK	BBHA 9120D(1201)	9120D-1343	2018.10.19	2021.10.18
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	J211020657	2018.03.11	2021.03.10
Pre-Amplifier(0.1M-3G Hz)	EM	EM330	060665	2019.10.09	2020.10.08
Pre-Amplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK2018080901	2019.10.12	2020.10.11
Pre-Amplifier (18G-40G)	SKET	LNPA_1840-50	SK2018101801	2019.10.22	2020.10.21
Temperature & Humidity	HH660	Mieo	N/A	2019.10.12	2020.10.11
turn table	EM	SC100_1	60531	N/A	N/A
Antenna mast	EM	SC100	N/A	N/A	N/A
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)			

Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2019.07.29	2020.07.28
LISN	R&S	ENV216	101242	2019.10.09	2020.10.08
LISN	EMCO	3810/2NM	23625	2019.10.09	2020.10.08
Temperature & Humidity	HH660	Mieo	N/A	2019.10.12	2020.10.11
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 CE)			

RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
USB RF power sensor	DARE	RPR3006W	15I00041SNO03	2019.10.09	2020.10.08
Signal Analyzer	Agilent	N9020A	MY49100060	2019.10.09	2020.10.08
Temperature & Humidity	HH660	Mieo	N/A	2019.10.12	2020.10.11
Test SW	FARAD	LZ-RF /LzRf-3A3			

3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

Operating frequency band. In case the emission fall within the restricted band specified on Part 15. 207(a)&RSS-Gen Issue 5 limit in the table below has to be followed.

FREQUENCY (MHz)	Conducted Emissionlimit (dBuV)	
	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

Note:

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

(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

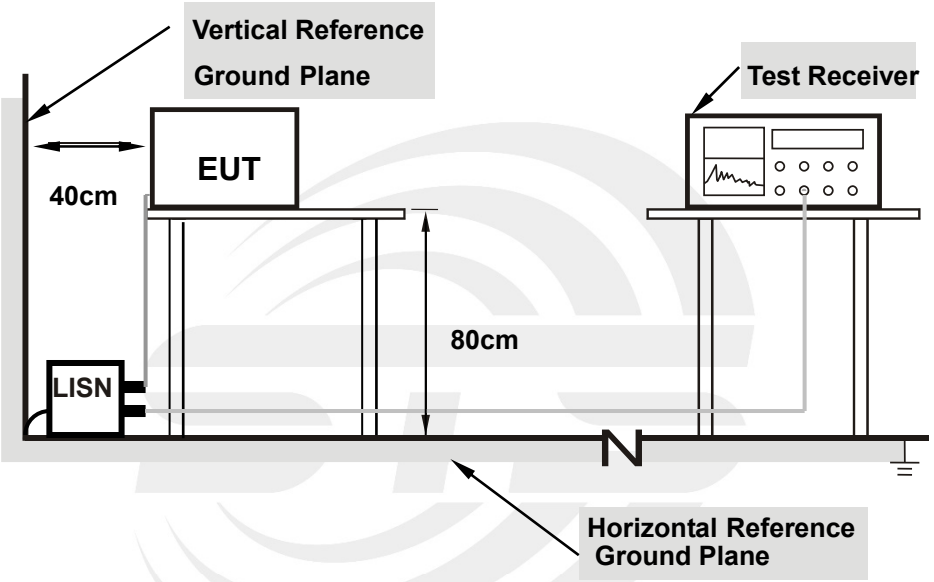
The following table is the setting of the receiver

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

3.1.2 TEST PROCEDURE

a. The EUT was 0.8 meters from the horizontal ground plane and 0.4 meters from the vertical 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 –EUT Test Photos.

3.1.3 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

3.1.4 EUT OPERATING CONDITIONS

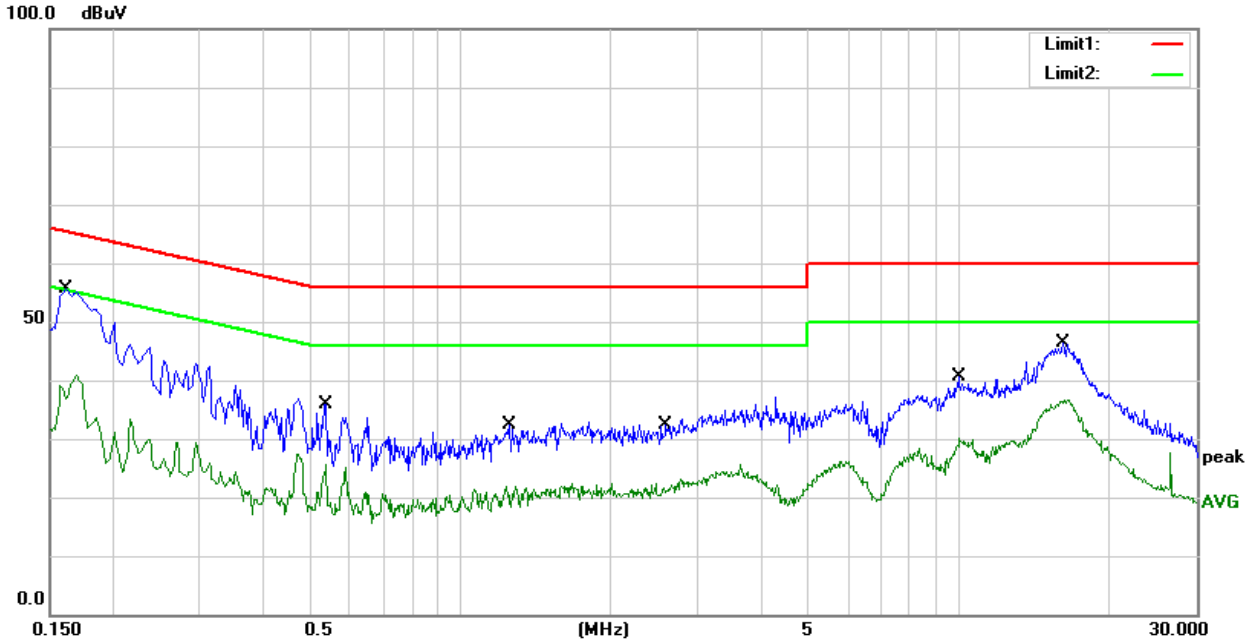
The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

3.1.5 TEST RESULT

Temperature:	23.5(C)	Relative Humidity:	62%RH
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode:	Mode 17		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1620	35.96	19.79	55.75	65.36	-9.61	QP
2	0.1620	20.97	19.79	40.76	55.36	-14.60	AVG
3	0.5380	15.87	19.99	35.86	56.00	-20.14	QP
4	0.5380	5.75	19.99	25.74	46.00	-20.26	AVG
5	1.2460	11.81	19.80	31.61	56.00	-24.39	QP
6	1.2460	2.09	19.80	21.89	46.00	-24.11	AVG
7	2.5940	12.54	19.80	32.34	56.00	-23.66	QP
8	2.5940	2.54	19.80	22.34	46.00	-23.66	AVG
9	9.9860	20.33	20.21	40.54	60.00	-19.46	QP
10	9.9860	8.13	20.21	28.34	50.00	-21.66	AVG
11	16.1940	26.16	20.29	46.45	60.00	-13.55	QP
12	16.1940	16.34	20.29	36.63	50.00	-13.37	AVG

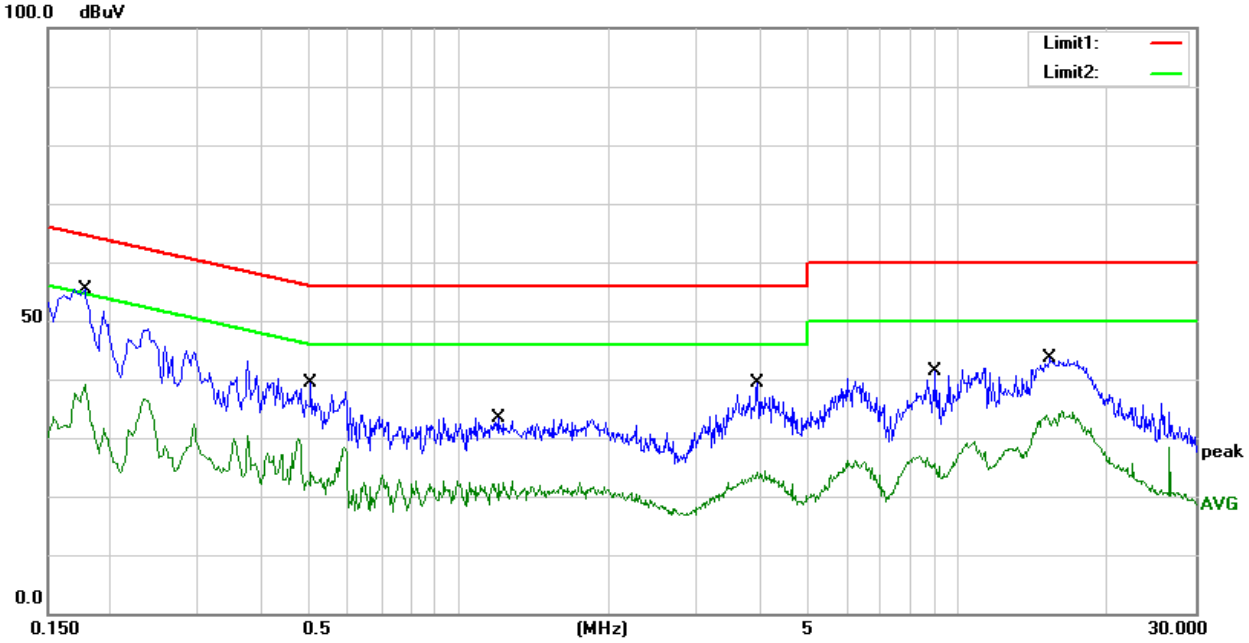
Remark:
1. All readings are Quasi-Peak and Average values.
2. Margin = Result (Result =Reading + Factor)–Limit



Temperature:	23.5(C)	Relative Humidity:	62%RH
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	Mode 17		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1780	35.54	19.78	55.32	64.58	-9.26	QP
2	0.1780	19.44	19.78	39.22	54.58	-15.36	AVG
3	0.5060	19.46	20.02	39.48	56.00	-16.52	QP
4	0.5060	9.82	20.02	29.84	46.00	-16.16	AVG
5	1.1980	13.52	19.80	33.32	56.00	-22.68	QP
6	1.1980	2.31	19.80	22.11	46.00	-23.89	AVG
7	3.9700	19.47	19.83	39.30	56.00	-16.70	QP
8	3.9700	4.36	19.83	24.19	46.00	-21.81	AVG
9	9.0300	21.25	20.10	41.35	60.00	-18.65	QP
10	9.0300	6.77	20.10	26.87	50.00	-23.13	AVG
11	15.3580	23.35	20.25	43.60	60.00	-16.40	QP
12	15.3580	14.26	20.25	34.51	50.00	-15.49	AVG

Remark:
1. All readings are Quasi-Peak and Average values.
2. Margin = Result (Result =Reading + Factor)–Limit



3.2 RADIATED EMISSION MEASUREMENT

3.2.1 RADIATED EMISSION LIMITS

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205(a)&209(a)& RSS-Gen Issue 5, Amendment 1, March 2019 and RSS-247 Issue 2, February 2017 (5.5) limit in the table and according to ANSI C63.10-2013 below has to be followed.

LIMITS OF RADIATED EMISSION MEASUREMENT (0.009MHz - 1000MHz)

Frequencies (MHz)	Field Strength (micorvolts/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
Above 960	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (1000MHz-25GHz)

FREQUENCY (MHz)	(dBuV/m) (at 3M)	
	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).

LIMITS OF RESTRICTED FREQUENCY BANDS

FCC:

FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (GHz)
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

IC:

FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (GHz)
0.090 - 0.110	149.9 - 150.05	9.0 - 9.2
0.495 - 0.505	156.52475 - 156.52525	9.3 - 9.5
2.1735 - 2.1905	156.7 - 156.9	10.6 - 12.7
3.020 - 3.026	162.0125 - 167.17	13.25 - 13.4
4.125 - 4.128	167.72 - 173.2	14.47 - 14.5
4.17725 - 4.17775	240 – 285	15.35 - 16.2
4.20725 - 4.20775	322 - 335.4	17.7 - 21.4
5.677 - 5.683	399.9 - 410	22.01 - 23.12
6.215 - 6.218	608 - 614	23.6 - 24.0
6.26775 - 6.26825	960 - 1427	31.2 - 31.8
6.31175 - 6.31225	1435 - 1626.5	36.43 - 36.5
8.291 - 8.294	1645.5 - 1646.5	Above 38.6
8.362 - 8.366	1660 - 1710	
8.37625 - 8.38675	1718.8 - 1722.2	
8.41425 - 8.41475	2200 - 2300	
12.29 - 12.293	2310 - 2390	
12.51975 - 12.52025	2483.5 - 2500	
12.57675 - 12.57725	2655 - 2900	
13.36 - 13.41	3260 – 3267	
16.42 - 16.423	3332 - 3339	
16.69475 - 16.69525	3345.8 - 3358	
16.80425 - 16.80475	3500 - 4400	
25.5 - 25.67	4500 - 5150	
37.5 - 38.25	5350 - 5460	
73 - 74.6	7250 - 7750	
74.8 - 75.2	8025 – 8500	
108 – 138		

For Radiated Emission

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/QP/AV
Start Frequency	9 KHz/150KHz(Peak/QP/AV)
Stop Frequency	150KHz/30MHz(Peak/QP/AV)
RB / VB (emission in restricted band)	200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz); 200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz)

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/QP
Start Frequency	30 MHz(Peak/QP)
Stop Frequency	1000 MHz (Peak/QP)
RB / VB (emission in restricted band)	120 KHz / 300 KHz

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/AV
Start Frequency	1000 MHz(Peak/AV)
Stop Frequency	10th carrier hamonic(Peak/AV)
RB / VB (emission in restricted band)	1 MHz / 3 MHz(Peak) 1 MHz/1/T MHz(AVG)

For Restricted band

Spectrum Parameter	Setting
Detector	Peak/AV
Start/Stop Frequency	Lower Band Edge: 2310 to 2430 MHz Upper Band Edge: 2440 to 2500 MHz
RB / VB	1 MHz / 3 MHz(Peak) 1 MHz/1/T MHz(AVG)

Receiver Parameter	Setting
Start ~ Stop Frequency	9kHz~90kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	90kHz~110kHz / RB 200Hz for QP
Start ~ Stop Frequency	110kHz~490kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	490kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

3.2.2 TEST PROCEDURE

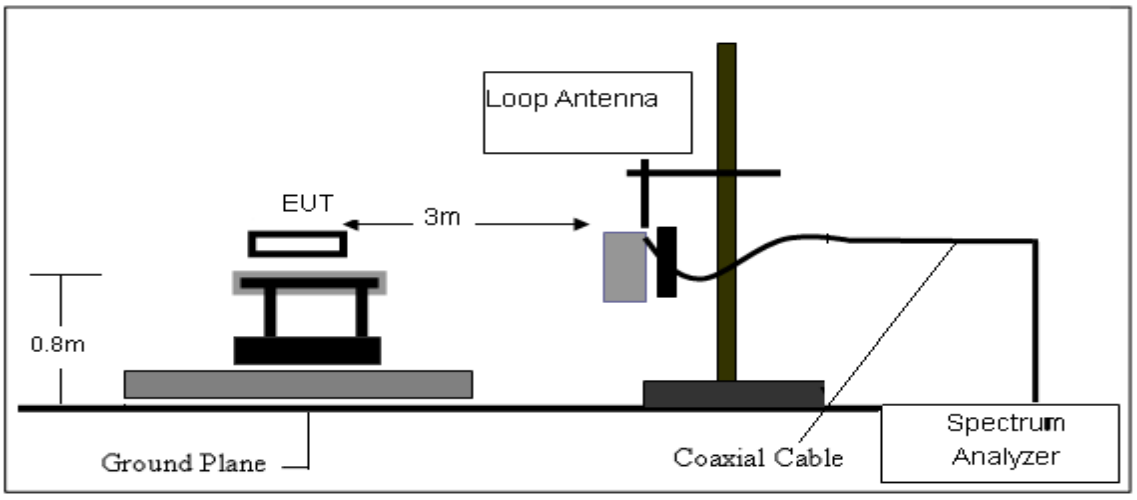
a. The measuring distance of at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz, and above 1GHz.
b. The EUT was placed on the top of a rotating table 0.8 meters(above 1GHz is 1.5 m) above the ground at a 3 meter anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The height of the equipment shall be 0.8 m(above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. 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 –EUT Test Photos.

Note:

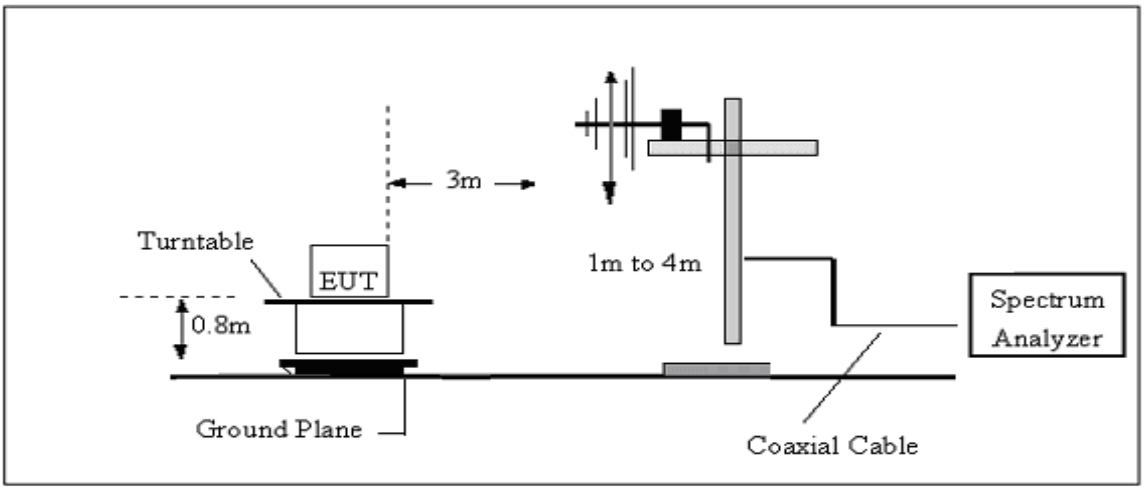
Both horizontal and vertical antenna polarities were testedand performed test to three orthogonal axis. The worst case emissions were reported.

3.2.3 TEST SETUP

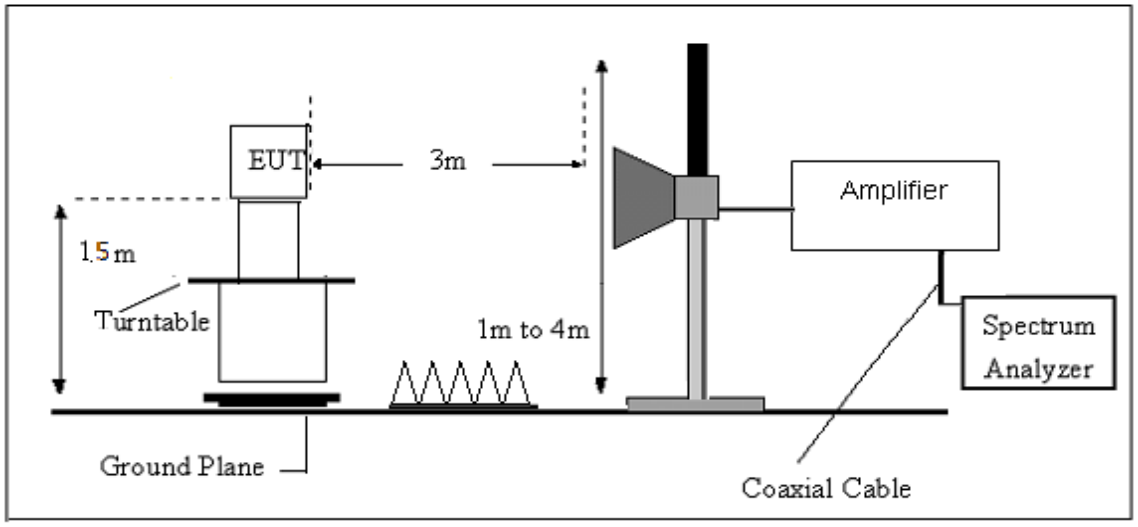
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



3.2.4 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

3.2.5 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting theAmplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where

FS = Field Strength

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

For example

Frequency	FS	RA	AF	CL	AG	Factor
(MHz)	(dBμV/m)	(dBμV/m)	(dB)	(dB)	(dB)	(dB)
300	40	58.1	12.2	1.6	31.9	-18.1

Factor=AF+CL-AG

3.2.6 TEST RESULT

9KHz-30MHz

Temperature:	22.9(C)	Relative Humidtity:	52%RH
Test Voltage:	DC 15.4V	Polarization:	--
Test Mode:	TX Mode		

Freq. (MHz)	Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	State P/F	Test Result
--	--	--	--	--	PASS
--	--	--	--	--	PASS

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

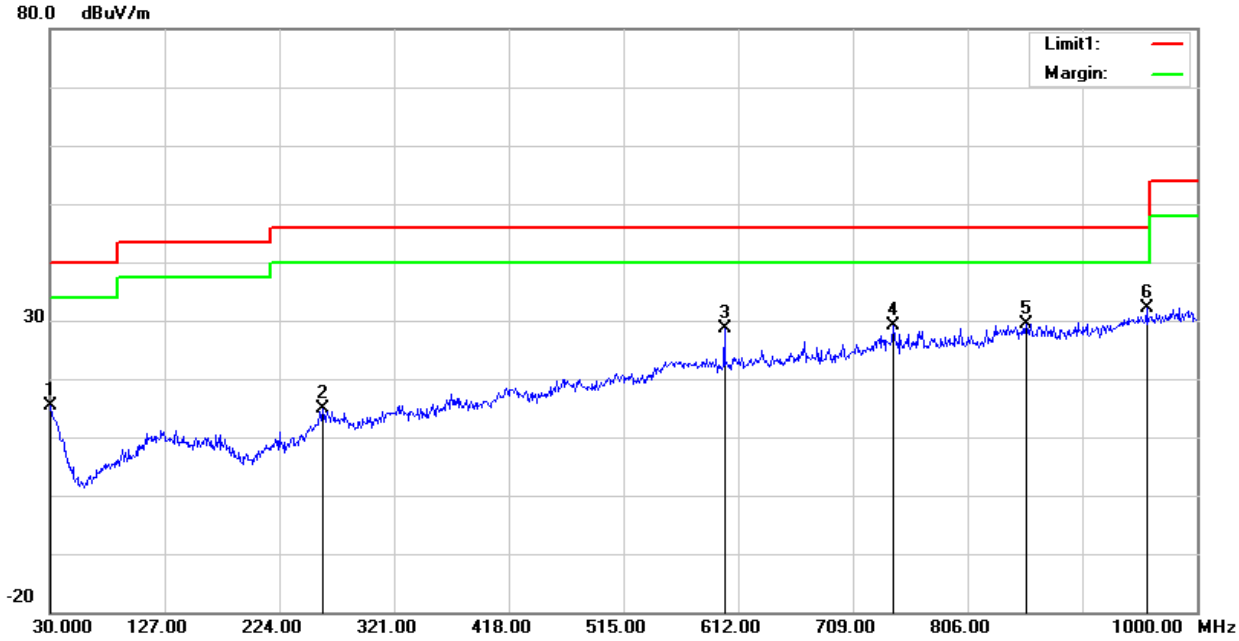
(30MHz - 1000MHz)

Temperature:	22.9(C)	Relative Humidtity:	52%RH
Test Voltage:	DC 15.4V	Phase:	Horizontal
Test Mode:	Mode 1/2/3/4/5/6/7/8/9/10/11/12/13/14/15/16 (Mode 12 worst mode)		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	30.9700	28.68	-13.35	15.33	40.00	-24.67	QP
2	260.8600	29.72	-14.78	14.94	46.00	-31.06	QP
3	600.3600	34.59	-5.84	28.75	46.00	-17.25	QP
4	742.9500	31.38	-2.13	29.25	46.00	-16.75	QP
5	855.4700	29.97	-0.57	29.40	46.00	-16.60	QP
6	957.3200	30.41	1.72	32.13	46.00	-13.87	QP

Remark:

1. Margin = Result (Result =Reading + Factor)–Limit

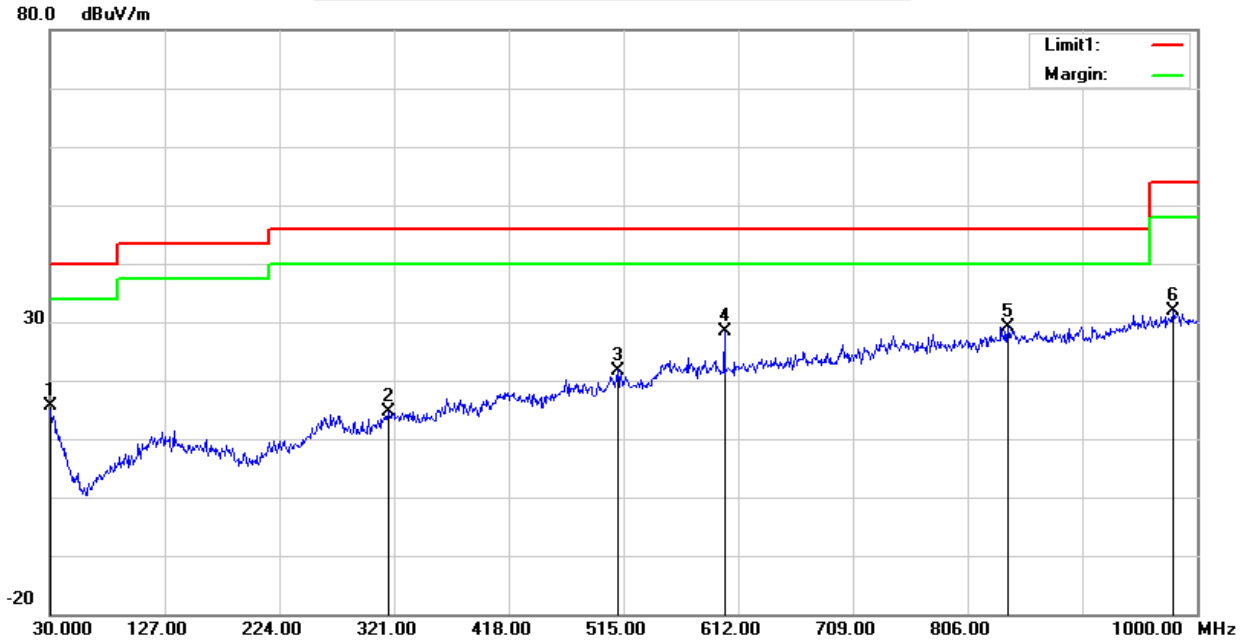


Temperature:	22.9(C)	Relative Humidtity:	52%RH
Test Voltage:	DC 15.4V	Phase:	Vertical
Test Mode:	Mode 1/2/3/4/5/6/7/8/9/10/11/12/13/14/15/16 (Mode 12 worst mode)		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	30.0000	28.54	-12.85	15.69	40.00	-24.31	QP
2	316.1500	28.72	-14.17	14.55	46.00	-31.45	QP
3	510.1500	29.69	-7.94	21.75	46.00	-24.25	QP
4	600.3600	34.12	-5.84	28.28	46.00	-17.72	QP
5	839.9500	29.53	-0.34	29.19	46.00	-16.81	QP
6	979.6300	29.19	2.65	31.84	54.00	-22.16	QP

Remark:.

1. Margin = Result (Result =Reading + Factor)–Limit



(1000MHz-25GHz) Restricted band and Spurious emission Requirements

802.11 n(HT20)

Frequency	Meter Reading	Amplifier	Loss	Antenna Factor	Orrected Factor	Emission Level	Limits	Margin	Detector	Comment
(MHz)	(dBμV)	（dB）	（dB）	（dB/m）	（dB）	(dBμV/m)	(dBμV/m)	(dB)	Type	
Low Channel (802.1n20/2412 MHz)										
3264.75	62.20	44.70	6.70	28.20	-9.80	52.40	74.00	-21.60	PK	Vertical
3264.75	50.02	44.70	6.70	28.20	-9.80	40.22	54.00	-13.78	AV	Vertical
3264.71	60.87	44.70	6.70	28.20	-9.80	51.07	74.00	-22.93	PK	Horizontal
3264.71	51.23	44.70	6.70	28.20	-9.80	41.43	54.00	-12.57	AV	Horizontal
4824.35	58.47	44.20	9.04	31.60	-3.56	54.91	74.00	-19.09	PK	Vertical
4824.35	50.23	44.20	9.04	31.60	-3.56	46.67	54.00	-7.33	AV	Vertical
4824.59	59.58	44.20	9.04	31.60	-3.56	56.02	74.00	-17.98	PK	Horizontal
4824.59	49.42	44.20	9.04	31.60	-3.56	45.86	54.00	-8.14	AV	Horizontal
5359.60	48.72	44.20	9.86	32.00	-2.34	46.38	74.00	-27.62	PK	Vertical
5359.60	40.05	44.20	9.86	32.00	-2.34	37.70	54.00	-16.30	AV	Vertical
5359.70	47.76	44.20	9.86	32.00	-2.34	45.42	74.00	-28.58	PK	Horizontal
5359.70	38.61	44.20	9.86	32.00	-2.34	36.27	54.00	-17.73	AV	Horizontal
7235.96	54.56	43.50	11.40	35.50	3.40	57.96	74.00	-16.04	PK	Vertical
7235.96	43.81	43.50	11.40	35.50	3.40	47.21	54.00	-6.79	AV	Vertical
7235.95	54.05	43.50	11.40	35.50	3.40	57.45	74.00	-16.55	PK	Horizontal
7235.95	44.14	43.50	11.40	35.50	3.40	47.54	54.00	-6.46	AV	Horizontal
Middle Channel (802.11n20/2437 MHz)										
3264.88	62.19	44.70	6.70	28.20	-9.80	52.39	74.00	-21.61	PK	Vertical
3264.88	51.21	44.70	6.70	28.20	-9.80	41.41	54.00	-12.59	AV	Vertical
3264.77	61.67	44.70	6.70	28.20	-9.80	51.87	74.00	-22.13	PK	Horizontal
3264.77	51.30	44.70	6.70	28.20	-9.80	41.50	54.00	-12.50	AV	Horizontal
4874.30	59.30	44.20	9.04	31.60	-3.56	55.74	74.00	-18.26	PK	Vertical
4874.30	49.73	44.20	9.04	31.60	-3.56	46.17	54.00	-7.83	AV	Vertical
4874.56	58.25	44.20	9.04	31.60	-3.56	54.69	74.00	-19.31	PK	Horizontal
4874.56	49.35	44.20	9.04	31.60	-3.56	45.79	54.00	-8.21	AV	Horizontal
5359.64	49.31	44.20	9.86	32.00	-2.34	46.97	74.00	-27.03	PK	Vertical
5359.64	39.77	44.20	9.86	32.00	-2.34	37.43	54.00	-16.57	AV	Vertical
5359.65	47.72	44.20	9.86	32.00	-2.34	45.37	74.00	-28.63	PK	Horizontal
5359.65	38.03	44.20	9.86	32.00	-2.34	35.69	54.00	-18.31	AV	Horizontal
7310.83	54.05	43.50	11.40	35.50	3.40	57.45	74.00	-16.55	PK	Vertical
7310.83	43.59	43.50	11.40	35.50	3.40	46.99	54.00	-7.01	AV	Vertical
7310.88	53.82	43.50	11.40	35.50	3.40	57.22	74.00	-16.78	PK	Horizontal
7310.88	43.81	43.50	11.40	35.50	3.40	47.21	54.00	-6.79	AV	Horizontal

High Channel (802.11n20/2462 MHz)										
3264.72	61.05	44.70	6.70	28.20	-9.80	51.25	74.00	-22.75	PK	Vertical
3264.72	51.11	44.70	6.70	28.20	-9.80	41.31	54.00	-12.69	AV	Vertical
3264.59	60.82	44.70	6.70	28.20	-9.80	51.02	74.00	-22.98	PK	Horizontal
3264.59	50.00	44.70	6.70	28.20	-9.80	40.20	54.00	-13.80	AV	Horizontal
4924.56	58.11	44.20	9.04	31.60	-3.56	54.55	74.00	-19.45	PK	Vertical
4924.56	49.39	44.20	9.04	31.60	-3.56	45.83	54.00	-8.17	AV	Vertical
4924.36	58.32	44.20	9.04	31.60	-3.56	54.76	74.00	-19.24	PK	Horizontal
4924.36	50.35	44.20	9.04	31.60	-3.56	46.79	54.00	-7.21	AV	Horizontal
5359.71	48.28	44.20	9.86	32.00	-2.34	45.93	74.00	-28.07	PK	Vertical
5359.71	40.32	44.20	9.86	32.00	-2.34	37.98	54.00	-16.02	AV	Vertical
5359.64	48.50	44.20	9.86	32.00	-2.34	46.16	74.00	-27.84	PK	Horizontal
5359.64	38.60	44.20	9.86	32.00	-2.34	36.26	54.00	-17.74	AV	Horizontal
7385.92	54.98	43.50	11.40	35.50	3.40	58.38	74.00	-15.62	PK	Vertical
7385.92	44.27	43.50	11.40	35.50	3.40	47.67	54.00	-6.33	AV	Vertical
7385.73	54.89	43.50	11.40	35.50	3.40	58.29	74.00	-15.71	PK	Horizontal
7385.73	44.51	43.50	11.40	35.50	3.40	47.91	54.00	-6.09	AV	Horizontal

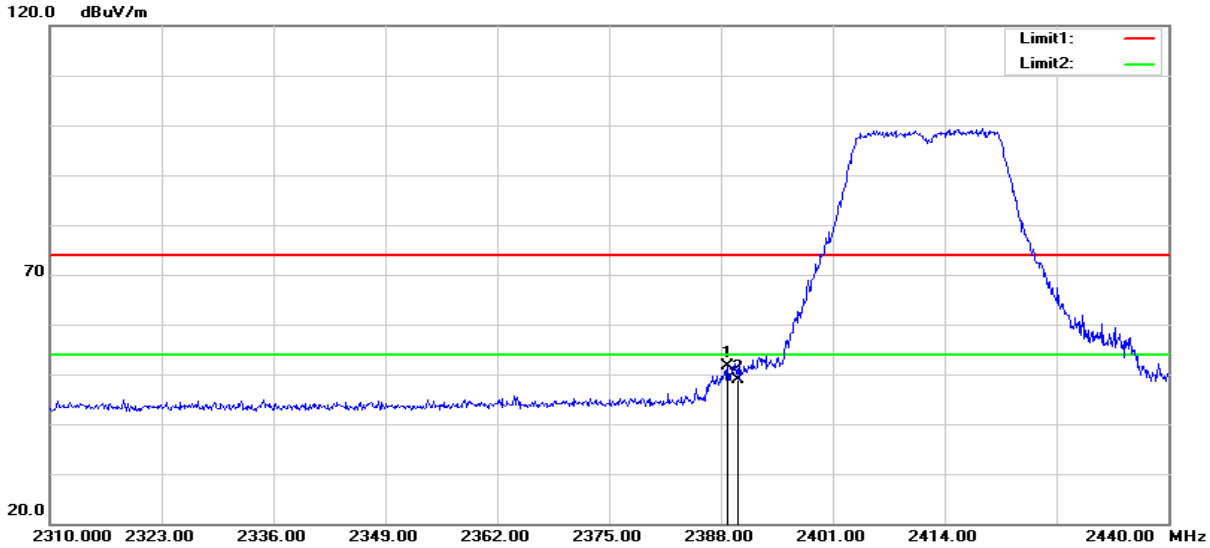
Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier.
2. Scan with 802.11b, 802.11g, 802.11n (HT-20), 802.11n (HT-40) all have been tested the antenna A, antenna B and antennaA+B, the worst case is 802.11n(HT20) of the antenna A+B.
   Emission Level = Reading + Factor
   Margin = Limit - Emission Level
3. The frequency emission of peak pointsthat did not show above the forms are at least 20dB below the limit, the frequency emission is mainly from the environment noise.

3.2.6 TEST RESULTS(Restricted band Requirements)

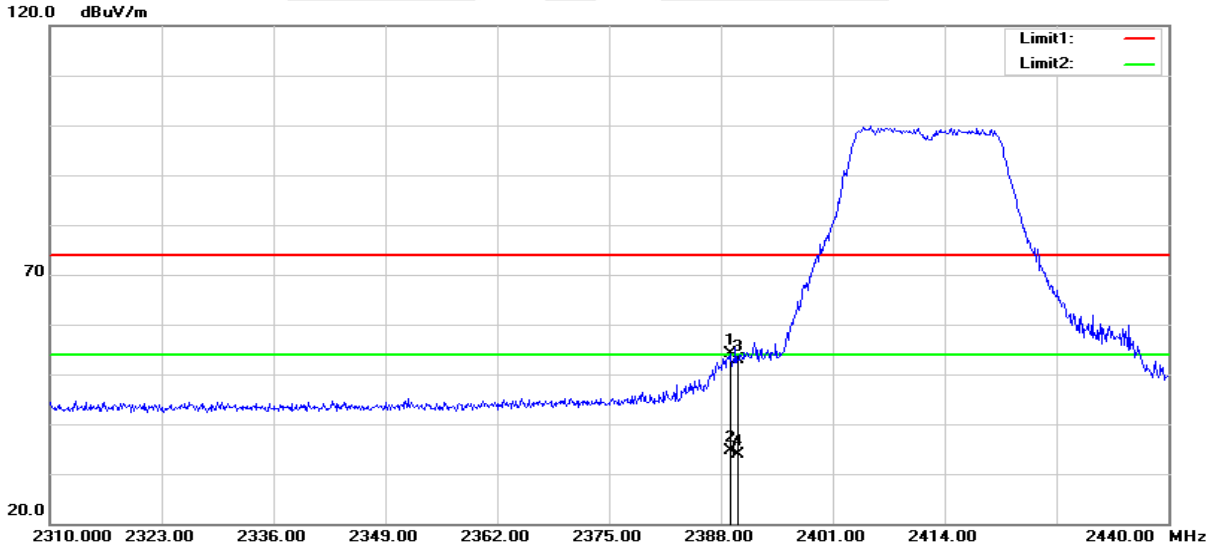
802.11 n(HT20)-Low

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2388.780	47.31	4.32	51.63	74.00	-22.37	peak
2	2390.000	44.52	4.34	48.86	74.00	-25.14	peak

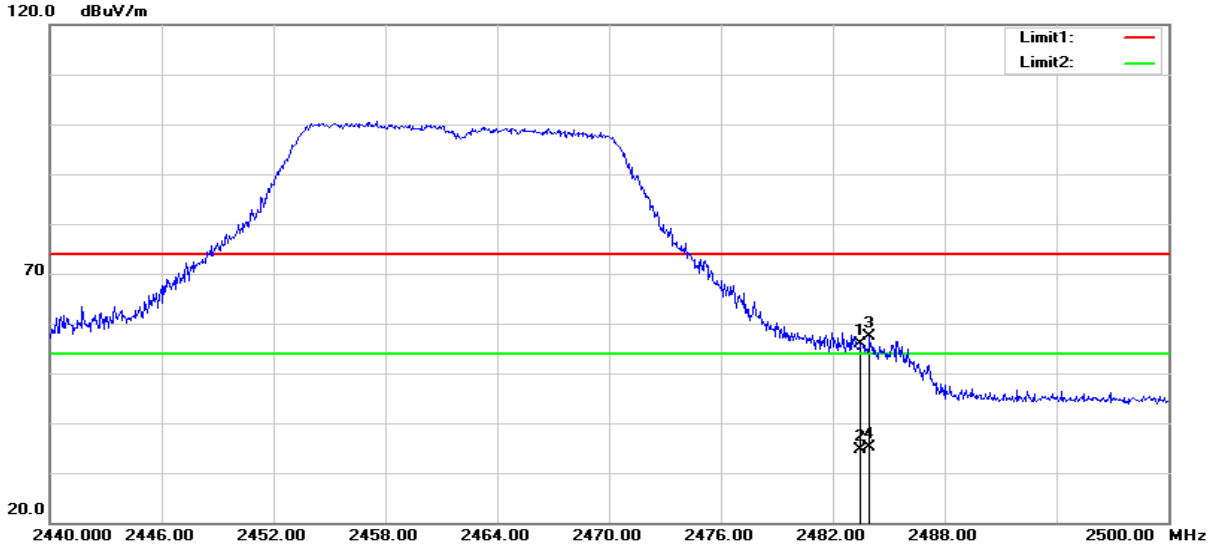
Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2389.040	49.69	4.32	54.01	74.00	-19.99	peak
2	2389.040	30.30	4.32	34.62	54.00	-19.38	AVG
3	2390.000	48.42	4.34	52.76	74.00	-21.24	peak
4	2390.000	29.52	4.34	33.86	54.00	-20.14	AVG

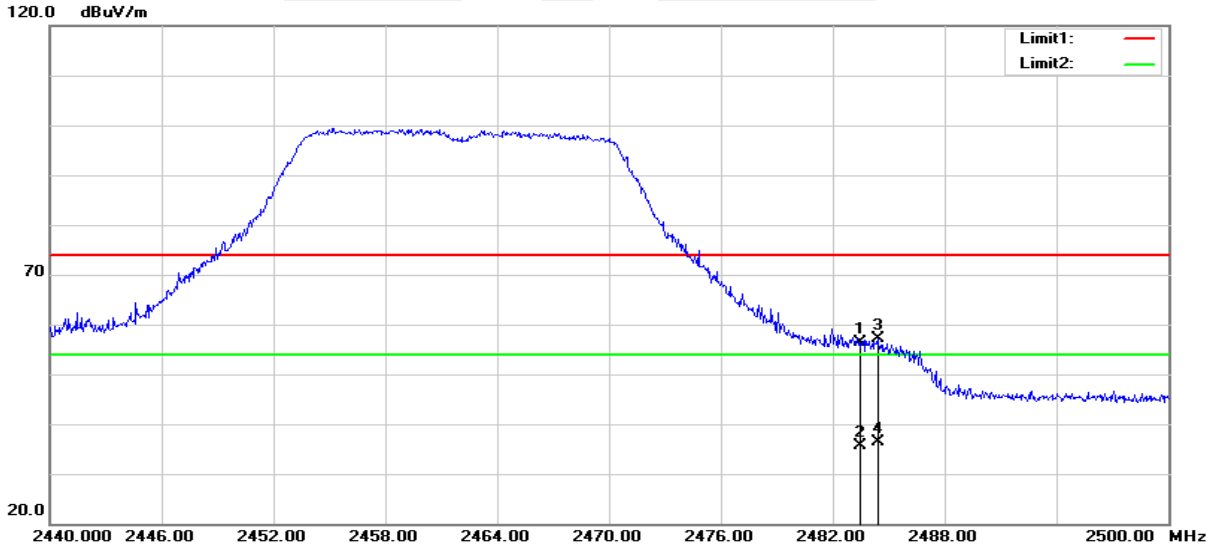
802.11 n(HT20)-High

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	51.20	4.60	55.80	74.00	-18.20	peak
2	2483.500	30.05	4.60	34.65	54.00	-19.35	AVG
3	2483.980	52.77	4.61	57.38	74.00	-16.62	peak
4	2483.980	30.63	4.61	35.24	54.00	-18.76	AVG

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	51.84	4.60	56.44	74.00	-17.56	peak
2	2483.500	31.04	4.60	35.64	54.00	-18.36	AVG
3	2484.400	52.43	4.61	57.04	74.00	-16.96	peak
4	2484.400	31.67	4.61	36.28	54.00	-17.72	AVG

Note: 802.11b, 802.11g, 802.11n (HT-20), 802.11n (HT-40),all have been tested the antenna A, antenna B and antenna A+B, the worst case is 802.11 n(HT20) of the antenna A+B.

4.CONDUCTED SPURIOUS & BAND EDGE EMISSION

4.1 LIMIT

According to FCC section 15.247(d)&RSS-247 Issue 2, in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

4.2 TEST PROCEDURE

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	30 MHz to 10th carrier harmonic
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

For Band edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 2300 to 2432 MHz Upper Band Edge: 2442 to 2500 MHz
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

4.3 DEVIATION FROM STANDARD

No deviation.

4.4 TEST SETUP

The EUT which is powered by the Battery, is connected to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

4.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

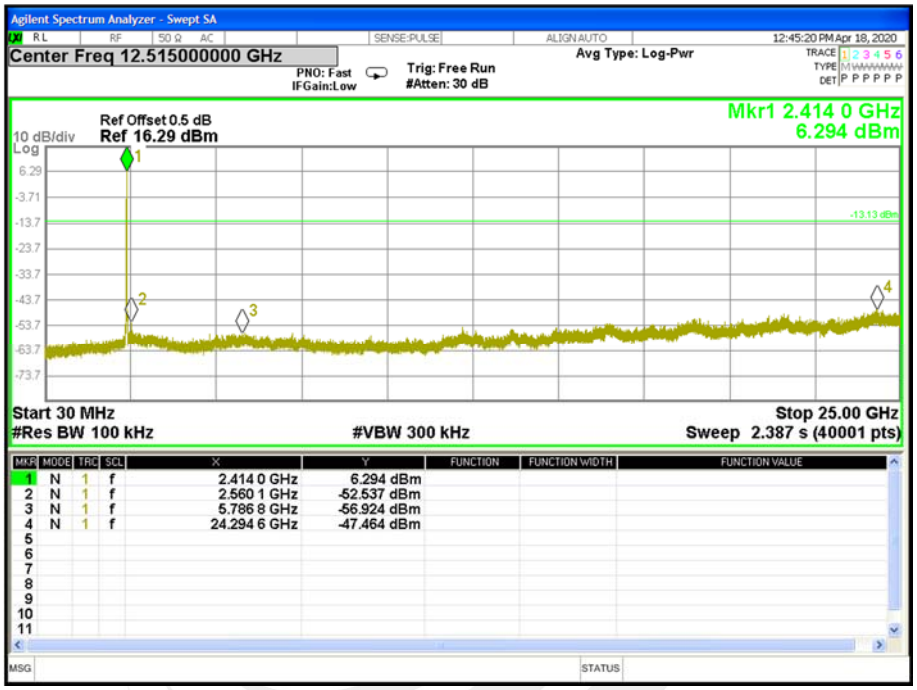
4.6 TEST RESULTS

Note: Antenna B Power> Antenna A Power, Both antenna A and B have been test, Only show the worst data of Antenna B

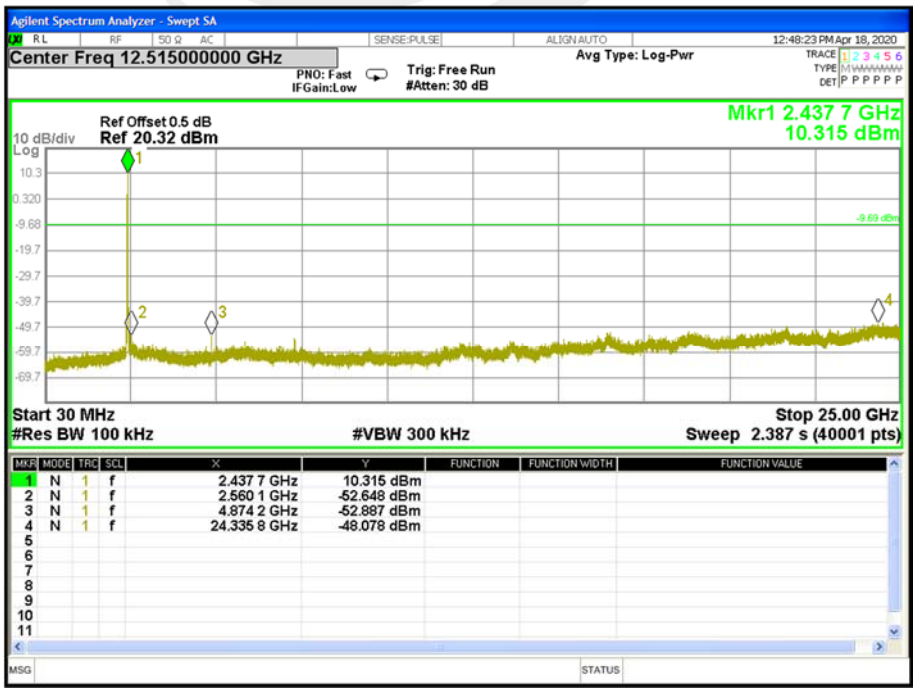
Temperature:	25℃	Relative Humidity:	60%
Test Voltage:	DC 15.4V	Test Mode:	TX b Mode /CH01, CH06, CH11

Antenna B

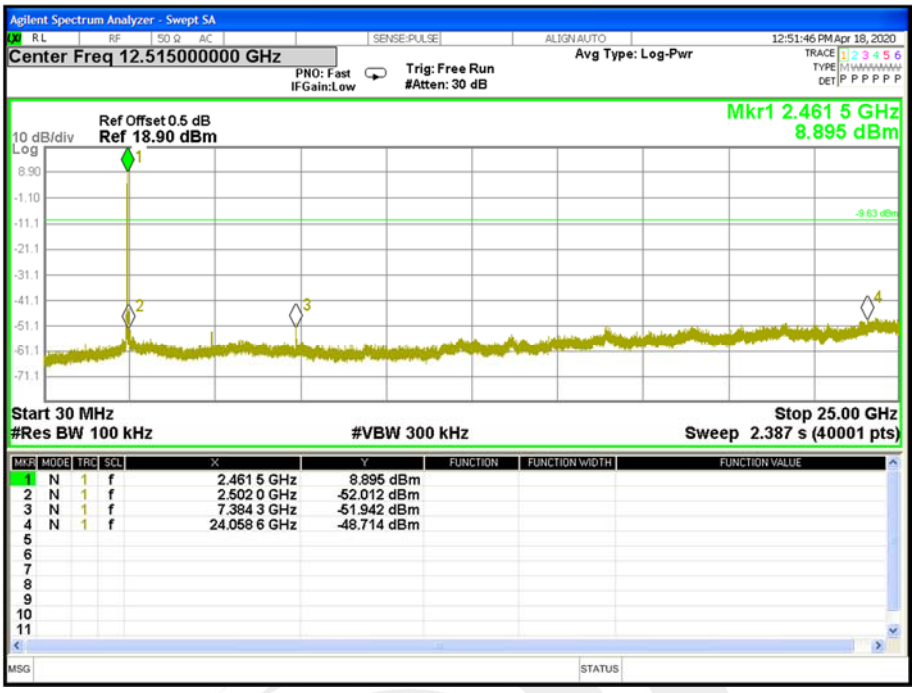
CH 01



CH 06

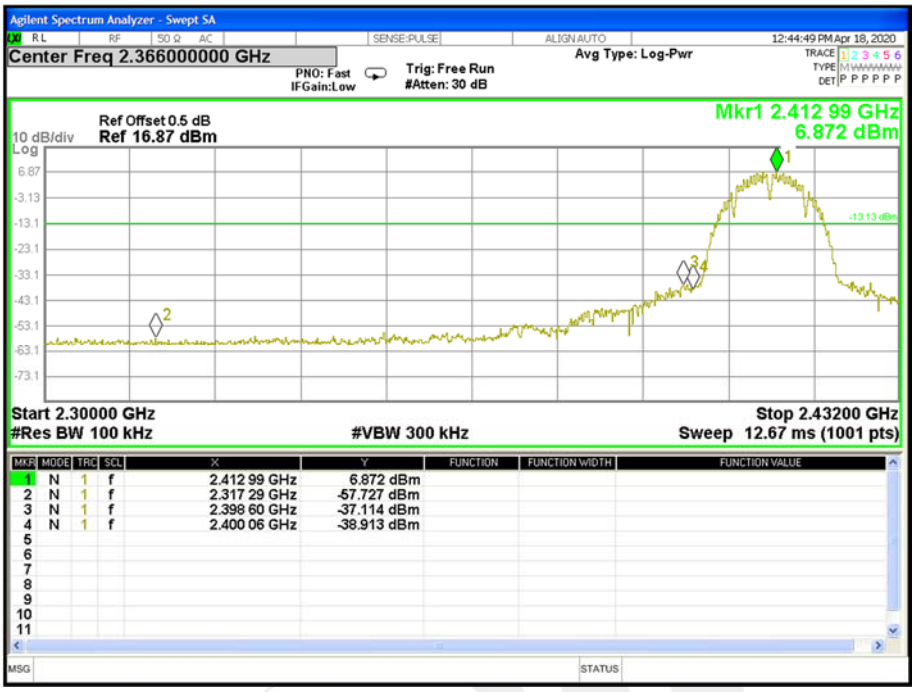


CH 11

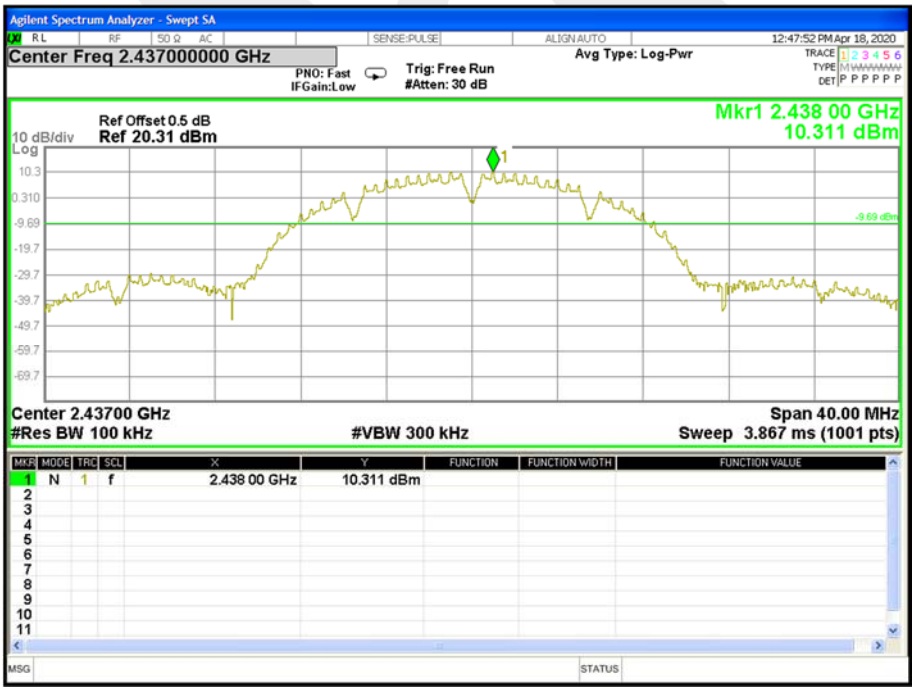

Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
12:51:46 PM Apr 18, 2020
Ref Offset 0.5 dB
10 dB/div
Ref 18.90 dBm
Mkr1 2.461 5 GHz
8.895 dBm
-9.63 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.387 s (40001 pts)
1 N 1 f 2.461 5 GHz 8.895 dBm
2 N 1 f 2.502 0 GHz -52.012 dBm
3 N 1 f 7.384 3 GHz -51.942 dBm
4 N 1 f 24.058 6 GHz -48.714 dBm

Band edge(it's also the reference level for conducted spurious emission)

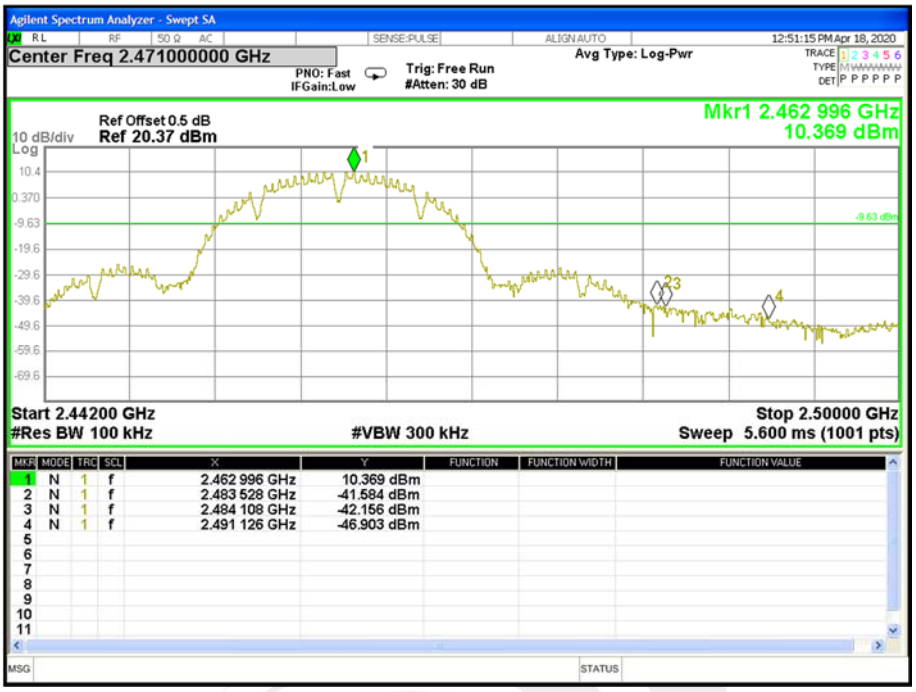
CH 01



CH 06



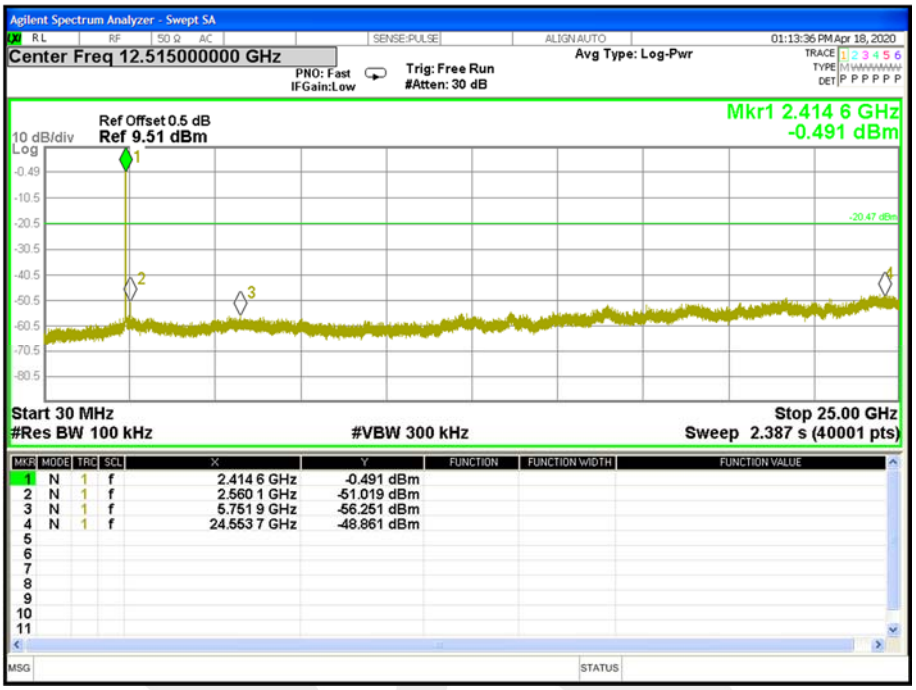
CH 11


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.471000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
12:51:15 PM Apr 18, 2020
Ref Offset 0.5 dB
10 dB/div
Ref 20.37 dBm
Mkr1 2.462 996 GHz
10.369 dBm
-9.63 dBm
Start 2.44200 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 5.600 ms (1001 pts)
1 N 1 f 2.462 996 GHz 10.369 dBm
2 N 1 f 2.483 528 GHz -41.584 dBm
3 N 1 f 2.484 108 GHz -42.156 dBm
4 N 1 f 2.491 126 GHz -46.903 dBm

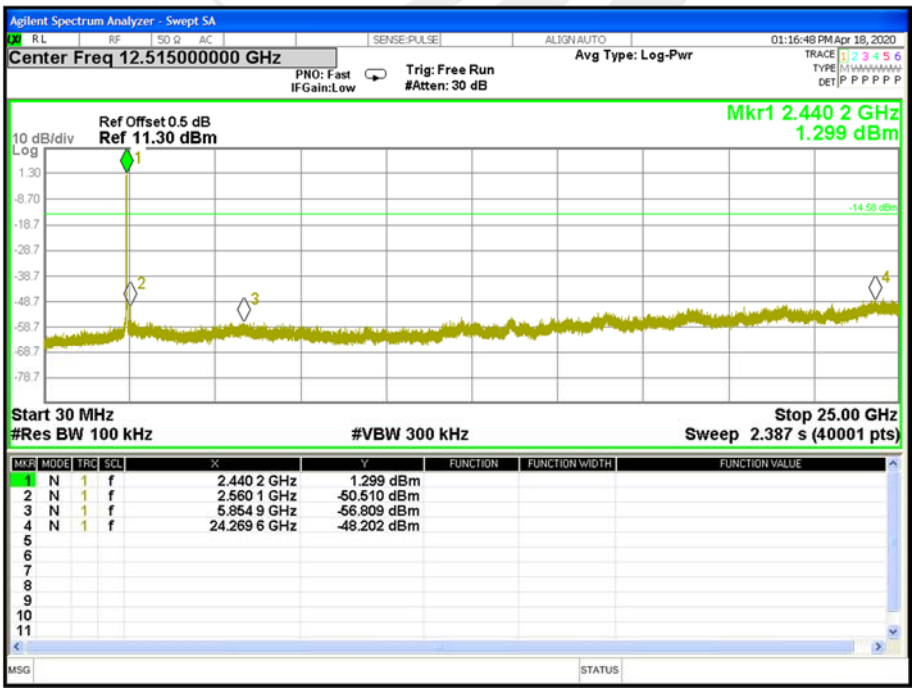
Temperature:	25℃	Relative Humidity:	60%
Test Voltage:	DC 15.4V	Test Mode:	TX g Mode /CH01, CH06, CH11

Antenna B

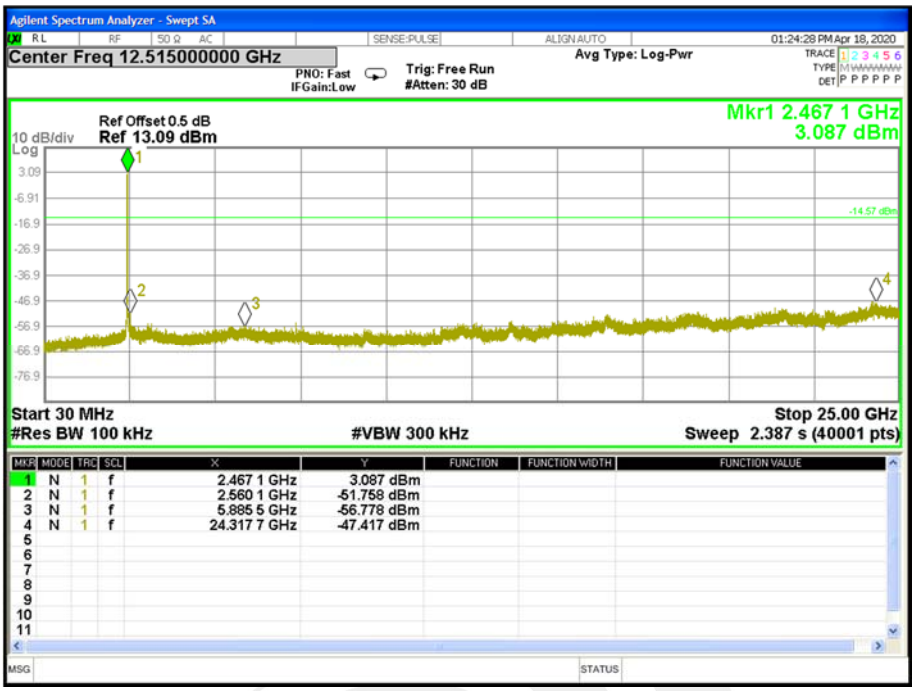
CH 01



CH06

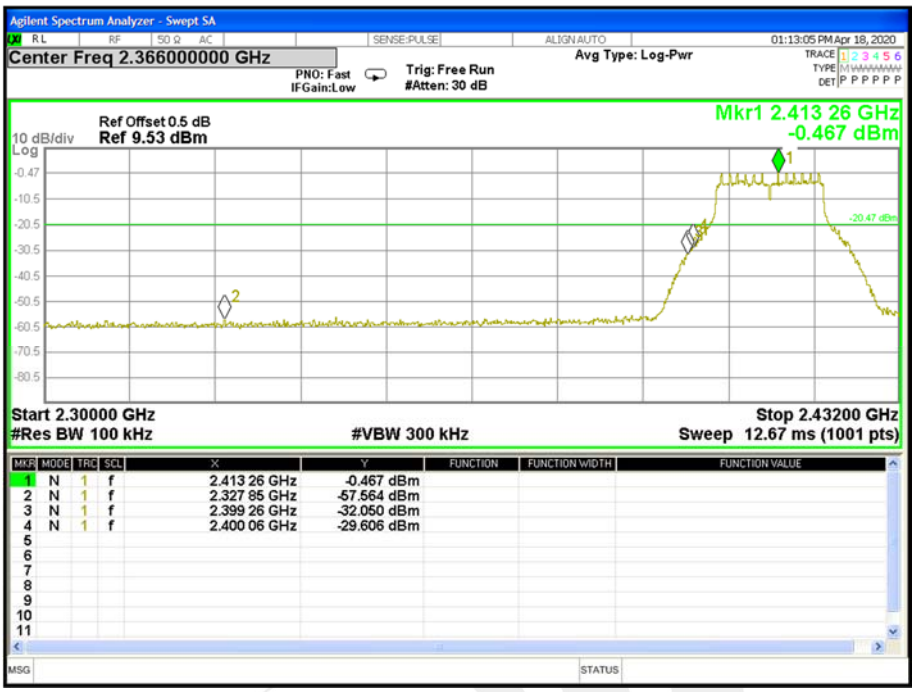


CH 11

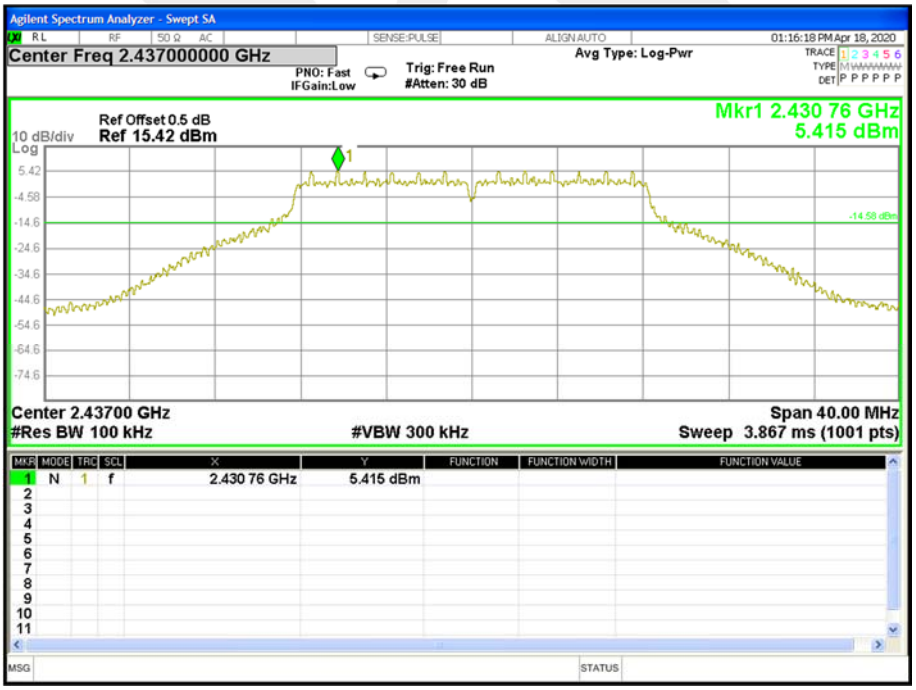

Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
01:24:28 PM Apr 18, 2020
Ref Offset 0.5 dB
10 dB/div
Ref 13.09 dBm
Mkr1 2.467 1 GHz
3.087 dBm
-14.57 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.387 s (40001 pts)
1 N 1 f 2.467 1 GHz 3.087 dBm
2 N 1 f 2.560 1 GHz -51.758 dBm
3 N 1 f 5.885 5 GHz -56.778 dBm
4 N 1 f 24.317 7 GHz -47.417 dBm

Band edge(it's also the reference level for conducted spurious emission)

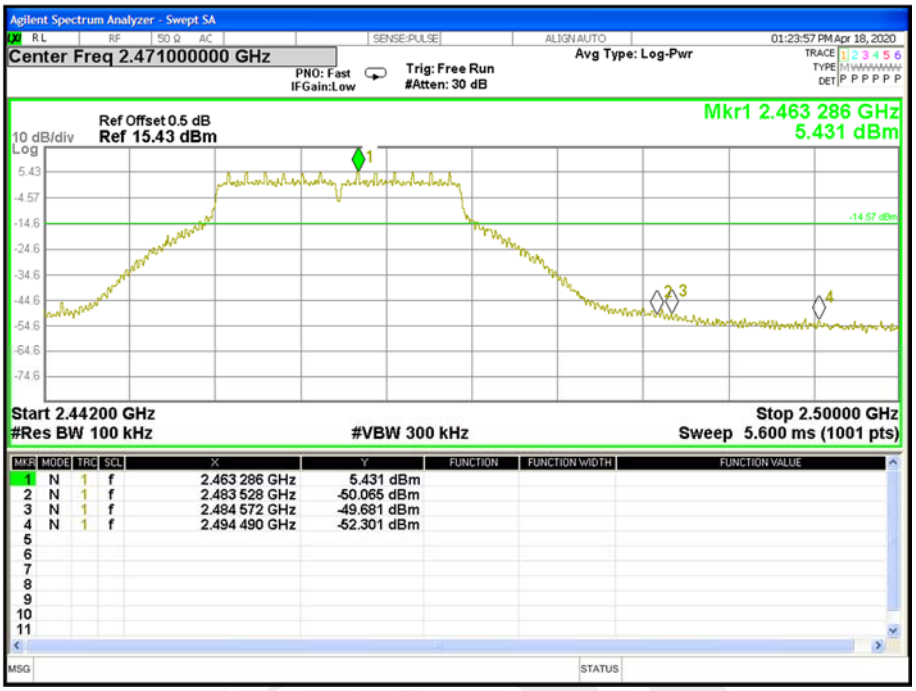
CH 01



CH06



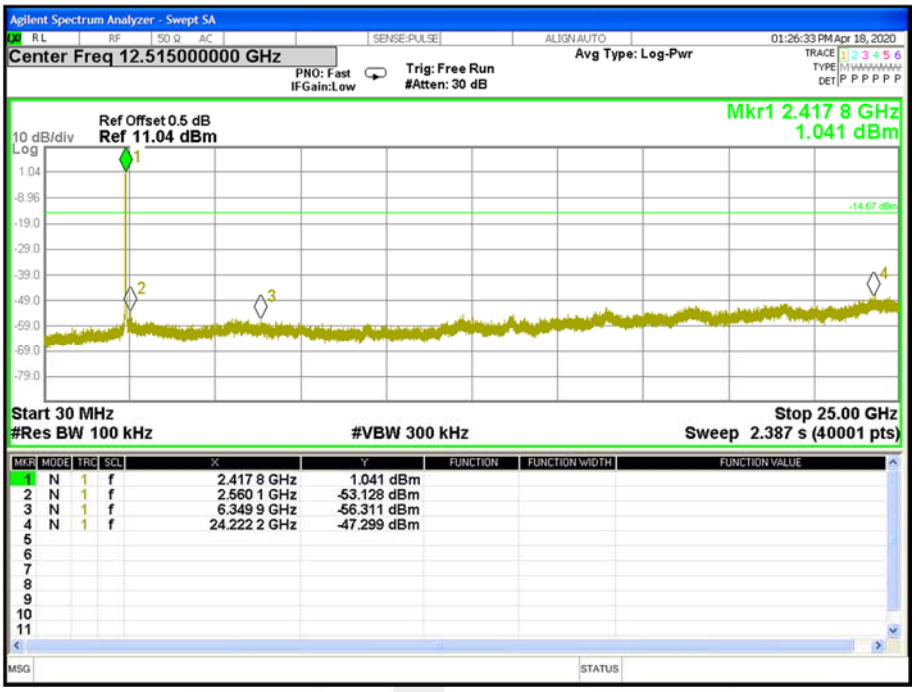
CH11


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.471000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
01:23:57 PM Apr 18, 2020
Ref Offset 0.5 dB
10 dB/div
Ref 15.43 dBm
Mkr1 2.463 286 GHz
5.431 dBm
-14.57 dBm
Start 2.44200 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 5.600 ms (1001 pts)
1 N 1 f 2.463 286 GHz 5.431 dBm
2 N 1 f 2.483 528 GHz -50.065 dBm
3 N 1 f 2.484 572 GHz -49.681 dBm
4 N 1 f 2.494 490 GHz -52.301 dBm

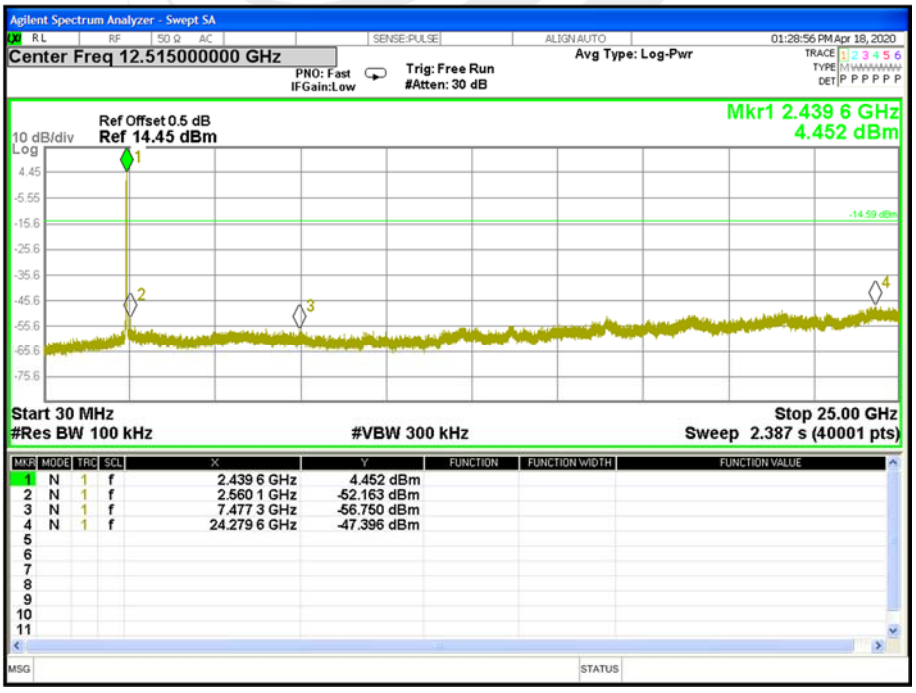
Temperature:	25℃	Relative Humidity:	60%
Test Voltage:	DC 15.4V	Test Mode:	TX n Mode(20M) /CH01, CH06, CH11

Antenna B

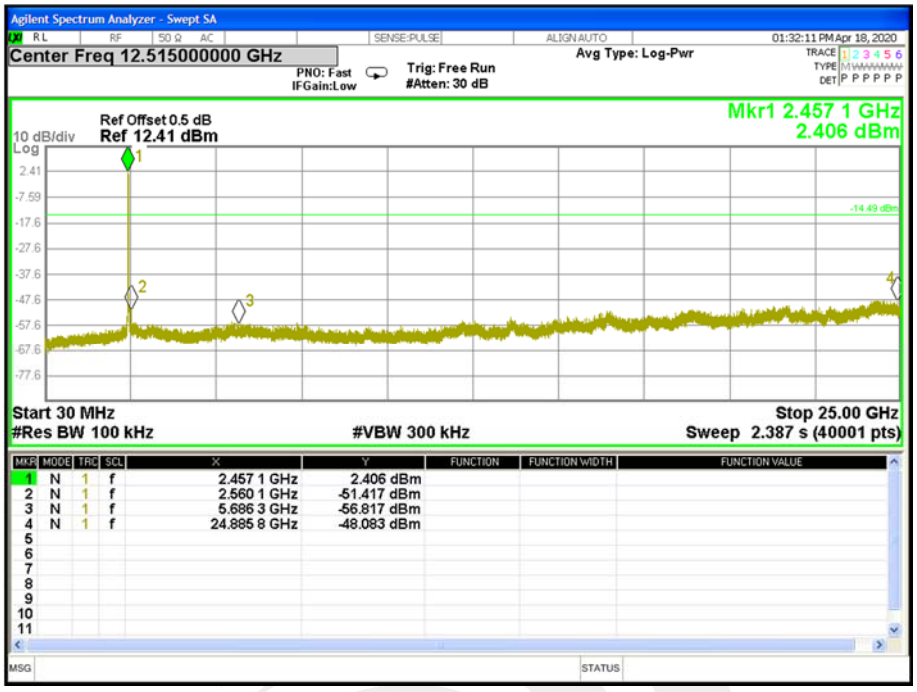
CH 01



CH 06

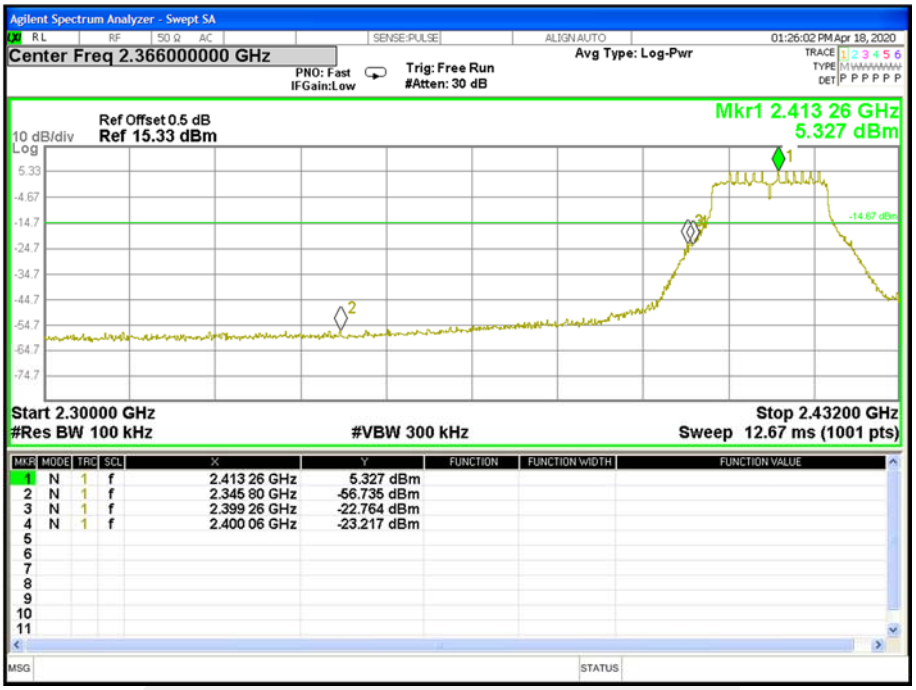


CH 11


Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
01:32:11 PM Apr 18, 2020
Ref Offset 0.5 dB
10 dB/div
Ref 12.41 dBm
Mkr1 2.457 1 GHz
2.406 dBm
-14.49 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.387 s (40001 pts)
1 N 1 f 2.457 1 GHz 2.406 dBm
2 N 1 f 2.560 1 GHz -51.417 dBm
3 N 1 f 5.686 3 GHz -56.817 dBm
4 N 1 f 24.885 8 GHz -48.083 dBm

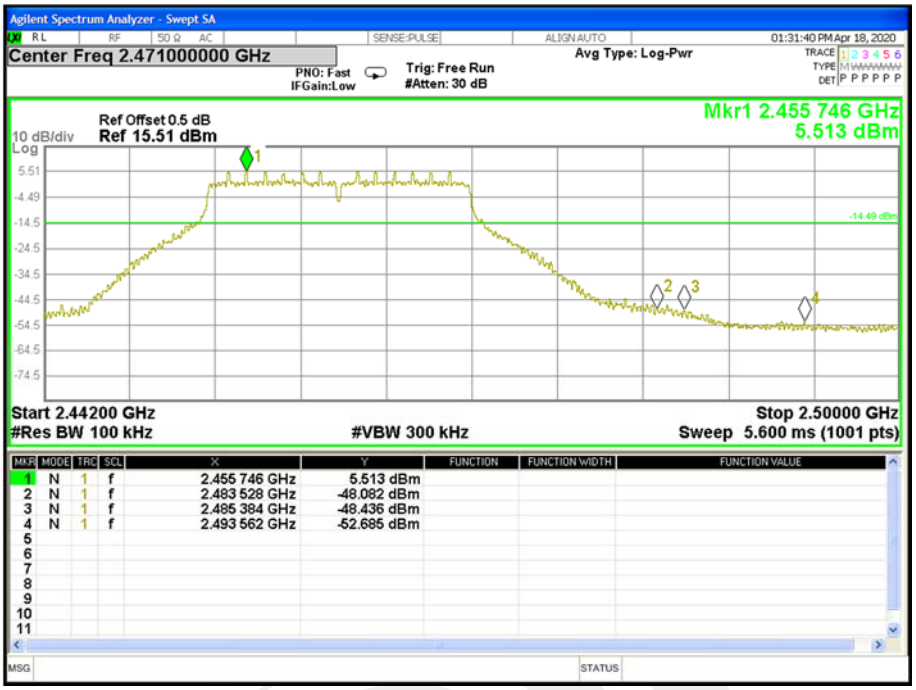
Band edge(it's also the reference level for conducted spurious emission)

CH 01



CH 06

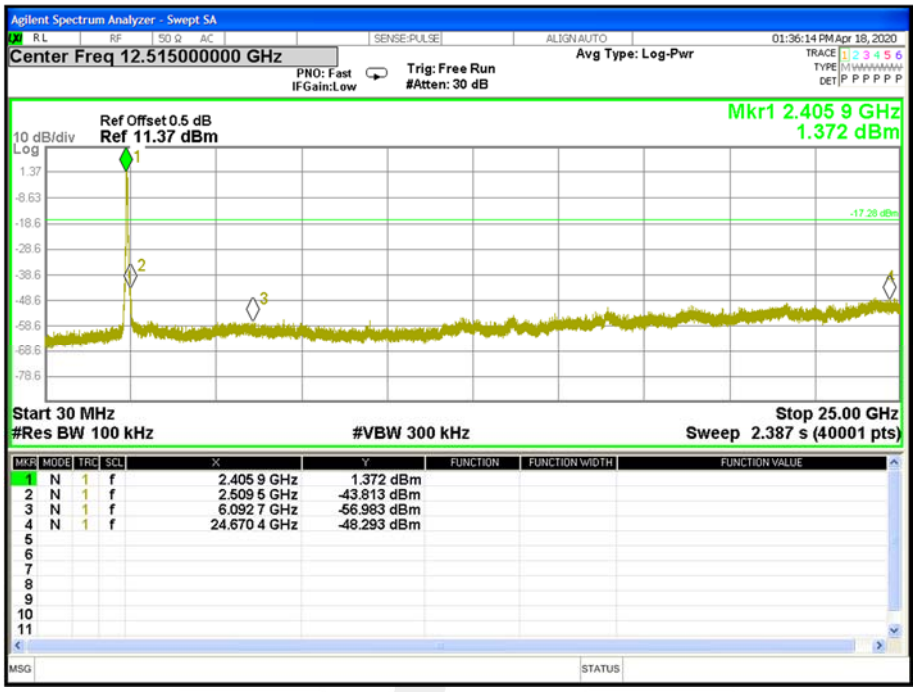
CH 11


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.471000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
01:31:40 PM Apr 18, 2020
Ref Offset 0.5 dB
10 dB/div
Ref 15.51 dBm
Mkr1 2.455 746 GHz
5.513 dBm
-14.49 dBm
Start 2.44200 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 5.600 ms (1001 pts)
1 N 1 f 2.455 746 GHz 5.513 dBm
2 N 1 f 2.483 528 GHz -48.082 dBm
3 N 1 f 2.485 384 GHz -48.436 dBm
4 N 1 f 2.493 562 GHz -52.685 dBm

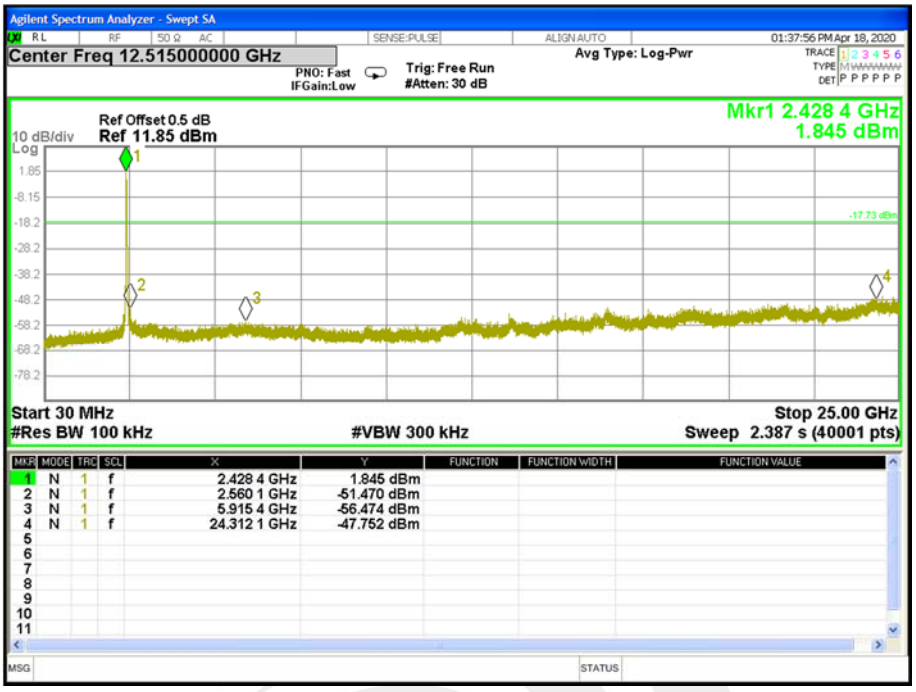
Temperature:	25℃	Relative Humidity:	60%
Test Voltage:	DC 15.4V	Test Mode:	TX n Mode(40M) /CH03, CH06, CH09

Antenna B

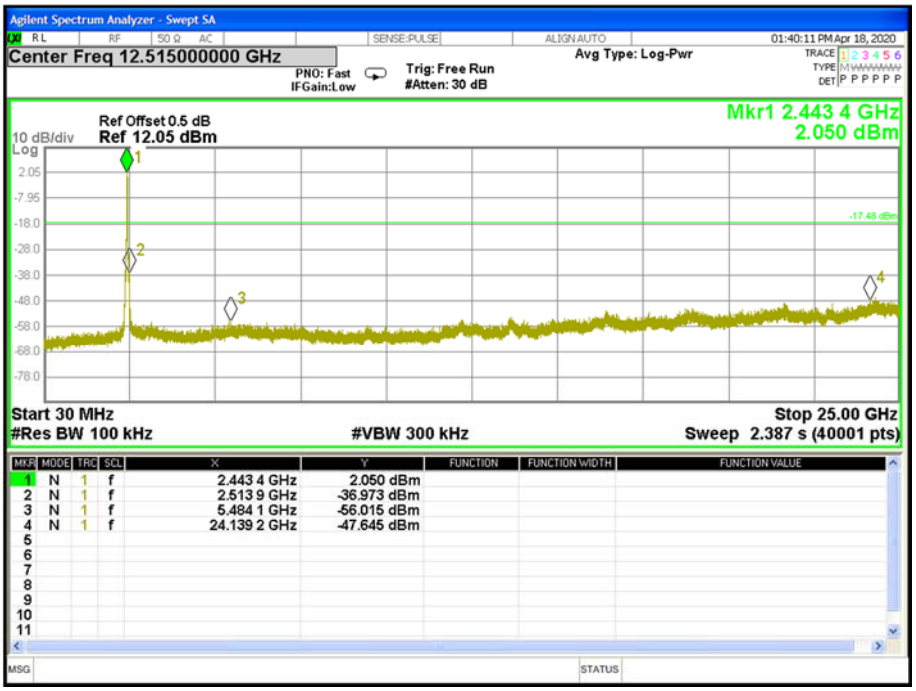
CH 03



CH06

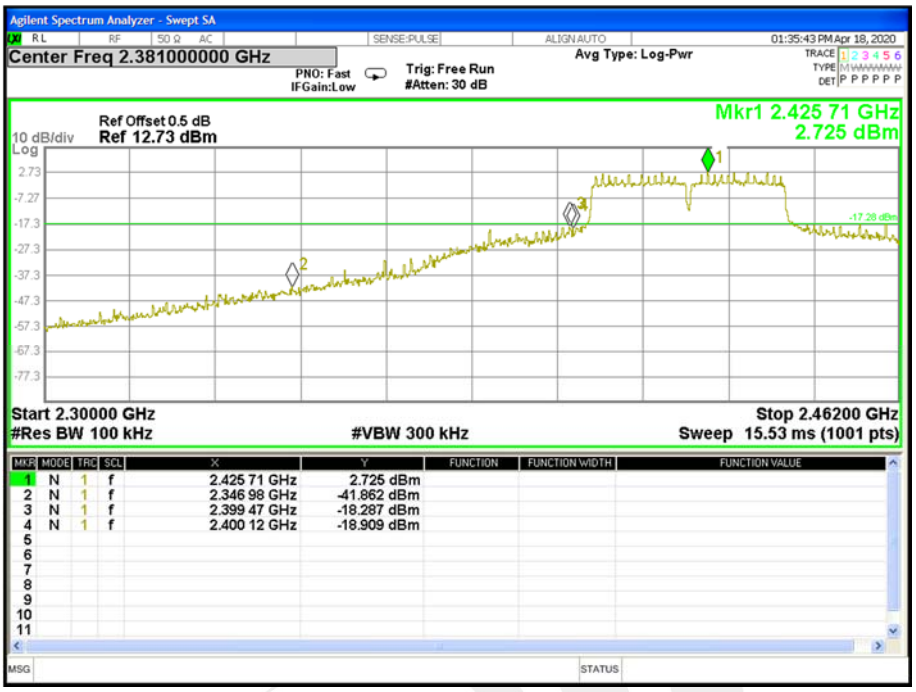

Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
01:37:56 PM Apr 18, 2020
Ref Offset 0.5 dB
10 dB/div
Ref 11.85 dBm
Mkr1 2.428 4 GHz
1.845 dBm
-17.73 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.387 s (40001 pts)
1 N 1 f 2.428 4 GHz 1.845 dBm
2 N 1 f 2.560 1 GHz -51.470 dBm
3 N 1 f 5.915 4 GHz -56.474 dBm
4 N 1 f 24.312 1 GHz -47.752 dBm

CH09


Agilent Spectrum Analyzer - Swept SA
Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
01:40:11 PM Apr 18, 2020
Ref Offset 0.5 dB
10 dB/div
Ref 12.05 dBm
Mkr1 2.443 4 GHz
2.050 dBm
-17.48 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.387 s (40001 pts)
1 N 1 f 2.443 4 GHz 2.050 dBm
2 N 1 f 2.513 9 GHz -36.973 dBm
3 N 1 f 5.484 1 GHz -56.015 dBm
4 N 1 f 24.139 2 GHz -47.645 dBm

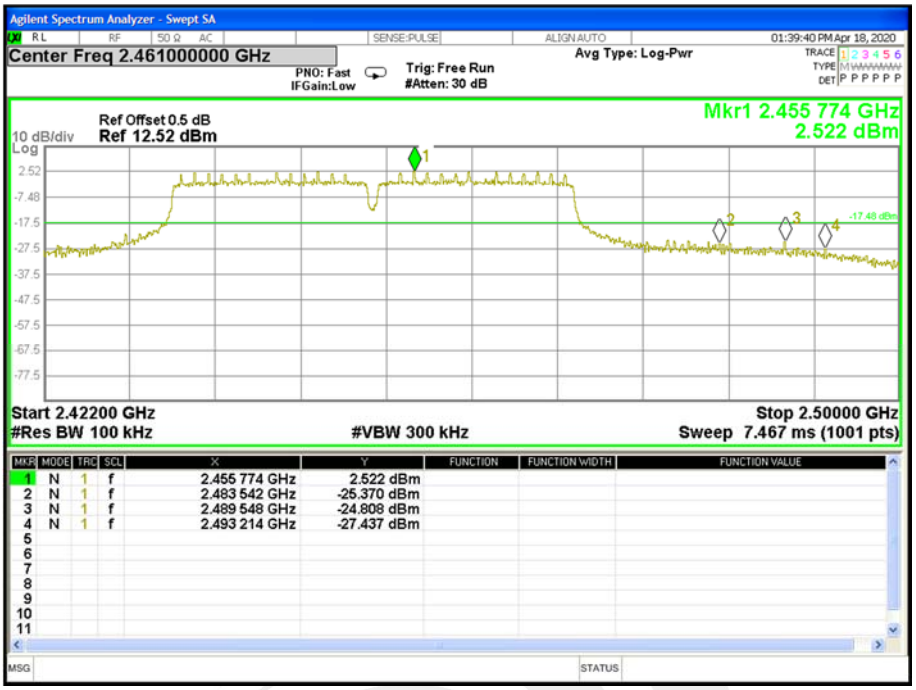
Band edge(it's also the reference level for conducted spurious emission)

CH03



CH 06

CH 09


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.461000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
01:39:40 PM Apr 18, 2020
Ref Offset 0.5 dB
10 dB/div
Ref 12.52 dBm
Mkr1 2.455 774 GHz
2.522 dBm
-17.48 dBm
Start 2.42200 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.50000 GHz
Sweep 7.467 ms (1001 pts)
1 N 1 f 2.455 774 GHz 2.522 dBm
2 N 1 f 2.483 542 GHz -25.370 dBm
3 N 1 f 2.489 548 GHz -24.808 dBm
4 N 1 f 2.493 214 GHz -27.437 dBm

5. POWER SPECTRAL DENSITY TEST

5.1 LIMIT

FCC Part15.247 , Subpart C RSS-247 Issue 2				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(e) RSS-247 Issue 2	Power Spectral Density	≤8 dBm (RBW ≥3KHz)	2400-2483.5	PASS

5.2 TEST PROCEDURE

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS channel bandwidth.
3. Set the 100 kHz ≥ RBW ≥3 kHz.
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

5.3 DEVIATION FROM STANDARD

No deviation.

5.4 TEST SETUP

5.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

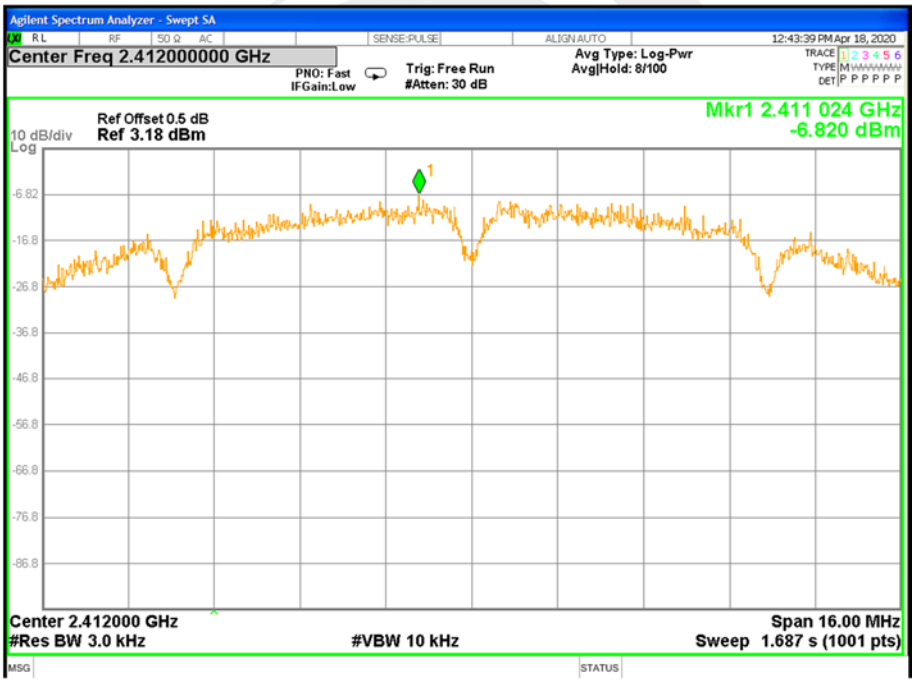
5.6 TEST RESULTS

Temperature:	25℃	Relative Humidity:	60%
Test Voltage:	DC 15.4V	Test Mode:	TX b Mode /CH01, CH06, CH11

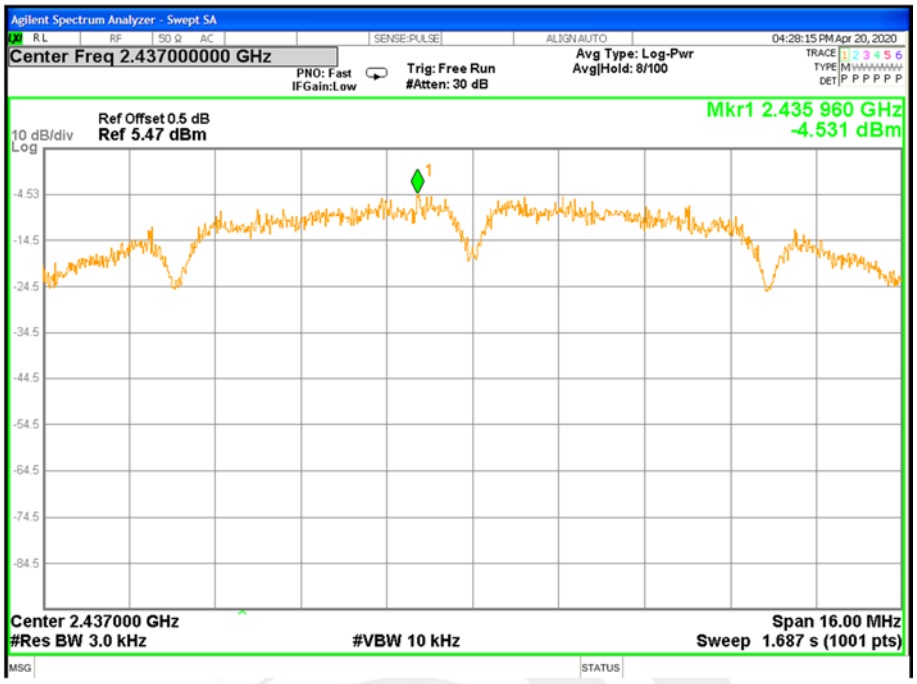
Frequency	Power Density			Limit	Result
	ANT A (dBm)	ANT B (dBm)	TOTAL (dBm)	(dBm)	
2412	-6.820	-4.167	--	8	PASS
2437	-4.531	-3.057	--	8	PASS
2462	-4.853	-4.250	--	8	PASS

Test plots for Ant A

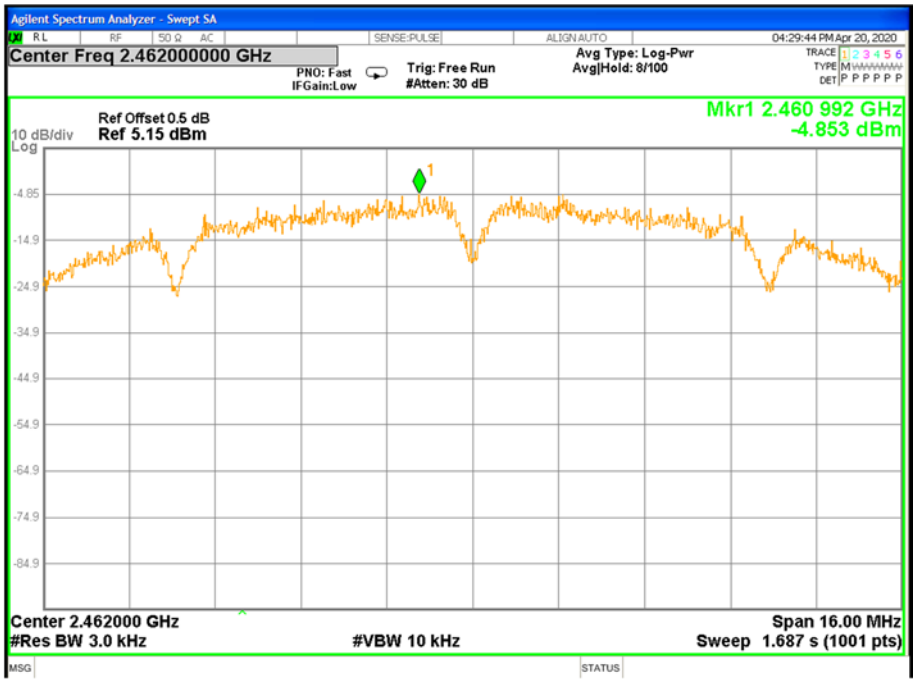
TX CH01



TX CH06

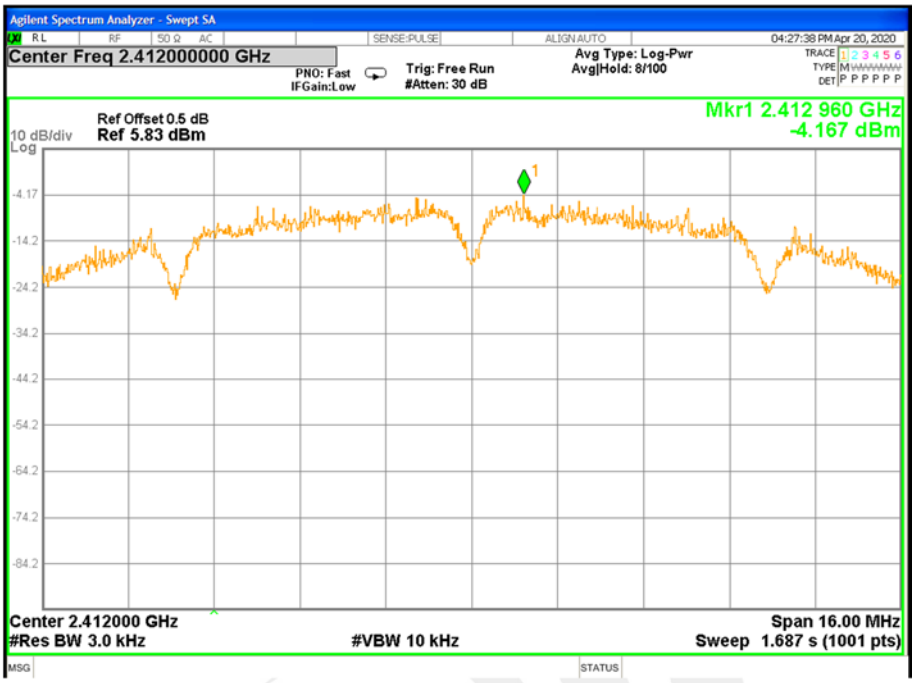


TX CH11

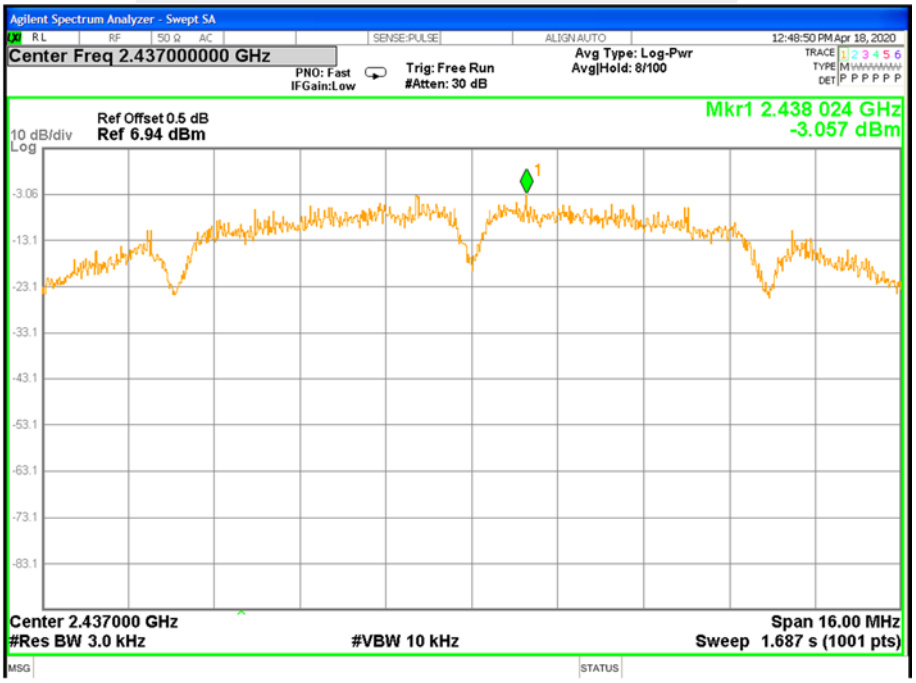


Test plots for Ant B

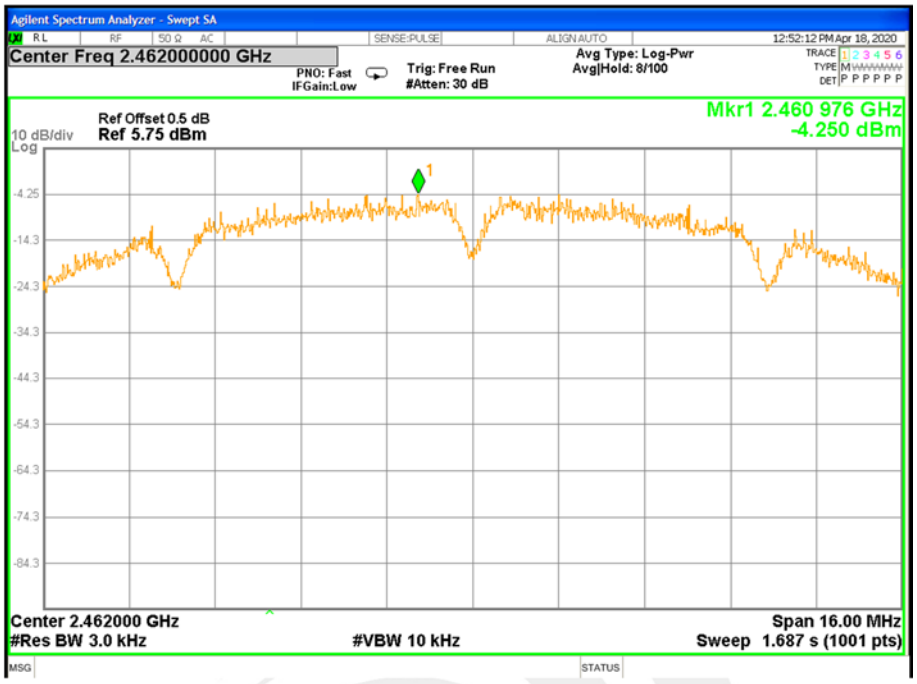
TX CH01



TX CH06



TX CH11

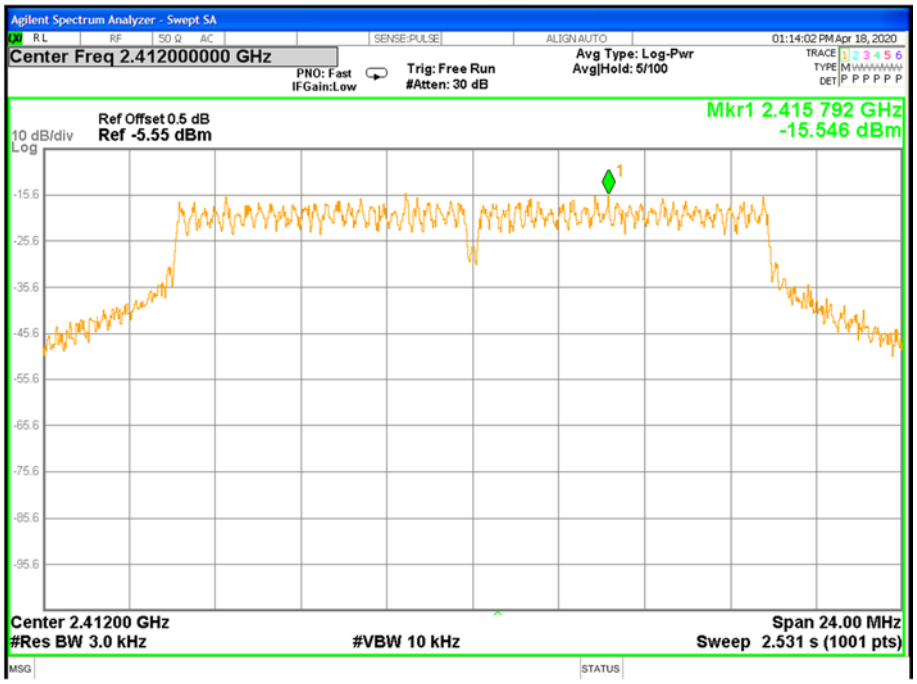

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.462000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 8/100
12:52:12 PM Apr 18, 2020
Ref Offset 0.5 dB
10 dB/div
Ref 5.75 dBm
Log
Mkr1 2.460 976 GHz
-4.250 dBm
-4.25
-14.3
-24.3
-34.3
-44.3
-54.3
-64.3
-74.3
-84.3
Center 2.462000 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 16.00 MHz
Sweep 1.687 s (1001 pts)

Temperature:	25℃	Relative Humidity:	60%
Test Voltage:	DC 15.4V	Test Mode:	TX g Mode /CH01, CH06, CH11

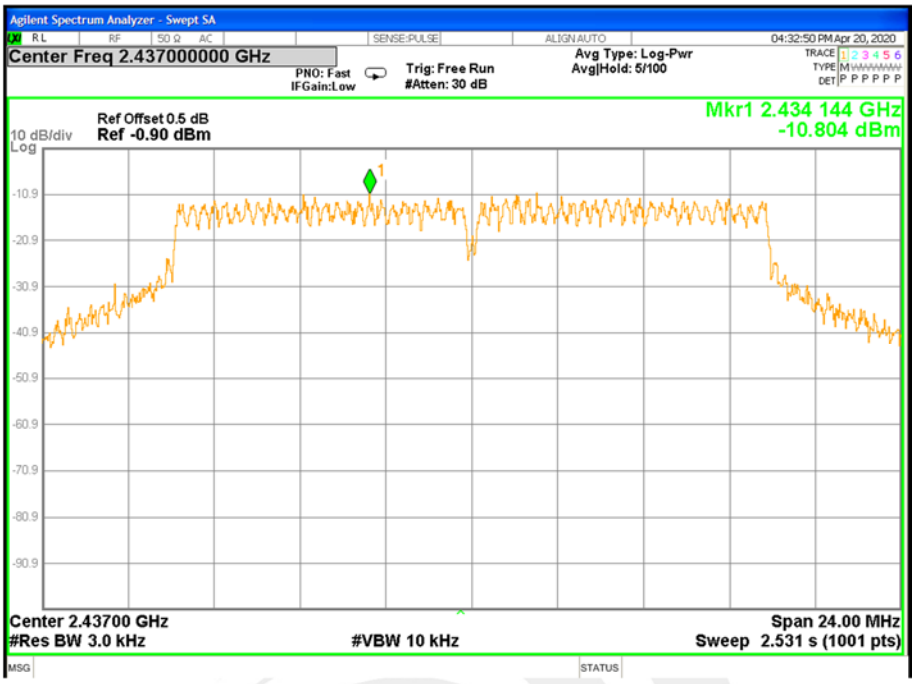
Frequency	Power Density			Limit	Result
	ANT A (dBm)	ANT B (dBm)	TOTAL (dBm)	(dBm)	
2412	-15.546	-11.062	--	8	PASS
2437	-10.804	-9.709	--	8	PASS
2462	-11.167	-10.036	--	8	PASS

Test plots for Ant A

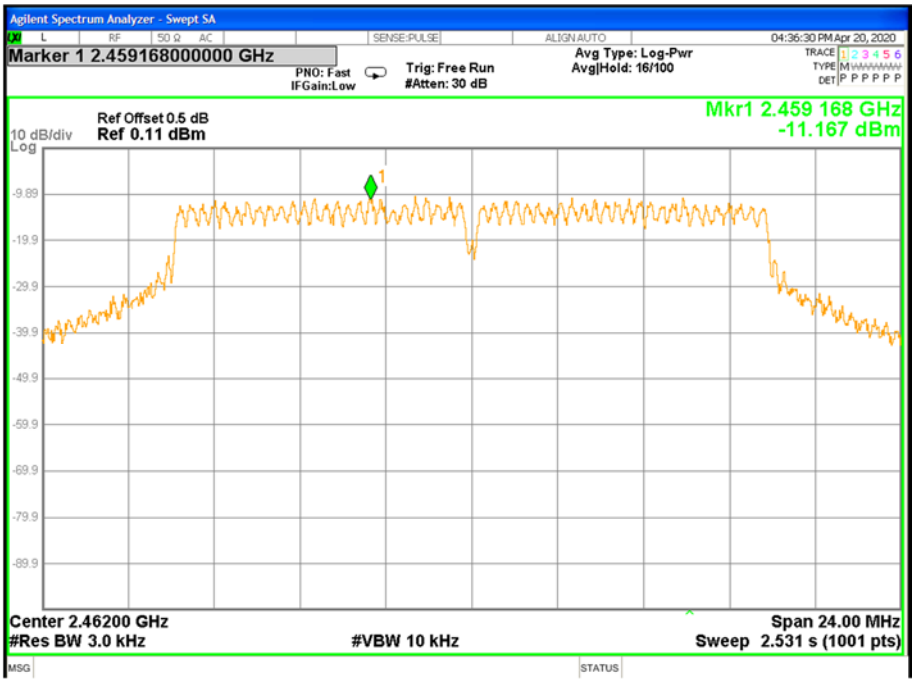
TX CH01



TX CH06

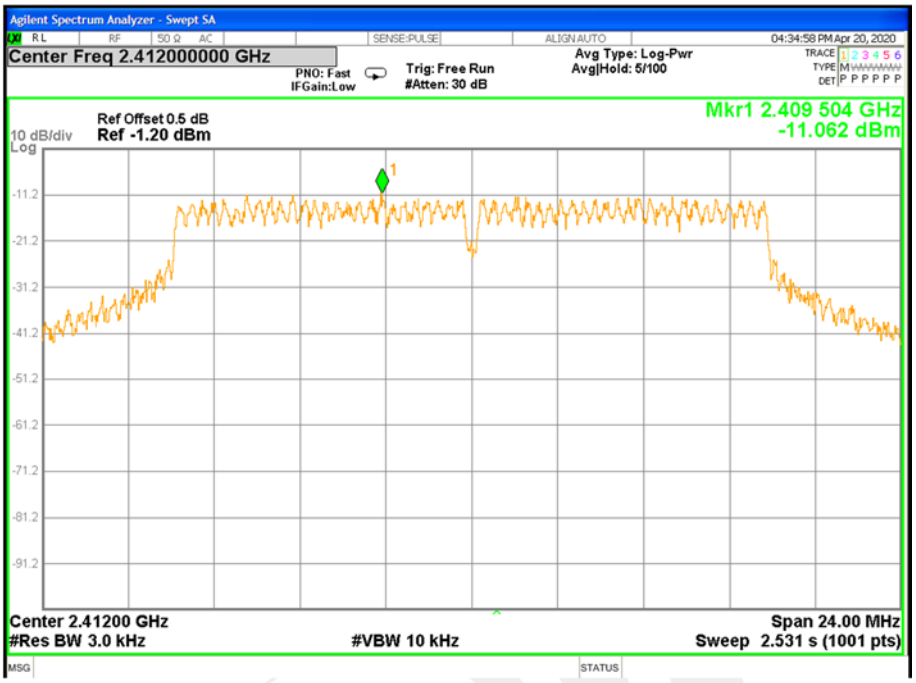


TX CH11

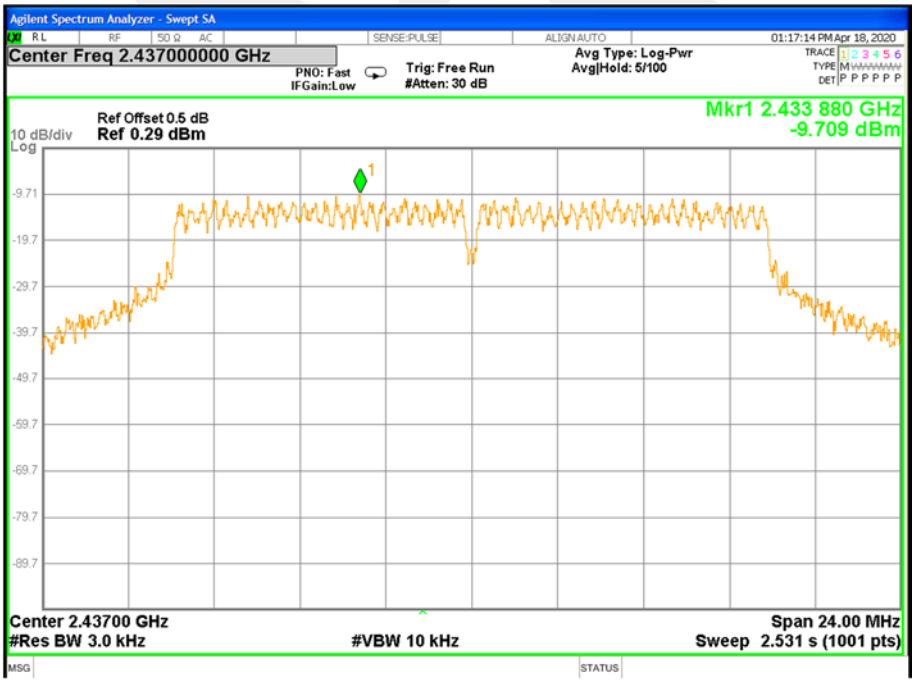


Test plots for Ant B

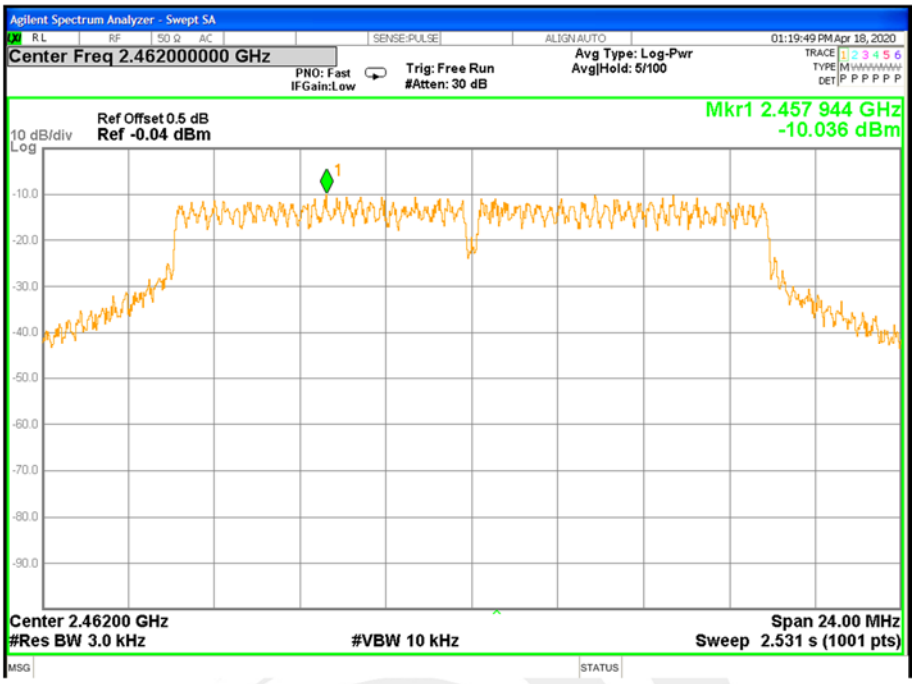
TX CH01



TX CH06



TX CH11

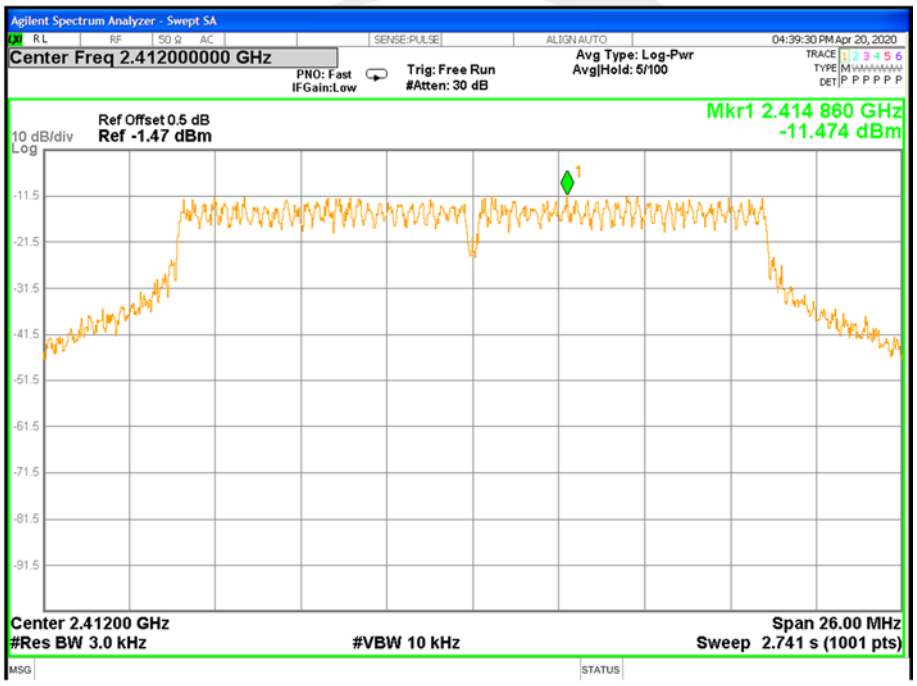

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.462000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 5/100
01:19:49 PM Apr 18, 2020
Ref Offset 0.5 dB
10 dB/div
Ref -0.04 dBm
Mkr1 2.457 944 GHz
-10.036 dBm
Center 2.46200 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 24.00 MHz
Sweep 2.531 s (1001 pts)

Temperature:	25℃	Relative Humidity:	60%
Test Voltage:	DC 15.4V	Test Mode:	TX n Mode(20M) /CH01, CH06, CH11

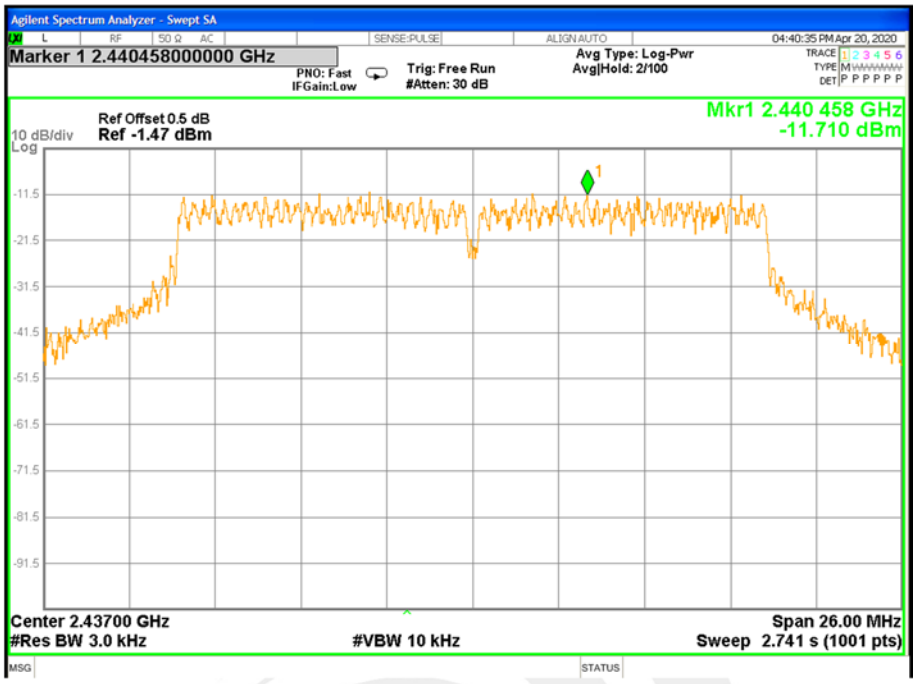
Frequency	Power Density			Limit	Result
	ANT A (dBm)	ANT B (dBm)	TOTAL (dBm)	(dBm)	
2412	-11.474	-10.179	-7.77	8	PASS
2437	-11.710	-9.782	-7.63	8	PASS
2462	-11.613	-8.589	-6.83	8	PASS

Test plots for Ant A

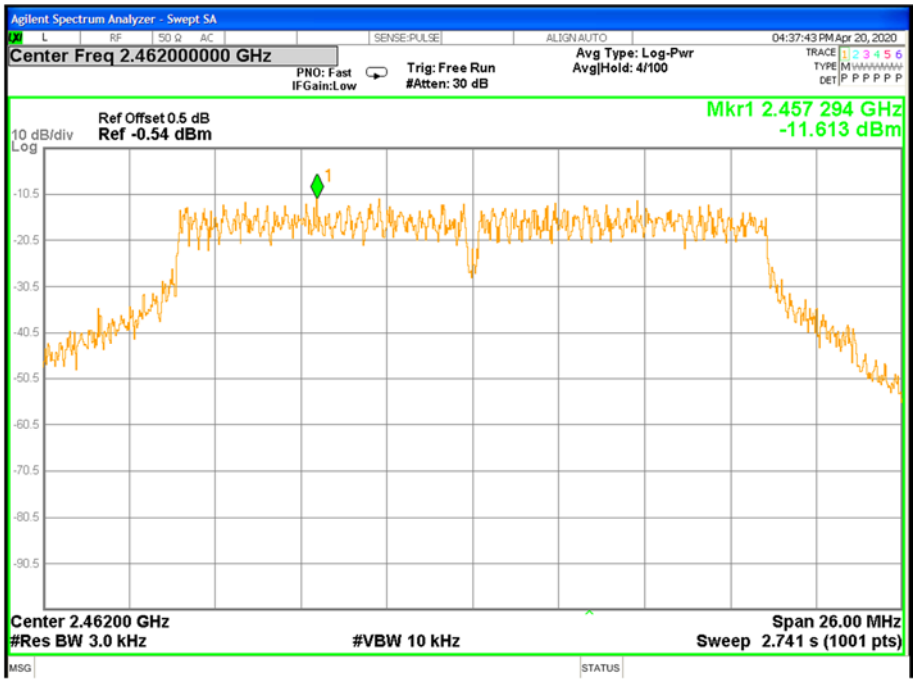
TX CH01



TX CH06

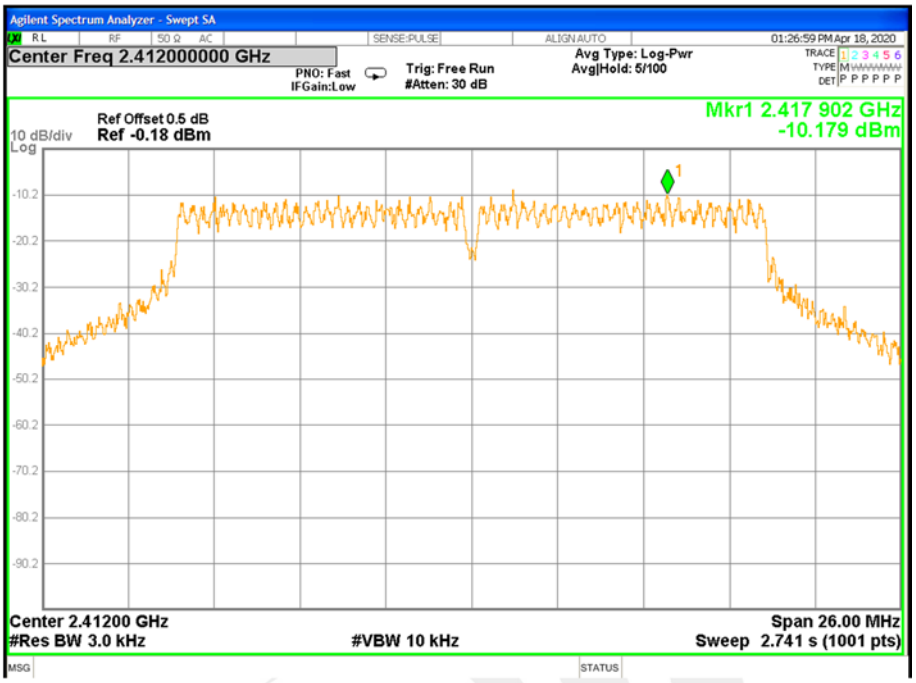


TX CH11

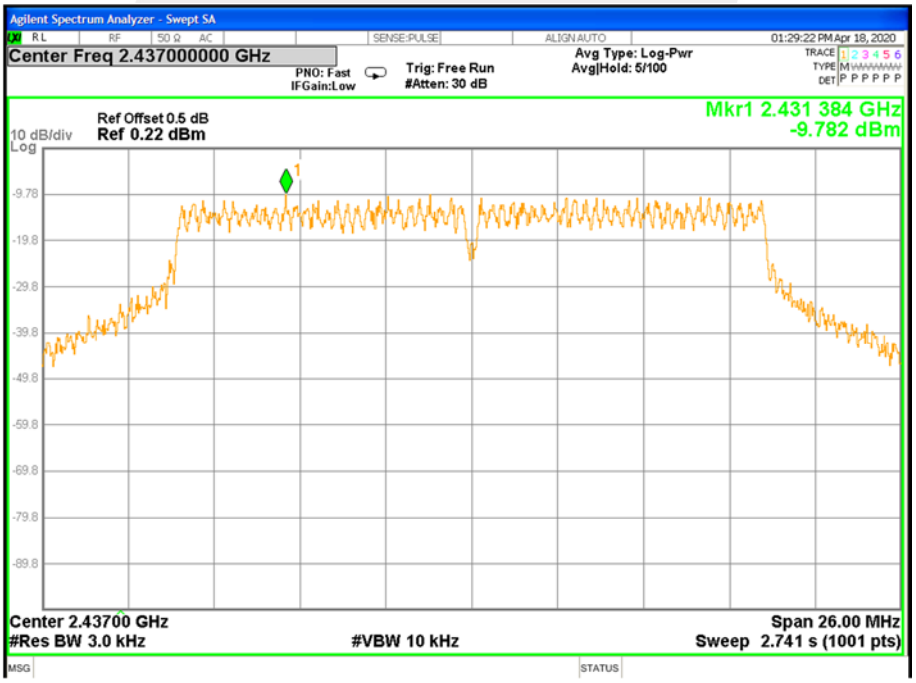


Test plots for Ant B

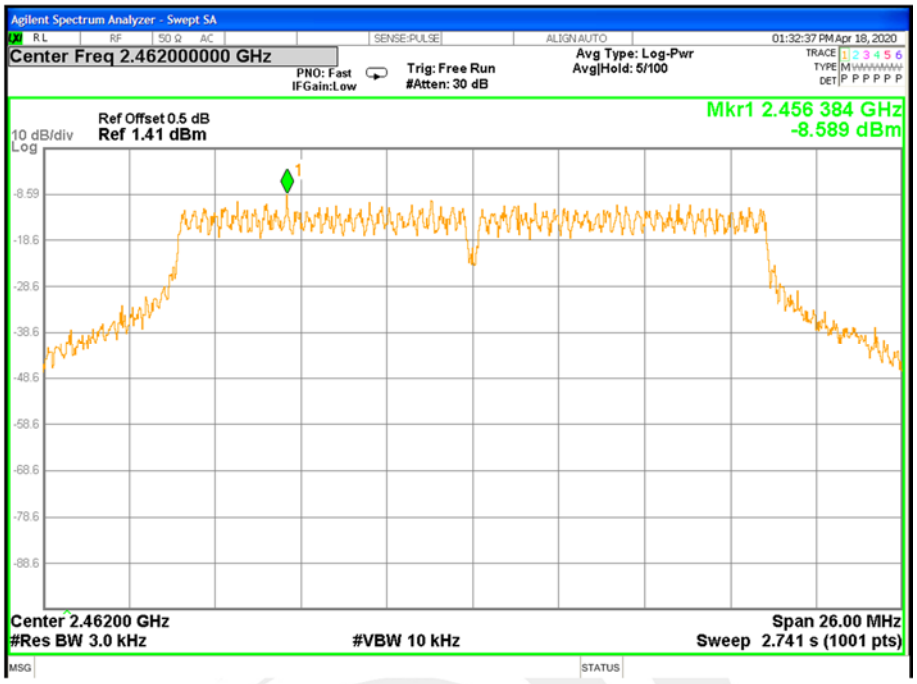
TX CH01



TX CH06



TX CH11

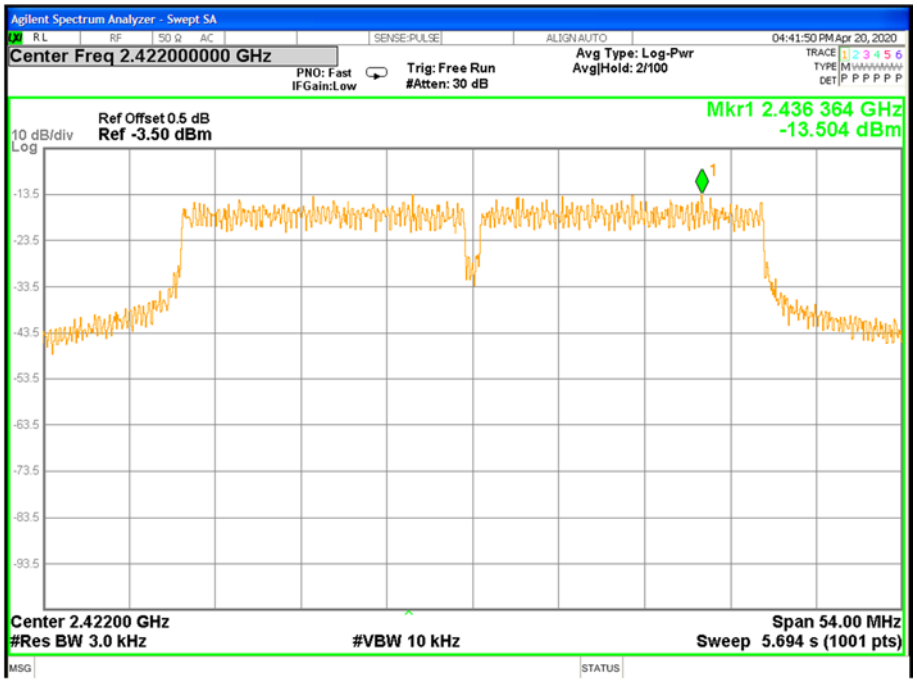

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.462000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 5/100
01:32:37 PM Apr 18, 2020
Ref Offset 0.5 dB
10 dB/div
Ref 1.41 dBm
Log
Mkr1 2.456 384 GHz
-8.589 dBm
-8.59
-18.6
-28.6
-38.6
-48.6
-58.6
-68.6
-78.6
-88.6
Center 2.46200 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 26.00 MHz
Sweep 2.741 s (1001 pts)

Temperature:	25℃	Relative Humidity:	60%
Test Voltage:	DC 15.4V	Test Mode:	TX n Mode(40M) /CH03, CH06, CH09

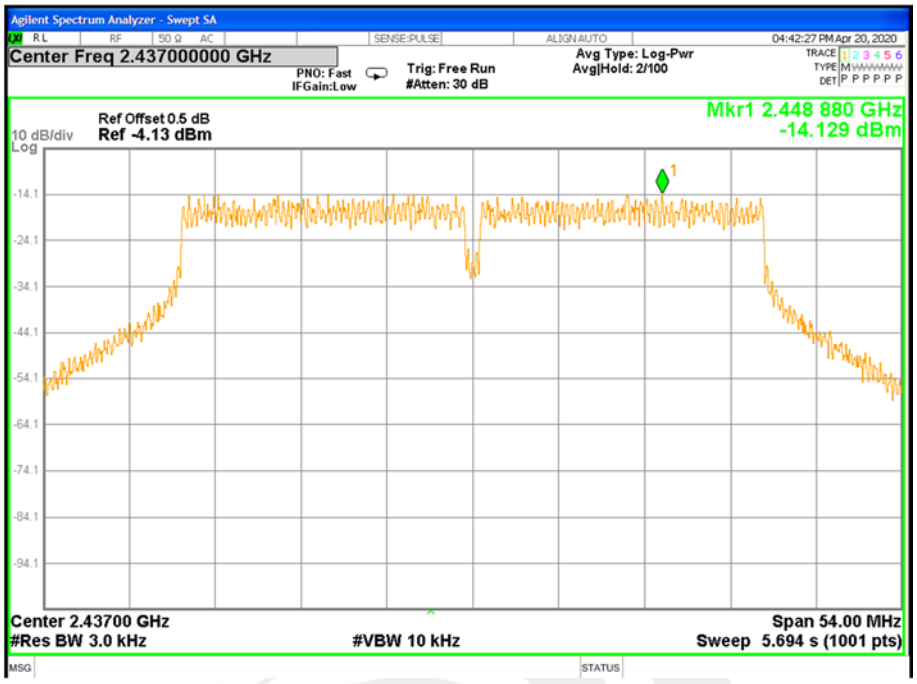
Frequency	Power Density			Limit	Result
	ANT A (dBm)	ANT B (dBm)	TOTAL (dBm)	(dBm)	
2422	-13.504	-12.417	-9.92	8	PASS
2437	-14.129	-13.071	-10.56	8	PASS
2452	-13.642	-13.229	-10.42	8	PASS

Test plots for Ant A

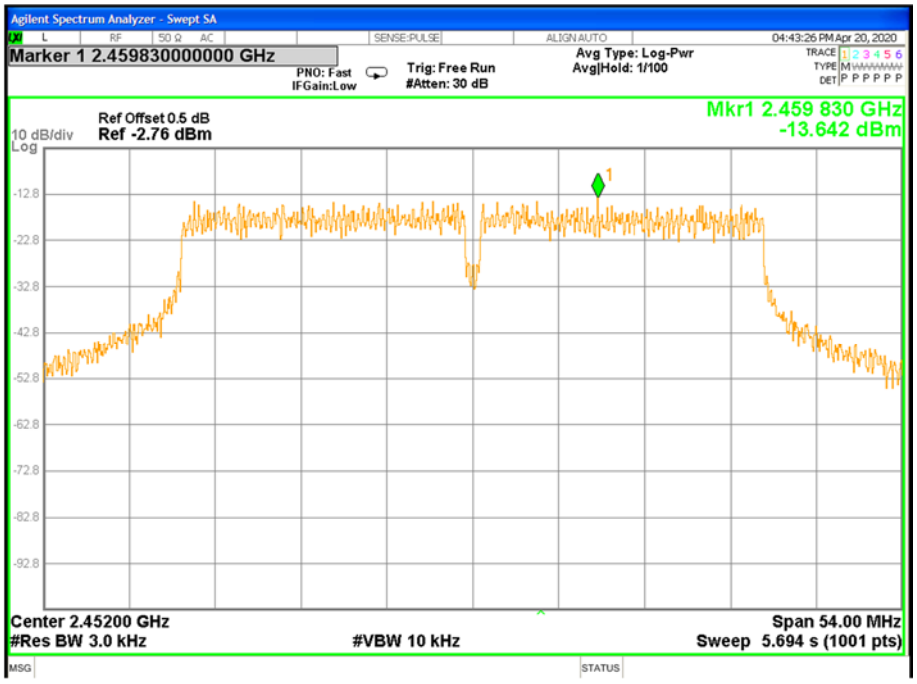
TX CH03



TX CH06

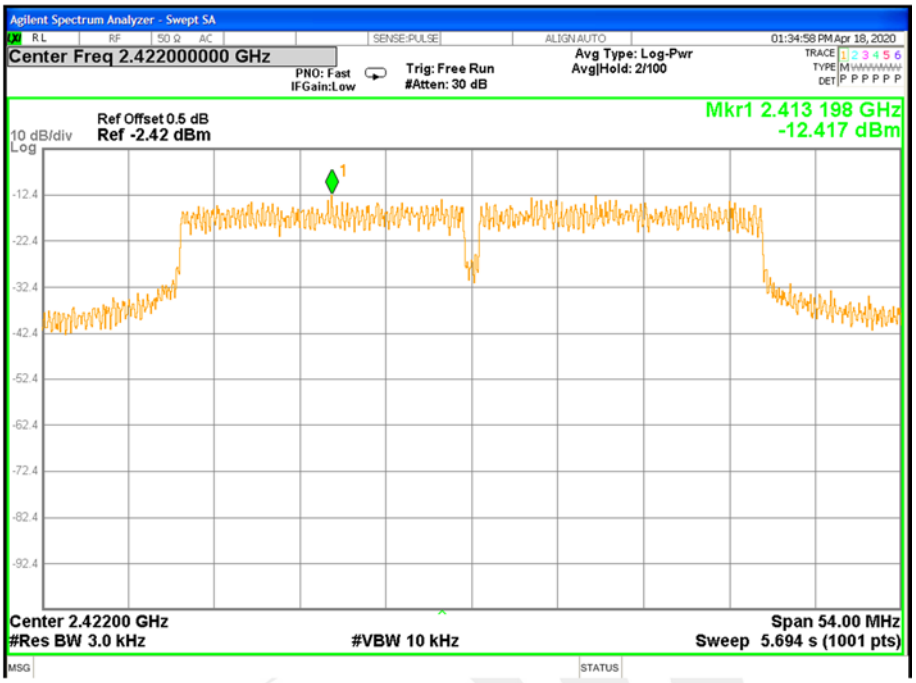


TX CH09

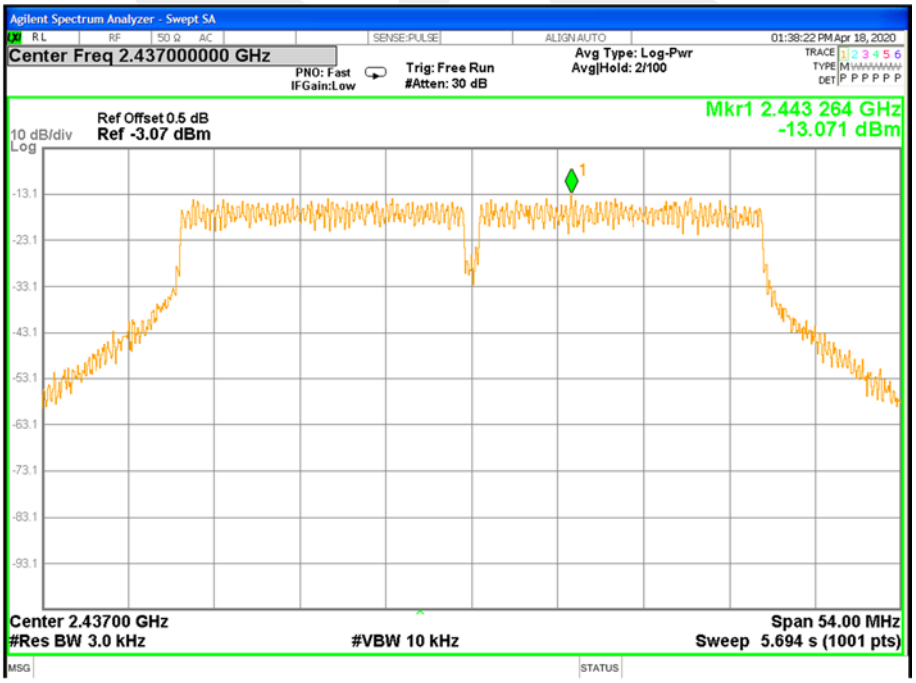


Test plots for Ant B

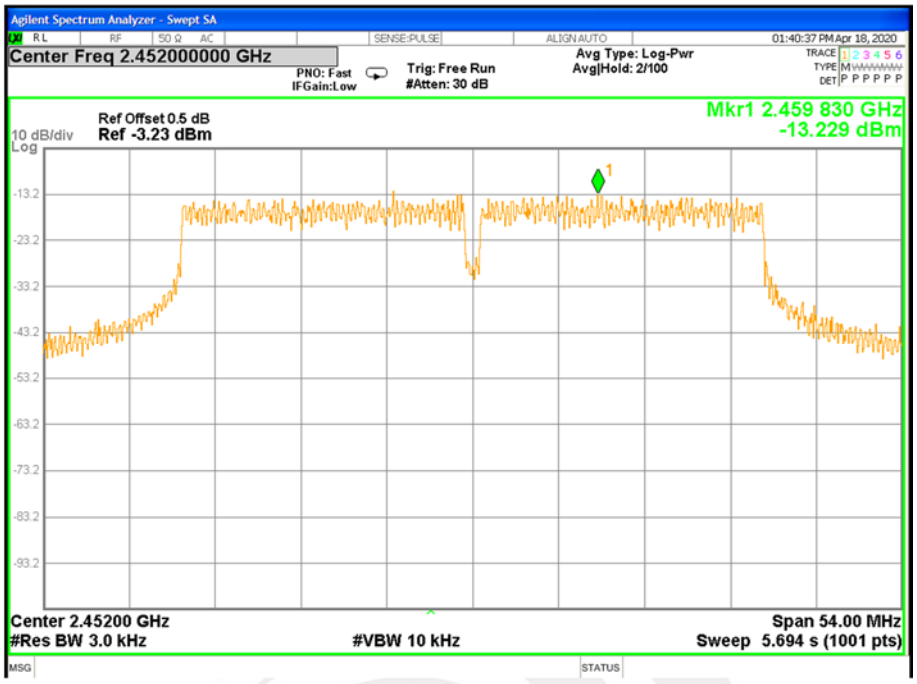
TX CH03



TX CH06



TX CH09


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.452000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 2/100
01:40:37 PM Apr 18, 2020
Ref Offset 0.5 dB
10 dB/div
Ref -3.23 dBm
Mkr1 2.459 830 GHz
-13.229 dBm
Center 2.45200 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 54.00 MHz
Sweep 5.694 s (1001 pts)

6. BANDWIDTH TEST

6.1 LIMIT

FCC Part15.247,Subpart C RSS-Gen Clause 6.7				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2) RSS-Gen Clause 6.7	Bandwidth	≥500KHz (6dB bandwidth)	2400-2483.5	PASS
RSS-Gen Clause 6.7	99% Bandwidth	For reporting purposes only.	2400-2483.5	PASS

6.2 TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

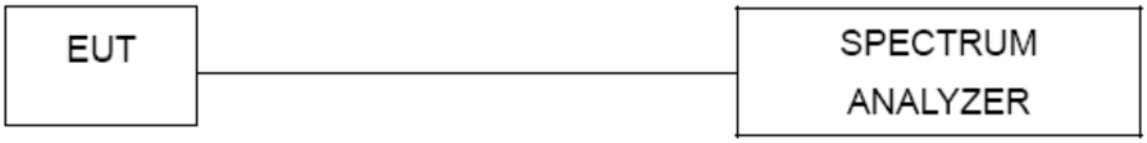
Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	For 6 dB Bandwidth :100KHz For 99% Bandwidth :1% to 5% of the occupied bandwidth
VBW	For 6dB Bandwidth : ≥3 × RBW For 99% Bandwidth : approximately 3×RBW
Trace	Max hold
Sweep	Auto

Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB and 99% relative to the maximum level measured in the fundamental emission.

6.3 DEVIATION FROM STANDARD

No deviation.

6.4 TEST SETUP



6.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

6.6 TEST RESULTS

Note: Antenna B Power> Antenna A Power, Both antenna A and B have been test, Only show the worst data of Antenna B

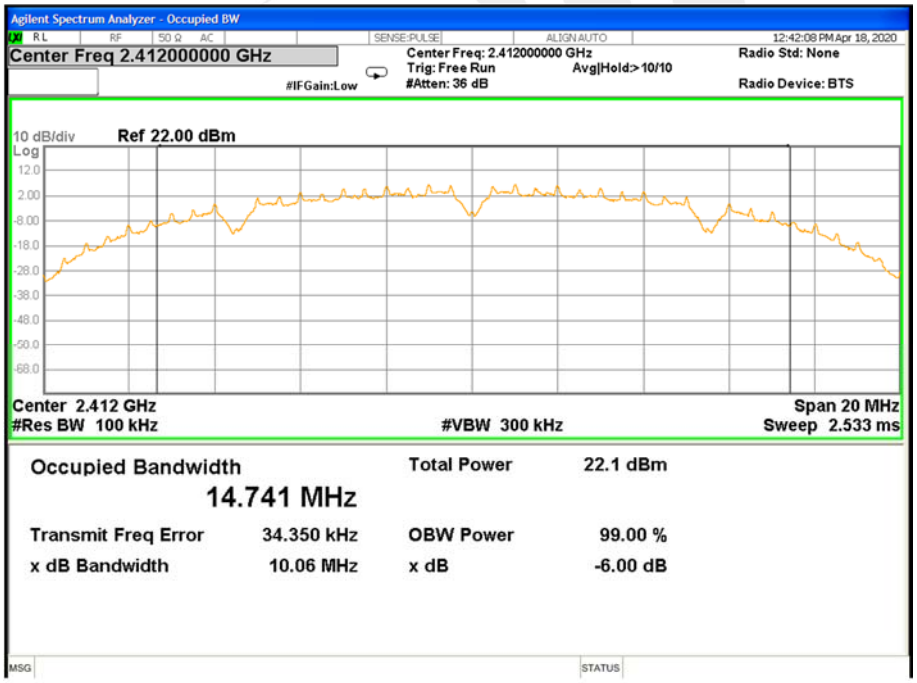
Temperature:	25℃	Relative Humidity:	60%
Test Voltage:	DC 15.4V	Test Mode:	TX b Mode /CH01, CH06, CH11

Remark: PEAK DETECTOR IS USED

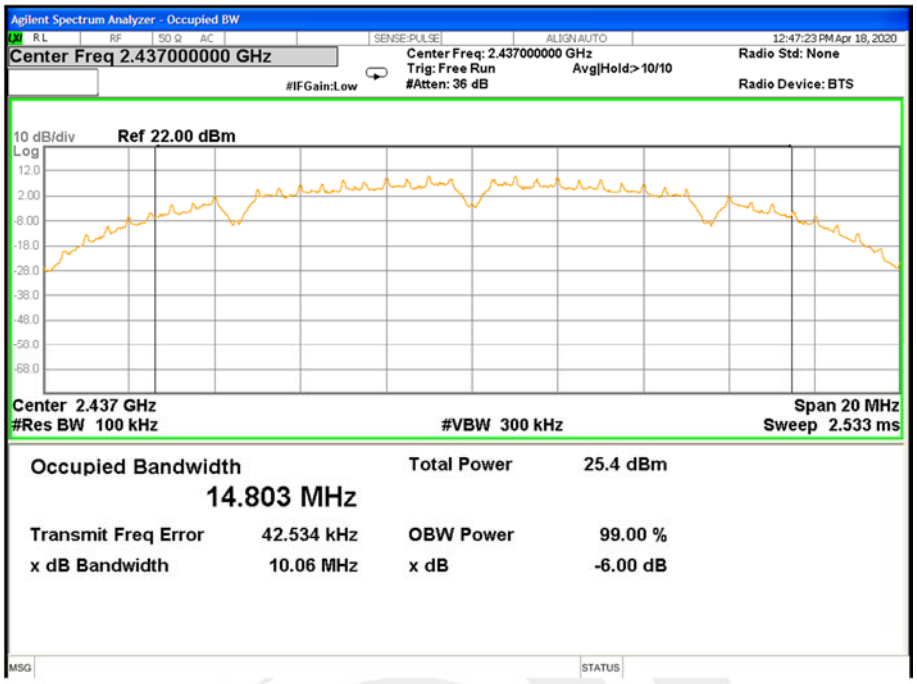
Frequency	6dB Bandwidth	99% Bandwidth	Channel Separation	Result
	(MHz)	(MHz)	(KHz)	
2412 MHz	10.06	15.057	≥500KHz	PASS
2437 MHz	10.06	14.794	≥500KHz	PASS
2462 MHz	10.05	14.432	≥500KHz	PASS

Antenna B

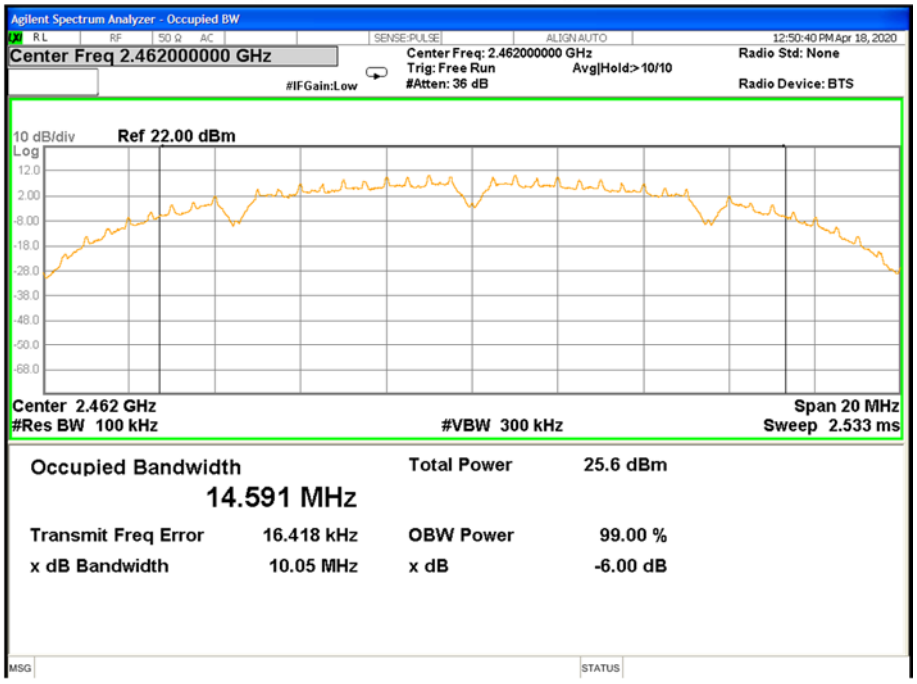
6dB Bandwidth TX CH 01



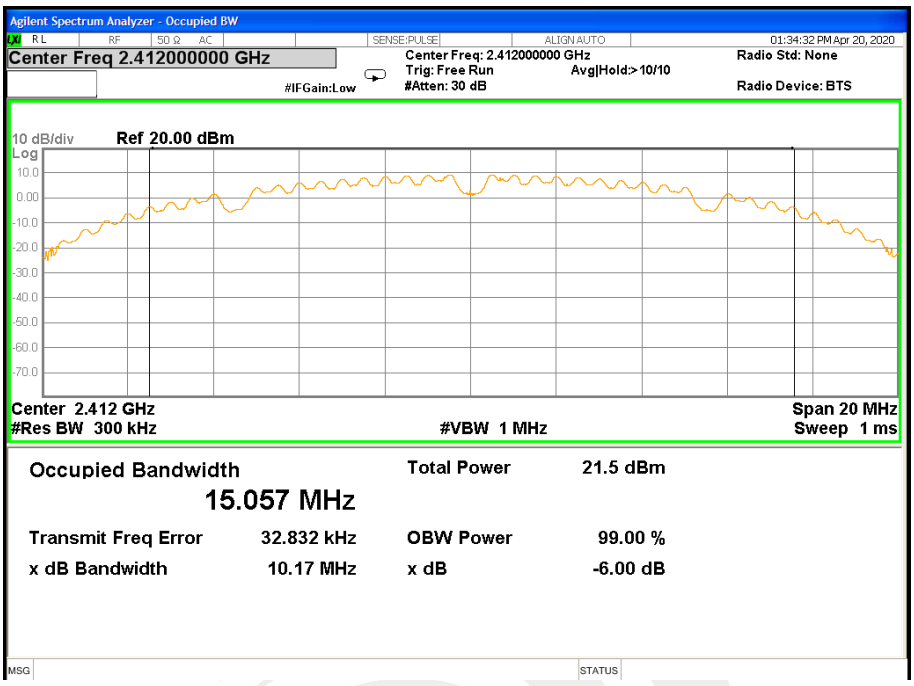
6dB Bandwidth TX CH 06



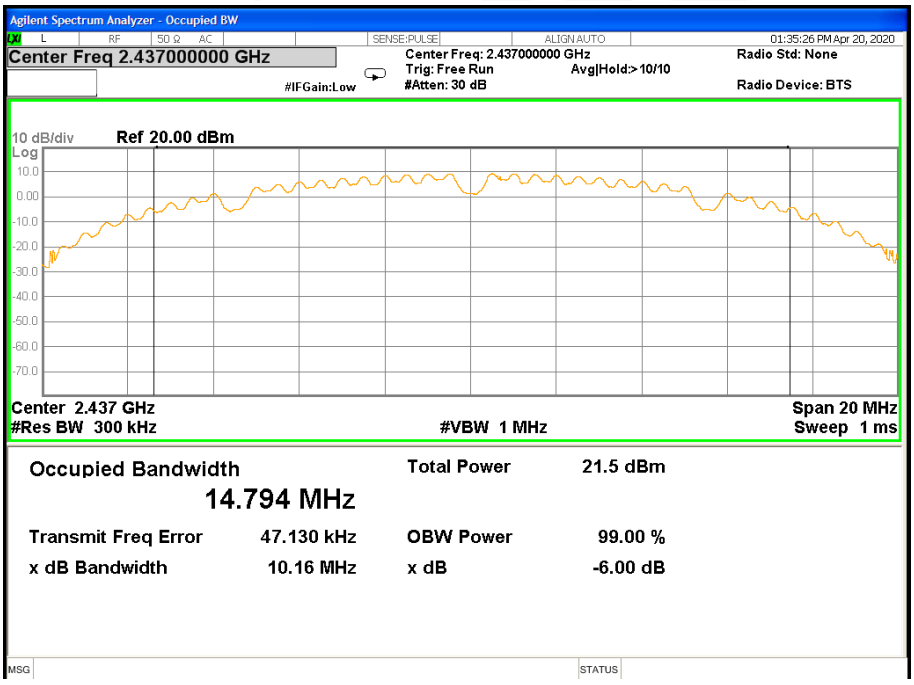
6dB Bandwidth TX CH 11



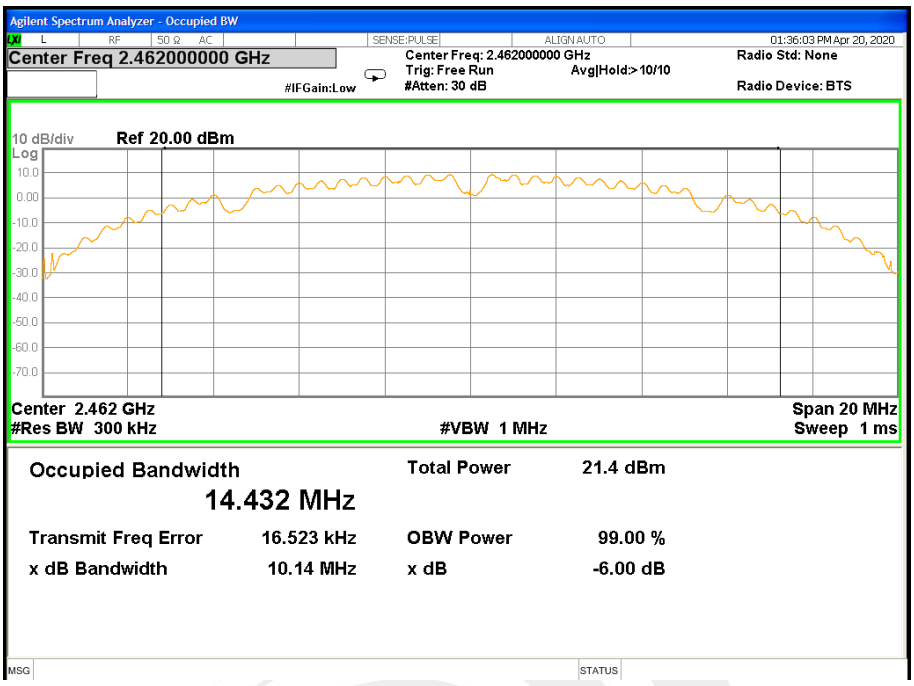
99% Bandwidth TX CH 01



99% Bandwidth TX CH 06



99% Bandwidth TX CH 11

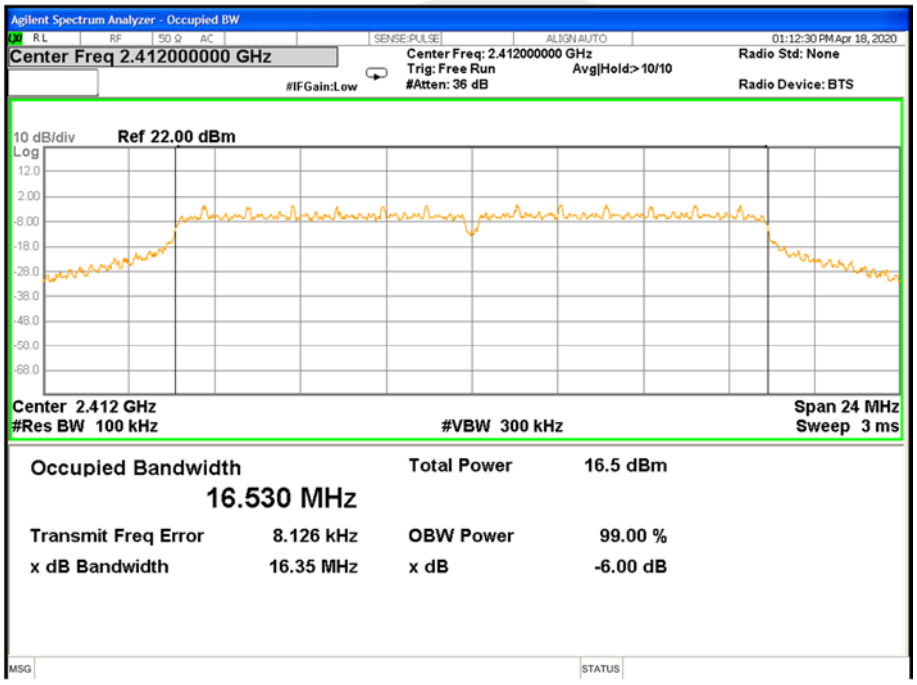


Temperature:	25℃	Relative Humidity:	60%
Test Voltage:	DC 15.4V	Test Mode:	TX g Mode /CH01, CH06, CH11

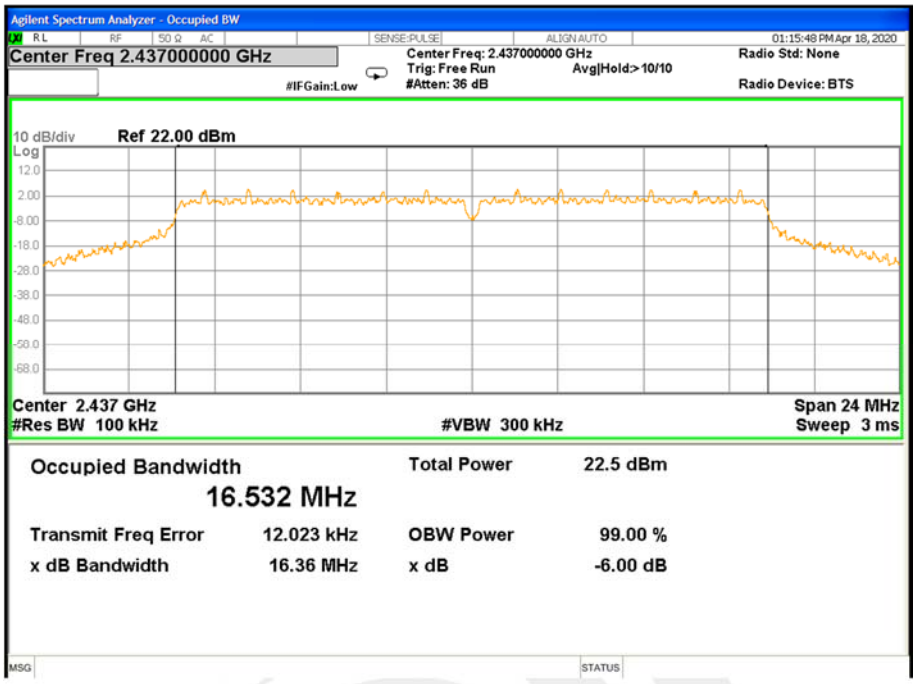
Frequency	6dB Bandwidth	99% Bandwidth	Channel Separation	Result
	(MHz)	(MHz)	(KHz)	
2412 MHz	16.35	16.879	≥500KHz	PASS
2437 MHz	16.36	16.844	≥500KHz	PASS
2462 MHz	16.36	16.859	≥500KHz	PASS

Antenna B

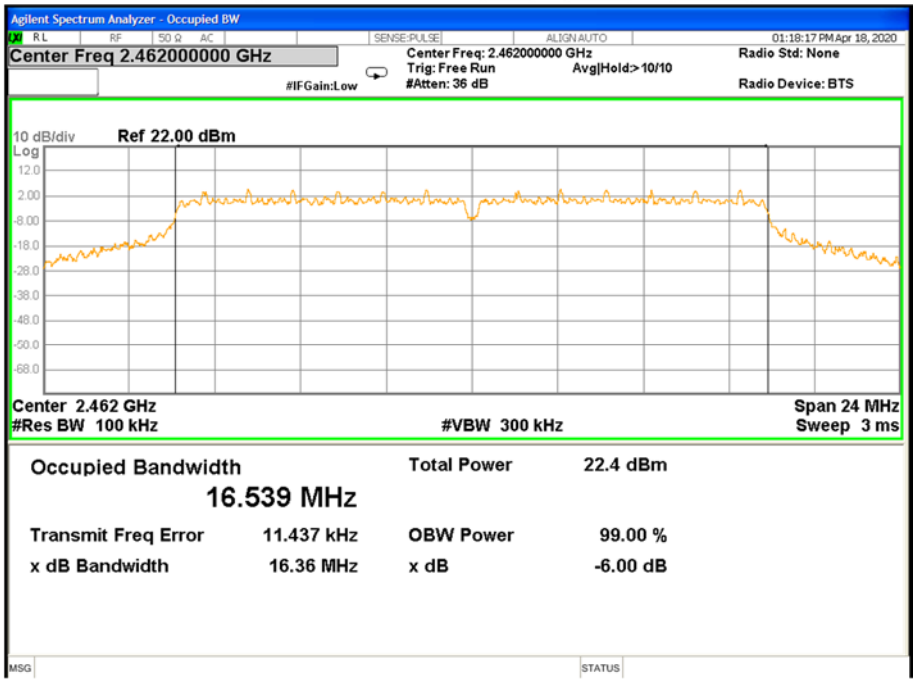
6dB Bandwidth TX CH 01



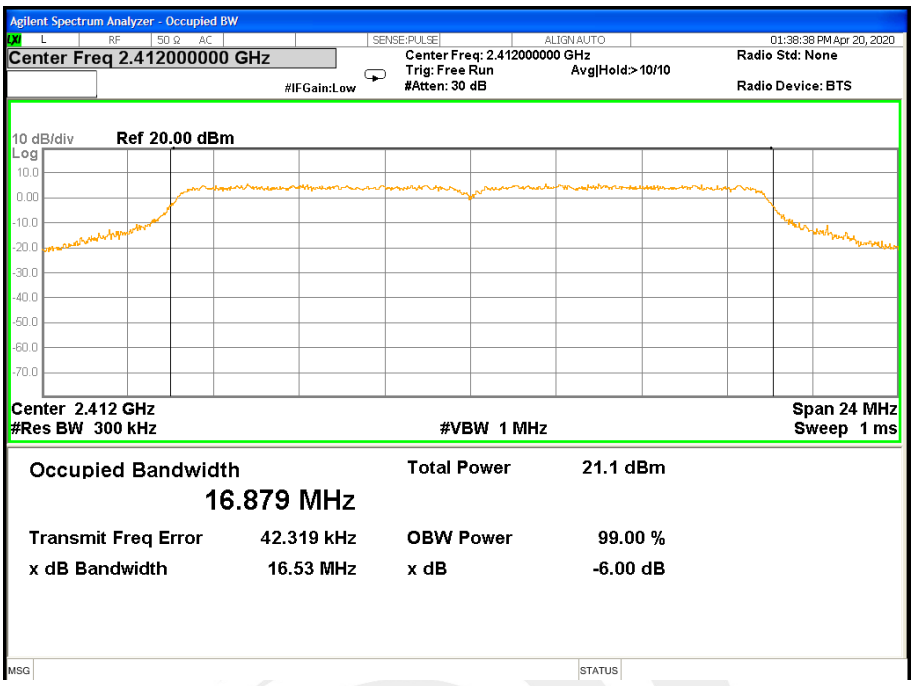
6dB Bandwidth TX CH 06



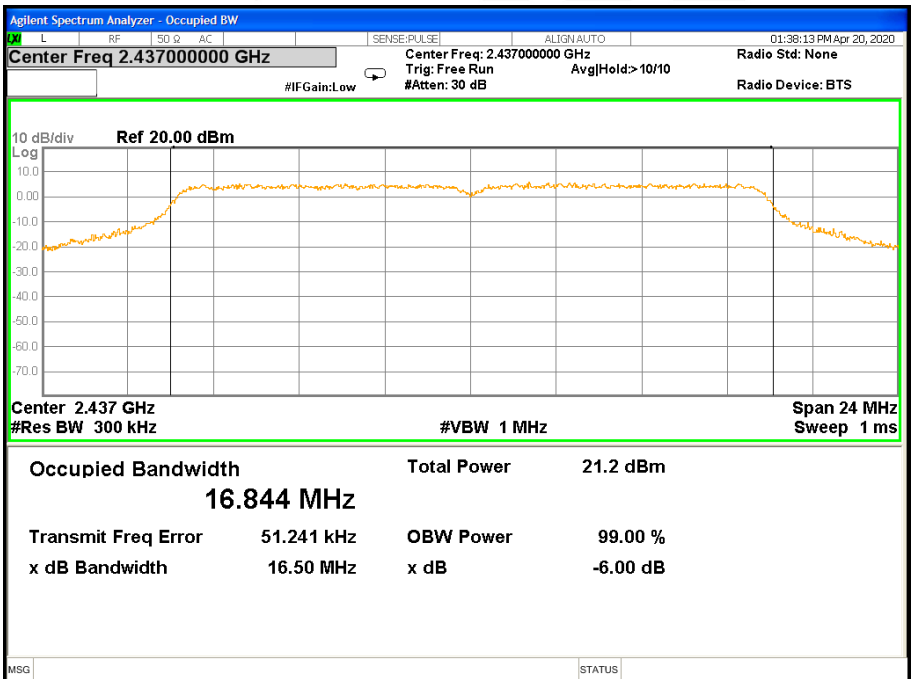
6dB Bandwidth TX CH 11



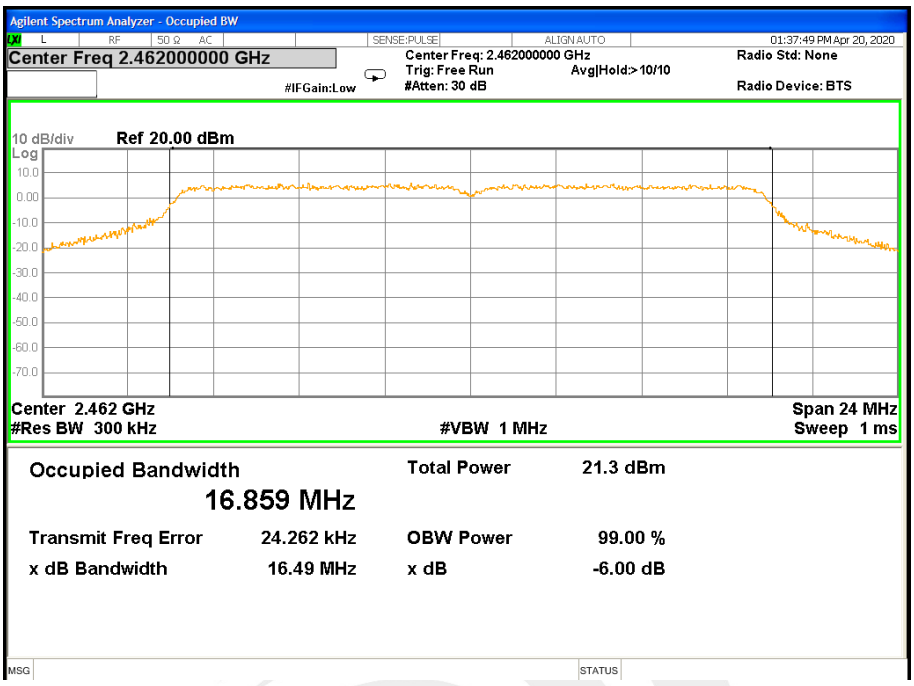
99% Bandwidth TX CH 01



99% Bandwidth TX CH 06



99% Bandwidth TX CH 11

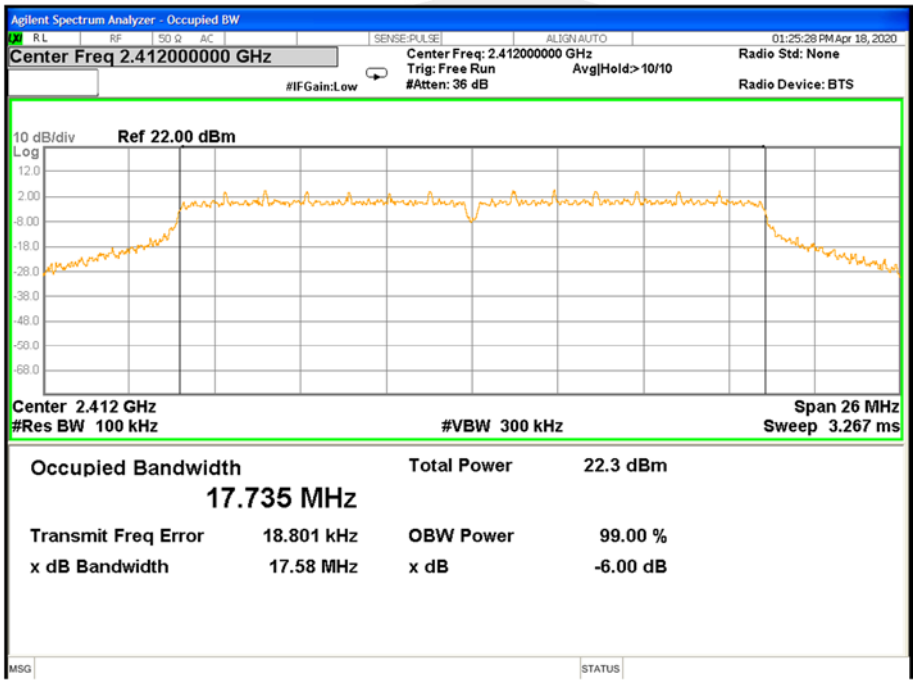


Temperature:	25℃	Relative Humidity:	60%
Test Voltage:	DC 15.4V	Test Mode:	TX n Mode(20M) /CH01, CH06, CH11

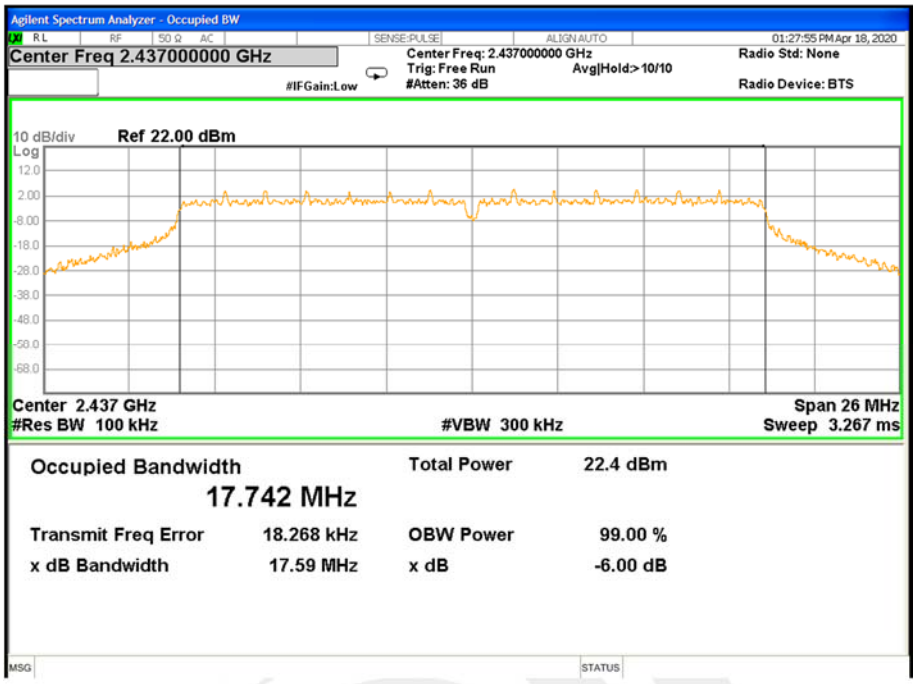
Frequency	6dB Bandwidth	99% Bandwidth	Channel Separation	Result
	(MHz)	(MHz)	(KHz)	
2412 MHz	17.58	18.005	≥500KHz	PASS
2437 MHz	17.59	17.998	≥500KHz	PASS
2462 MHz	17.59	17.996	≥500KHz	PASS

Antenna B

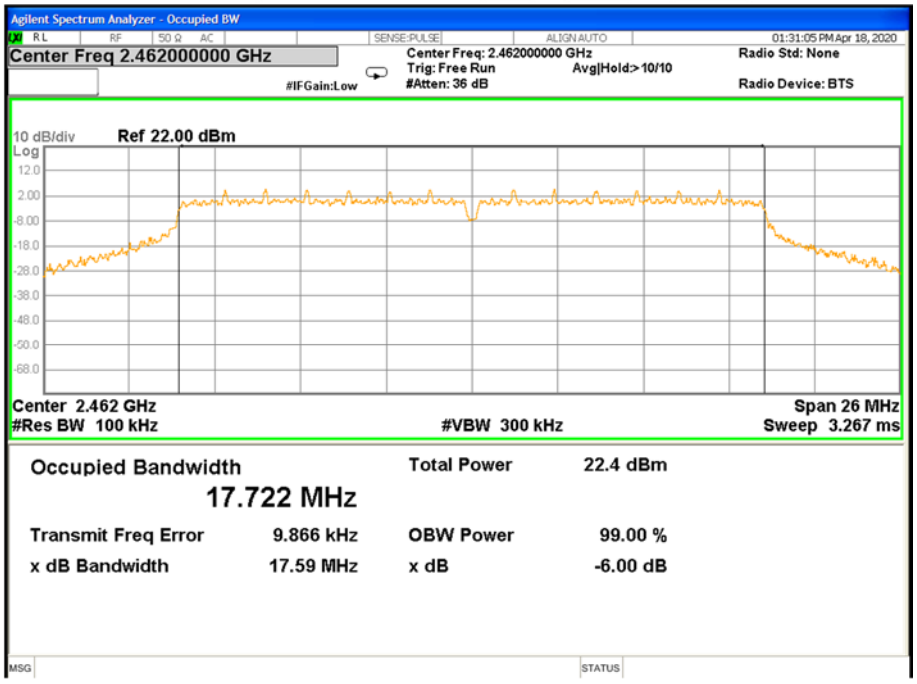
6dB Bandwidth TX CH 01



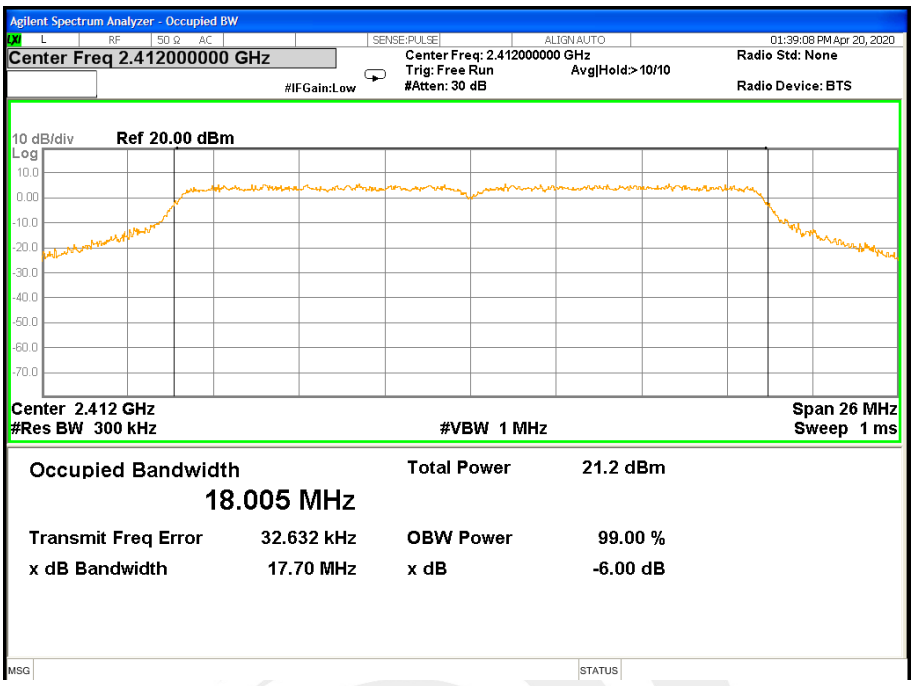
6dB Bandwidth TX CH 06



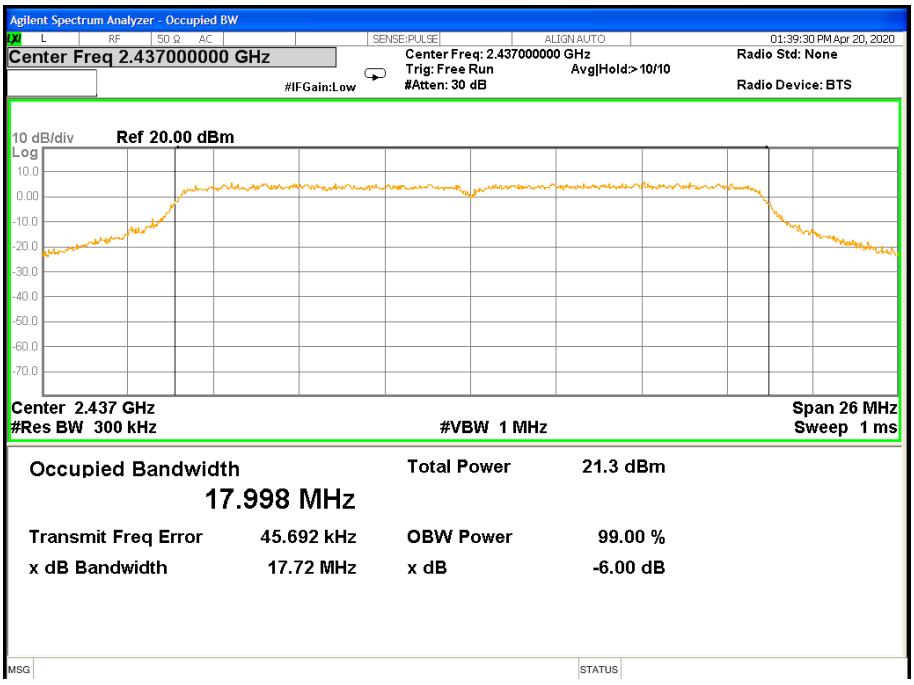
6dB Bandwidth TX CH 11



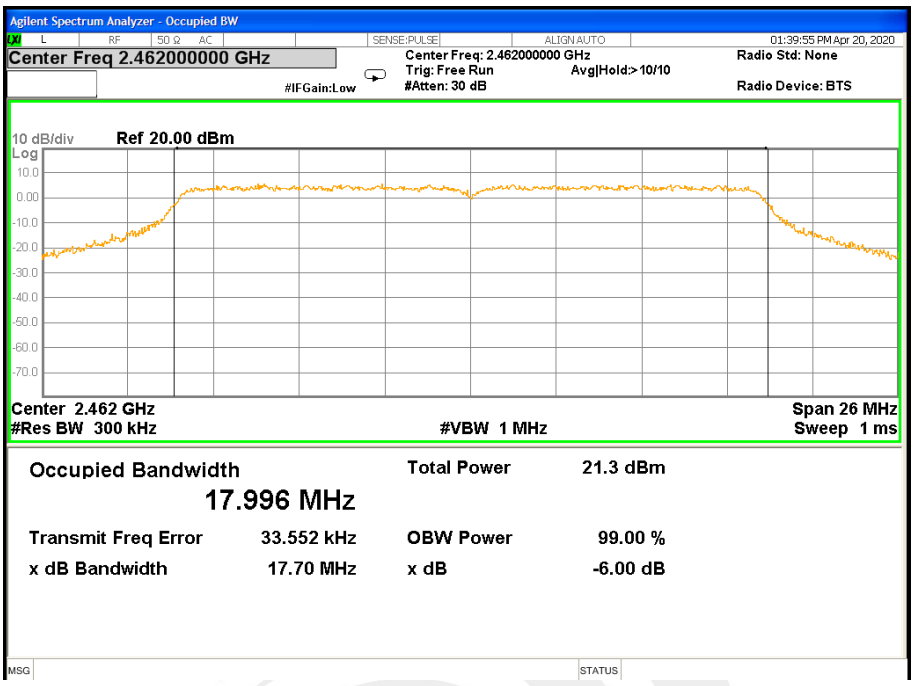
99% Bandwidth TX CH 01



99% Bandwidth TX CH 06



99% Bandwidth TX CH 11

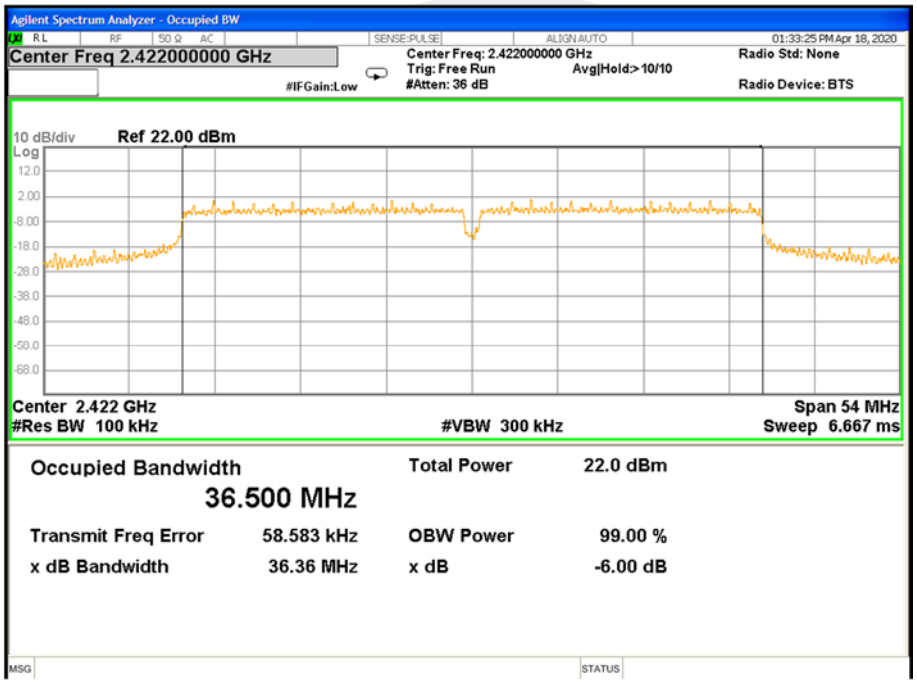


Temperature:	25℃	Relative Humidity:	60%
Test Voltage:	DC 15.4V	Test Mode:	TX n Mode(40M) /CH03, CH06, CH09

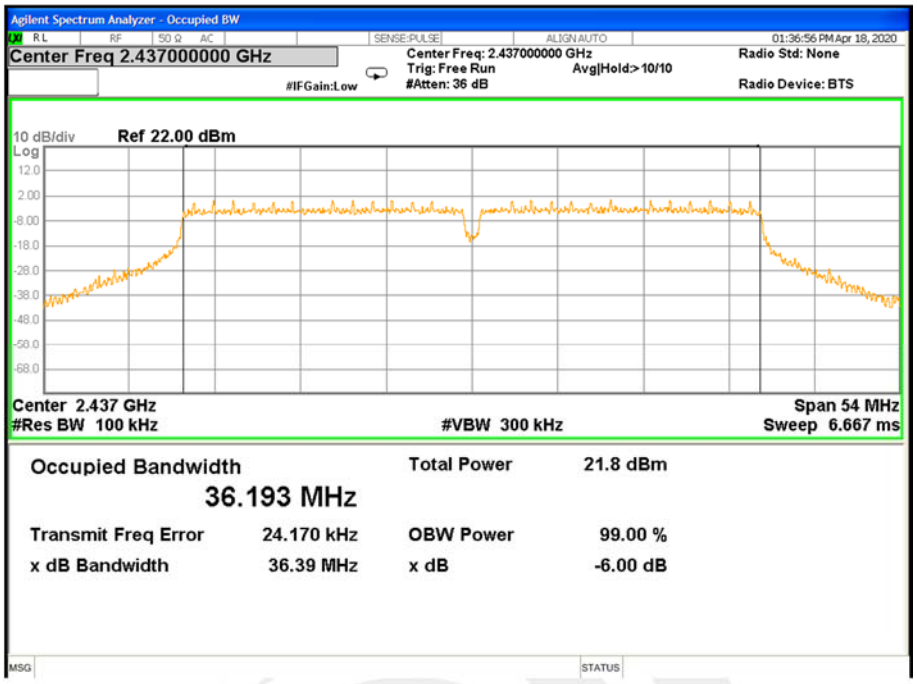
Frequency	6dB Bandwidth	99% Bandwidth	Channel Separation	Result
	(MHz)	(MHz)	(KHz)	
2422 MHz	36.36	36.629	≥500KHz	PASS
2437 MHz	36.39	36.294	≥500KHz	PASS
2452 MHz	36.35	36.397	≥500KHz	PASS

Antenna B

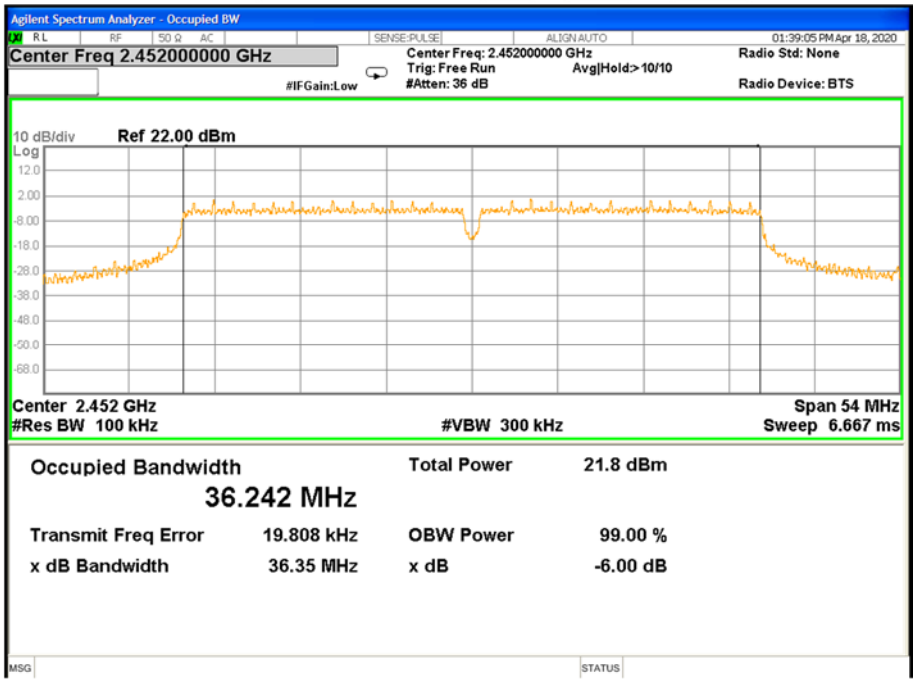
6dB Bandwidth TX CH 03



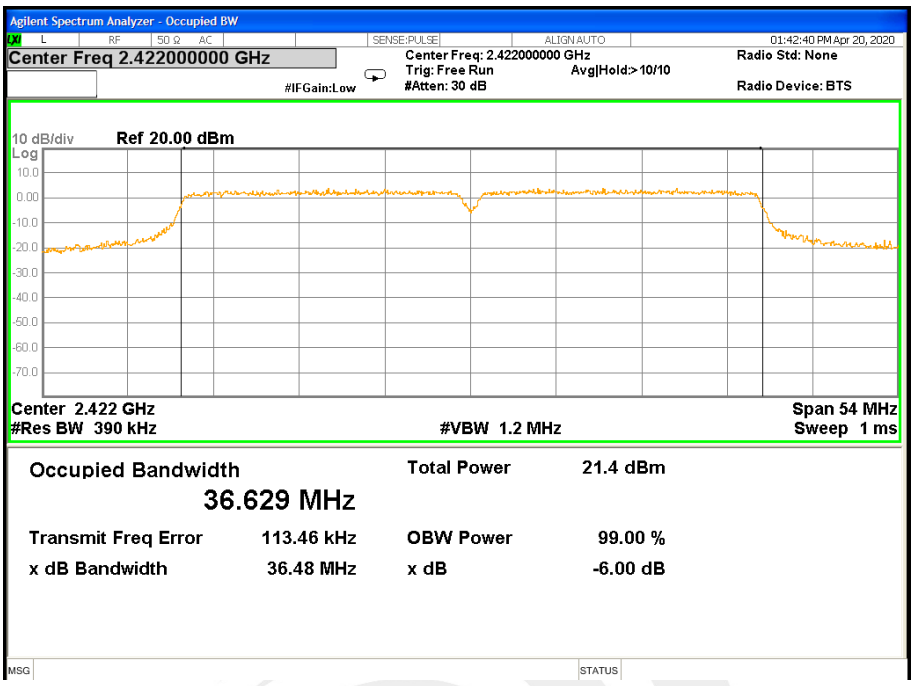
6dB Bandwidth TX CH 06



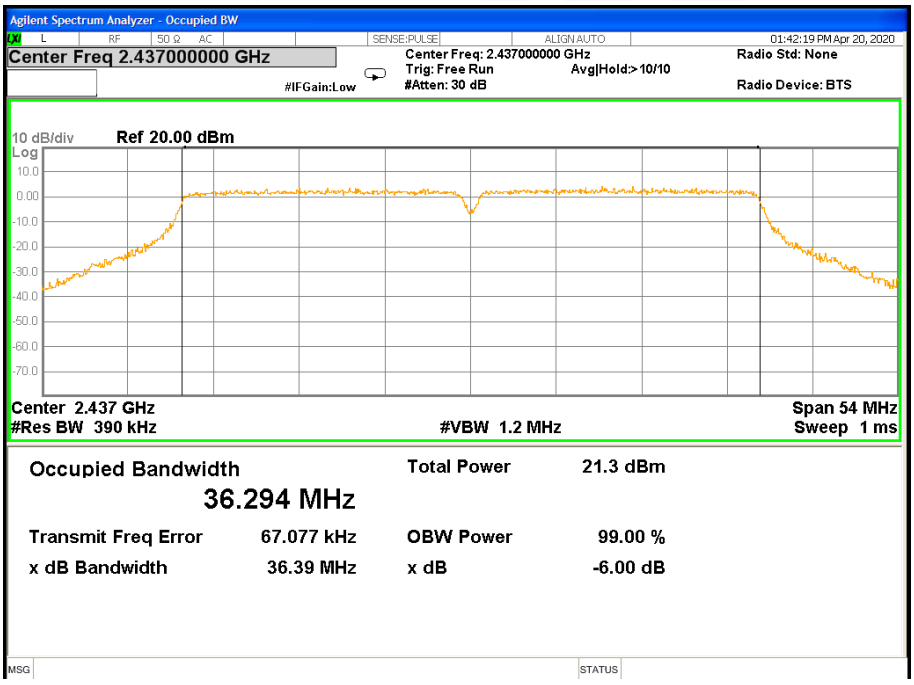
6dB Bandwidth TX CH 09



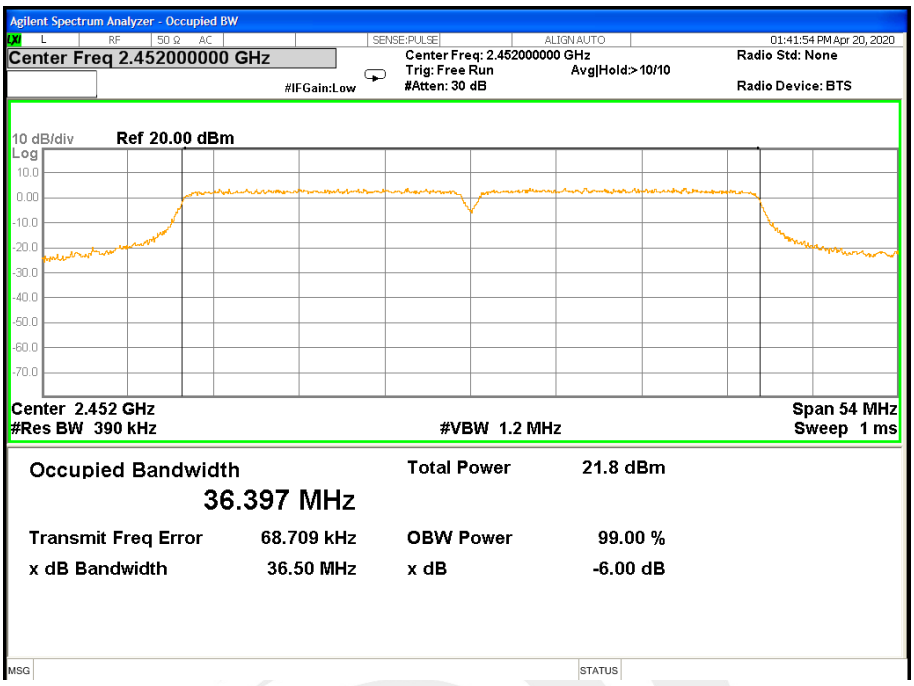
99% Bandwidth TX CH 03



99% Bandwidth TX CH 06



99% Bandwidth TX CH 09



7. PEAK OUTPUT POWER TEST

7.1 LIMIT

FCC Part15.247,Subpart C RSS-247 Issue 2				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3) RSS 247 Issue 2	Output Power	1 watt or 30dBm	2400-2483.5	PASS
RSS-247	EIRP	4W	2400-2483.5	PASS

7.2 TEST PROCEDURE

One of the following procedures may be used to determine the maximum peak conducted output power of a DTS EUT.

RBW ≥ DTS bandwidth

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:

a) Set the RBW ≥ DTS bandwidth.
b) Set VBW ≥ [3 × RBW].
c) Set span ≥ [3 × RBW].
d) Sweep time = auto couple.
e) Detector = peak.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use peak marker function to determine the peak amplitude level.

Integrated band power method:

The following procedure can be used when the maximum available RBW of the instrument is less than the

DTS bandwidth:

a) Set the RBW = 1 MHz.
b) Set the VBW ≥ [3 × RBW].
c) Set the span ≥ [1.5 × DTS bandwidth].
d) Detector = peak.
e) Sweep time = auto couple.
f) Trace mode = max hold.
g) Allow trace to fully stabilize.
h) Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select the peak detector). If the instrument does not have a band power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS channel bandwidth.

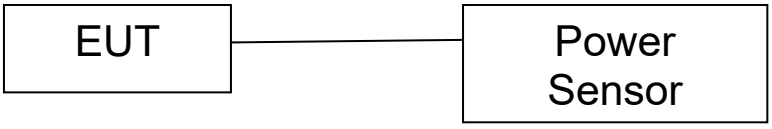
PKPM1 Peak power meter method:

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall use a fast-responding diode detector.

7.3 DEVIATION FROM STANDARD

No deviation.

7.4 TEST SETUP



7.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

7.6 TEST RESULTS

Temperature:	25℃	Relative Humidity:	60%
Test Voltage:	DC 15.4V		

TX 802.11b Mode								
Test Channe	Frequency	PK Powe ANT A	PK Powe ANT B	PK Powe ANT A+ANT B	AV Power ANT A	AV Power ANT B	AV Power ANT A+ANT B	LIMIT
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	dBm
CH01	2412	20.46	20.50	--	18.65	18.65	--	30
CH06	2437	20.37	20.67	--	18.45	18.79	--	30
CH11	2462	20.38	20.65	--	18.46	18.61	--	30

TX 802.11g Mode								
Test Channe	Frequency	PK Powe ANT A	PK Powe ANT B	PK Powe ANT A+ANT B	AV Power ANT A	AV Power ANT B	AV Power ANT A+ANT B	LIMIT
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	dBm
CH01	2412	20.15	20.41	--	14.97	15.06	--	30
CH06	2437	20.11	20.56	--	14.86	15.16	--	30
CH11	2462	20.07	20.46	--	14.87	15.07	--	30

TX 802.11n20 Mode								
Test Channe	Frequency	PK Powe ANT A	PK Powe ANT B	PK Powe ANT A+ANT B	AV Power ANT A	AV Power ANT B	AV Power ANT A+ANT B	LIMIT
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	dBm
CH01	2412	20.18	20.26	23.23	14.94	14.99	17.98	30
CH06	2437	20.13	20.54	23.35	14.80	15.08	17.95	30
CH11	2462	20.17	20.34	23.27	14.79	15.00	17.91	30

TX 802.11n40 Mode								
Test Channe	Frequency	PK Powe ANT A	PK Powe ANT B	PK Powe ANT A+ANT B	AV Power ANT A	AV Power ANT B	AV Power ANT A+ANT B	LIMIT
	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	(dBm)	dBm
CH03	2422	19.94	19.96	22.96	14.82	15.11	17.98	30
CH06	2437	20.43	20.73	23.59	14.72	14.92	17.83	30
CH09	2452	20.29	20.36	23.34	14.74	14.90	17.83	30

EIRP Power

TX 802.11b Mode									
Test Channel	Frequency	PK Power Ant_A	PK Power Ant_B	Antenna A Gain	Antenna B Gain	EIRP Power Ant_A	EIRP Power Ant_B	EIRP Power Total	LIMIT
	(MHz)	(dBm)	(dBm)	(dBi)	(dBi)	(dBm)	(dBm)	(dBm)	dBm
CH01	2412	20.46	20.50	1.46	3.21	21.92	23.71	--	36.02
CH06	2437	20.37	20.67	1.46	3.21	21.83	23.88	--	36.02
CH11	2462	20.38	20.65	1.46	3.21	21.84	23.86	--	36.02
TX 802.11g Mode									
Test Channel	Frequency	PK Power Ant_A	PK Power Ant_B	Antenna Gain	Antenna Gain	EIRP Power Ant_A	EIRP Power Ant_B	EIRP Power Total	LIMIT
	(MHz)	(dBm)	(dBm)	(dBi)	(dBi)	(dBm)	(dBm)	(dBm)	dBm
CH01	2412	20.15	20.41	1.46	3.21	21.61	23.62	--	36.02
CH06	2437	20.11	20.56	1.46	3.21	21.57	23.77	--	36.02
CH11	2462	20.07	20.46	1.46	3.21	21.53	23.67	--	36.02
TX 802.11n20 Mode									
Test Channel	Frequency	PK Power Ant_A	PK Power Ant_B	Antenna Gain	Antenna Gain	EIRP Power Ant_A	EIRP Power Ant_B	EIRP Power Total	LIMIT
	(MHz)	(dBm)	(dBm)	(dBi)	(dBi)	(dBm)	(dBm)	(dBm)	dBm
CH01	2412	20.18	20.26	1.46	3.21	21.64	23.47	25.66	36.02
CH06	2437	20.13	20.54	1.46	3.21	21.59	23.75	25.81	36.02
CH11	2462	20.17	20.34	1.46	3.21	21.63	23.55	25.71	36.02
TX 802.11n40 Mode									
Test Channel	Frequency	PK Power Ant_A	PK Power Ant_B	Antenna Gain	Antenna Gain	EIRP Power Ant_A	EIRP Power Ant_B	EIRP Power Total	LIMIT
	(MHz)	(dBm)	(dBm)	(dBi)	(dBi)	(dBm)	(dBm)	(dBm)	dBm
CH03	2422	19.94	19.96	1.46	3.21	21.40	23.17	25.38	36.02
CH06	2437	20.43	20.73	1.46	3.21	21.89	23.94	26.05	36.02
CH09	2452	20.29	20.36	1.46	3.21	21.75	23.57	25.76	36.02

8. ANTENNA REQUIREMENT

8.1 STANDARD REQUIREMENT

15.203&RSS GEN requirement: For intentional device, according to 15.203&RSS GEN: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible partyshall be used with the device.

8.2 EUT ANTENNA

The EUT antenna is PIFA Antenna, the antenna connection port is located inside the product casing that will not be easily opened. It comply with the standard requirement. You can refer to KDB353028 D01 Antennas Part 15 Transmitters v01 (II. A. 2. b).

9. FREQUENCY STABILITY

9.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

The frequency tolerance of the carrier signal shall be maintained within +/-0.02% of the operating frequency over a temperature variation of -30 degrees to 50 degrees C at normal supply voltage,and for a variation in primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees.

9.2 TEST PROCEDURE

1. The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
2. Turn the EUT on and couple its output to spectrum analyzer.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize,turn the EUT on and measure the operating frequency after 2,5,and 10 minutes.
5. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
6. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes.The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

9.3 TEST RESULT

Channel 06 (2437MHz)

Voltage vs. Frequency Stability

Voltage(V)	Measurement Frequency(MHz)
17.71	2437.0032
15.4	2437.0028
13.09	2437.0023
Max.Deviation(MHz)	0.0032
Max.Deviation(ppm)	1.31

Rated working voltage: DC 15.4V

Temperature vs. Frequency Stability

Temperature(℃)	Measurement Frequency(MHz)
-30	2437.0035
-20	2437.0035
-10	2437.0033
0	2437.0025
10	2437.0027
20	2437.0028
30	2437.0031
40	2437.0034
50	2437.0034
Max.Deviation(MHz)	0.0035
Max.Deviation(ppm)	1.44

APPENDIX-PHOTOS OF TEST SETUP

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

※※※※※END OF THE REPORT※※※※※