



**FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-247 ISSUE 2**

CERTIFICATION TEST REPORT

For

TLC-BLE

MODEL NUMBER: 04760184

**FCC ID: SKW04760184
IC: 11163A-04760184**

REPORT NUMBER: 4788290739.2-6

ISSUE DATE: January 19, 2018

Prepared for

**TESA SA
Rue du Bugnon 38, Renens 1020, Switzerland**

Prepared by

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Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	1/19/2018	Initial Issue	

Summary of Test Results			
Clause	Test Items	FCC/IC Rules	Test Results
1	6db DTS Bandwidth and 99% Bandwidth	FCC 15.247 (a) (2) RSS-247 Clause 5.2 (a) RSS-Gen Clause 6.6	PASS
2	Peak Conducted Power	FCC 15.247 (b) (3) RSS-247 Clause 5.4 (e)	PASS
3	Power Spectral Density	FCC 15.247 (e) RSS-247 Clause 5.2 (b)	PASS
4	Conducted Band edge And Spurious emission	FCC 15.247 (d) RSS-247 Clause 5.5	PASS
5	Radiated Band edges and Spurious emission	FCC 15.247 (d) FCC 15.209 FCC 15.205 RSS-247 Clause 5.5 RSS-GEN Clause 8.9 RSS-GEN Clause 8.10	PASS
6	Conducted Emission Test For AC Power Port	FCC 15.207 RSS-GEN Clause 8.8	N/A
7	Antenna Requirement	FCC 15.203 RSS-GEN Clause 8.3	PASS
Note: "N/A" denotes test is not applicable in this Test Report			

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1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name: TESA SA
Address: Rue du Bugnon 38, 1020 Renens, Switzerland

Manufacturer Information

Company Name: TESA SA
Address: Rue du Bugnon 38, 1020 Renens, Switzerland

EUT Description

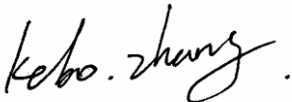
Product Name: TLC-BLE
Brand Name: NA
Model Name: 04760184
Sample ID: 1329948
Sample Status: Good
Sample Received date: January 6, 2018
Date Tested: January 6~17, 2018

APPLICABLE STANDARDS

STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	PASS
ISED RSS-247 Issue 2	PASS
ISED RSS-GEN Issue 4	PASS

Tested By:

Checked By:



Kebo Zhang
Engineer

Shawn Wen
Laboratory Leader

Approved By:



Stephen Guo
Laboratory Manager

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with KDB414788 D01 Radiated Test Site v01, ANSI C63.10-2013, KDB558074 D01 DTS Meas Guidance v04, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 4, and RSS-247 Issue 2.

3. FACILITIES AND ACCREDITATION

Test Location	UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch.
Address	Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China
Accreditation Certificate	UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing. The Certificate Registration Number is 4102.01. UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The Designation Number is CN1187. UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. EMC Laboratory has been registered and fully described in a report filed with Industry Canada. The Company Number is 21320.

Note: The test anechoic chamber in UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch had been calibrated and compared to the open field sites.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognize national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Item	Uncertainty
Uncertainty for Conduction emission test	2.90dB
Uncertainty for Radiation Emission test(include Fundamental emission) (9KHz-30MHz)	2.2dB
Uncertainty for Radiation Emission test(include Fundamental emission) (30MHz-1GHz)	4.52dB
Uncertainty for Radiation Emission test (1GHz to 26GHz)(include Fundamental emission)	5.04dB(1-6GHz)
	5.30dB (6GHz-18Gz)
	5.23dB (18GHz-26Gz)
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

Equipment	TLC-BLE		
Model Name	04760184		
Product Description	Operation Frequency	2402 MHz ~ 2480 MHz	
	Modulation Type		Data Rate
	GFSK		1Mbps
Power Supply	DC 3.0V		
Bluetooth Version	BT 4.2LE		
Hardware Version	TLC-BLE-71000789C		
Software Version	V3.2.114		

Note: This chip does not support EDR.

5.2. MAXIMUM OUTPUT POWER

Bluetooth Mode	Frequency (MHz)	Channel Number	Max Output Power (dBm)	EIRP (dBm)
BLE	2402-2480	0-39[40]	-1.112	-1.112

5.3. CHANNEL LIST

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	11	2424	22	2446	33	2468
1	2404	12	2426	23	2448	34	2470
2	2406	13	2428	24	2450	35	2472
3	2408	14	2430	25	2452	36	2474
4	2410	15	2432	26	2454	37	2476
5	2412	16	2434	27	2456	38	2478
6	2414	17	2436	28	2458	39	2480
7	2416	18	2438	29	2460		
8	2418	19	2440	30	2462		
9	2420	20	2442	31	2464		
10	2422	21	2444	32	2468		

5.4. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel	Frequency
GFSK	CH 0, CH 19, CH 39	2402MHz, 2440MHz, 2480MHz

5.5. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band				
Test Software		nrfgostudio		
Modulation Type	Transmit Antenna Number	Test Channel		
		CH 00	CH 19	CH 39
GFSK	1	MAX	MAX	MAX

5.6. DESCRIPTION OF AVAILABLE ANTENNAS

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
1	2402-2480	Chip Antenna	0

Test Mode	Transmit and Receive Mode	Description
GFSK	1TX, 1RX	Chain 1 can be used as transmitting/receiving antenna.

5.7. WORST-CASE CONFIGURATIONS

Bluetooth Mode	Modulation Technology	Modulation Type	Data Rate (Mbps)
BLE	DTS	GFSK	1Mbit/s

5.8. TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests	
Relative Humidity	55 ~ 65%	
Atmospheric Pressure:	1025Pa	
Temperature	TN	23 ~ 28°C
Voltage :	VL	N/A
	VN	DC 3V
	VH	N/A

Note: VL= Lower Extreme Test Voltage
VN= Nominal Voltage
VH= Upper Extreme Test Voltage
TN= Normal Temperature

5.9. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	P/N
1	PC	Dell	Vostro 3902	8KNDDDB2
2	USB TO RS232	N/A	N/A	N/A

I/O CABLES

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	N/A	N/A	N/A	N/A	N/A

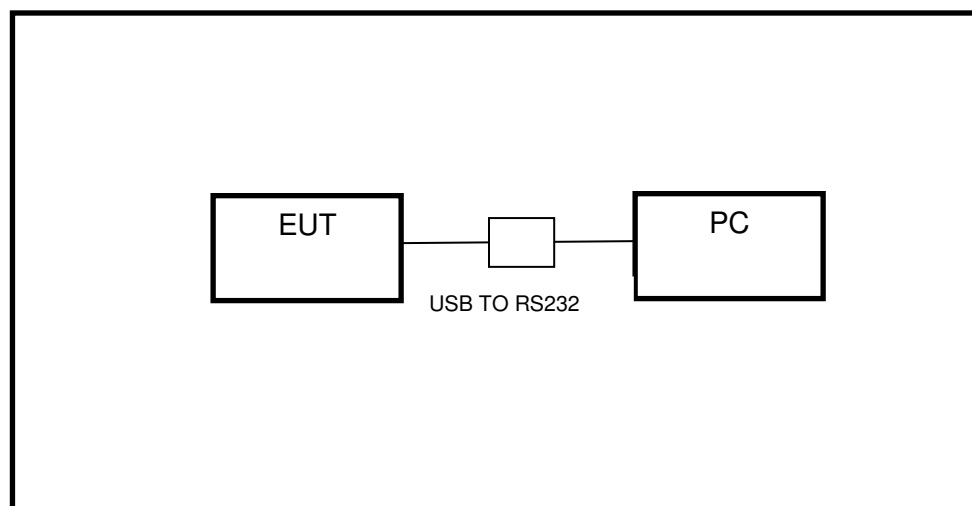
ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
1	N/A	N/A	N/A	N/A

TEST SETUP

The EUT can work in an engineer mode with a software through a PC.

SETUP DIAGRAM FOR TEST



5.10. MEASURING INSTRUMENT AND SOFTWARE USED

Conducted Emissions						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
☒	EMI Test Receiver	R&S	ESR3	101961	Dec.12, 2017	Dec.11, 2018
☒	Two-Line V-Network	R&S	ENV216	101983	Dec.12, 2017	Dec.11, 2018
☒	Artificial Mains Networks	Schwarzbeck	NSLK 8126	8126465	Dec.12, 2017	Dec.11, 2018
Software						
Used	Description		Manufacturer	Name		Version
☒	Test Software for Conducted disturbance		UL	Antenna port		Ver. 7.2
Radiated Emissions						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
☒	MXE EMI Receiver	KESIGHT	N9038A	MY56400036	Dec.12, 2017	Dec.11, 2018
☒	Hybrid Log Periodic Antenna	TDK	HLP-3003C	130960	Dec.12, 2017	Dec.11, 2018
☒	Preamplifier	HP	8447D	2944A09099	Dec.12, 2017	Dec.11, 2018
☒	EMI Measurement Receiver	R&S	ESR26	101377	Dec.12, 2017	Dec.11, 2018
☒	Horn Antenna	TDK	HRN-0118	130939	Jan. 09, 2016	Jan. 09, 2019
☒	High Gain Horn Antenna	Schwarzbeck	BBHA-9170	691	Jan.06, 2016	Jan.06, 2019
☒	Preamplifier	TDK	PA-02-0118	TRS-305-00066	Dec.12, 2017	Dec.11, 2018
☒	Preamplifier	TDK	PA-02-2	TRS-307-00003	Dec.12, 2017	Dec.11, 2018
☒	Loop antenna	Schwarzbeck	1519B	00008	Mar. 26, 2016	Mar. 26, 2019
☒	Band Reject Filter	Wainwright	WRCJV8-2350-2400-2483.5-2533.5-40SS	4	Dec.12, 2017	Dec.11, 2018
Software						
Used	Description		Manufacturer	Name		Version
☒	Test Software for Radiated disturbance		Farad	EZ-EMC		Ver. UL-3A1
Other instruments						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
☒	Spectrum Analyzer	Keysight	N9030A	MY55410512	Dec.12, 2017	Dec.11, 2018
☒	Power Meter	Keysight	N9031A	MY55416024	Dec.12, 2017	Dec.11, 2018
☒	Power Sensor	Keysight	N9323A	MY55440013	Dec.12, 2017	Dec.11, 2018

6. MEASUREMENT METHODS

No.	Test Item	KDB Name	Section
1	6 dB Bandwidth	KDB 558074 D01 DTS Meas Guidance v04	8.0
2	Peak Output Power	KDB 558074 D01 DTS Meas Guidance v04	9.1.1
3	Power Spectral Density	KDB 558074 D01 DTS Meas Guidance v04	10.2
4	Out-of-band emissions in non-restricted bands	KDB 558074 D01 DTS Meas Guidance v04	11.0
5	Out-of-band emissions in restricted bands	KDB 558074 D01 DTS Meas Guidance v04	12.1
6	Band-edge	KDB 558074 D01 DTS Meas Guidance v04	13.3.2
7	Conducted Emission Test For AC Power Port	ANSI C63.10-2013	7.3

7. ANTENNA PORT TEST RESULTS

7.1. ON TIME AND DUTY CYCLE

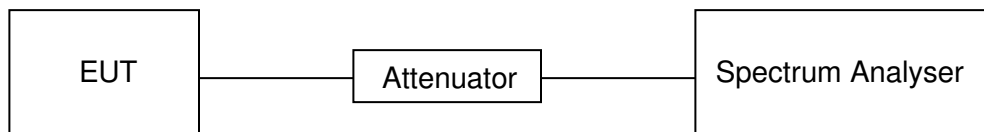
LIMITS

None; for reporting purposes only

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method

TEST SETUP

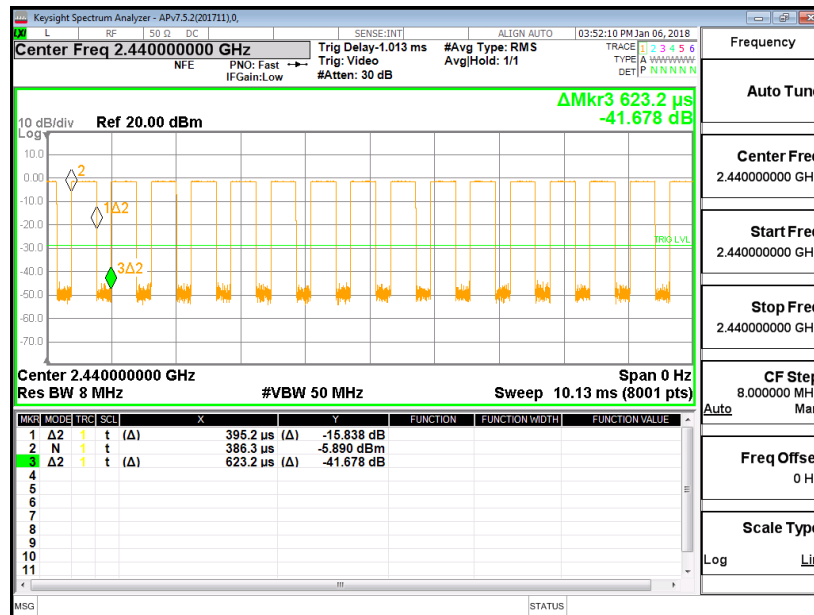


RESULTS

Mode	On Time (msec)	Period (msec)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (db)	1/T Minimum VBW (KHz)
BLE	395.2	623.2	0.634	63.4%	1.98	0.0025

Note: Duty Cycle Correction Factor = $10\log(1/x)$.
Where: x is Duty Cycle(Linear)
Where: T is On Time (transmit duration)

ON TIME AND DUTY CYCLE MID CH



7.2. 6 dB DTS BANDWIDTH AND 99% BANDWIDTH

LIMITS

FCC Part15 (15.247) Subpart C RSS-247 ISSUE 2			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247(a)(2) RSS-247 5.2 (a)	6dB Bandwidth	$\geq 500\text{KHz}$	2400-2483.5
RSS-Gen Clause 6.6	99% Bandwidth	For reporting purposes only.	2400-2483.5

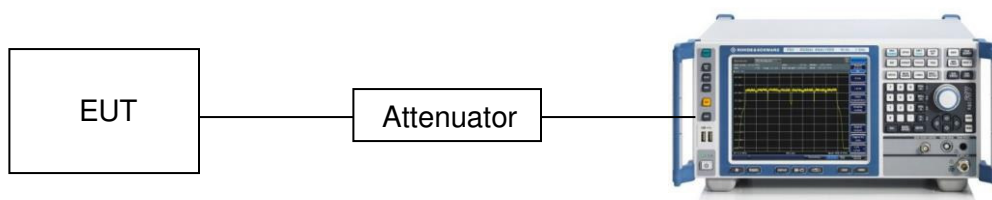
TEST PROCEDURE

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

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	For 6 dB Bandwidth :100K For 99% Bandwidth :1% to 5% of the occupied bandwidth
VBW	For 6dB Bandwidth : $\geq 3 \times \text{RBW}$ For 99% Bandwidth : approximately $3 \times \text{RBW}$
Trace	Max hold
Sweep	Auto couple

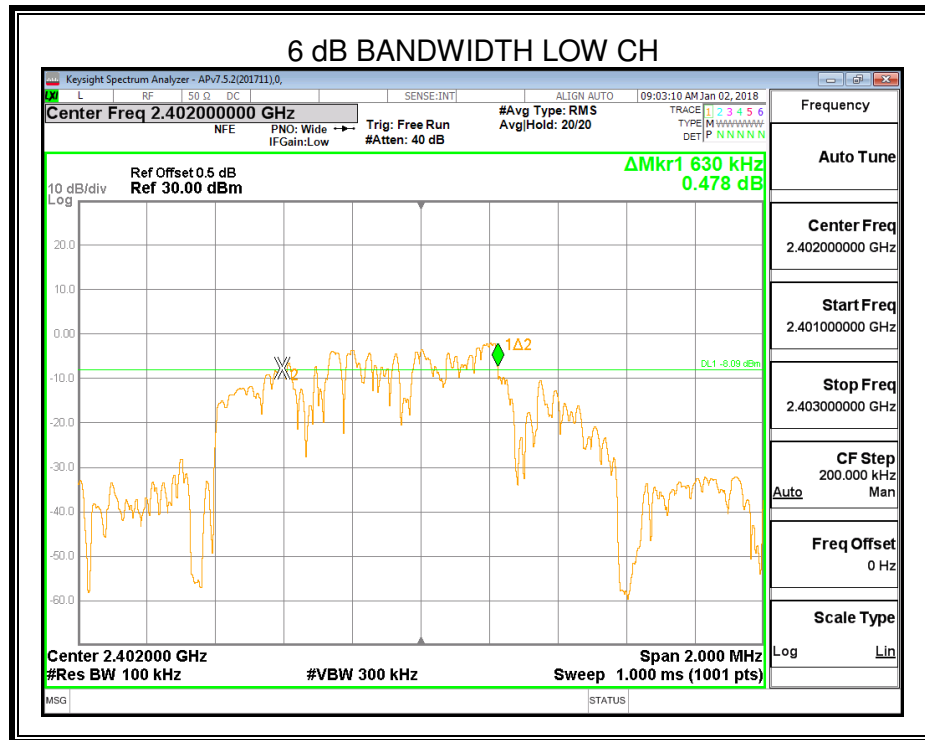
Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

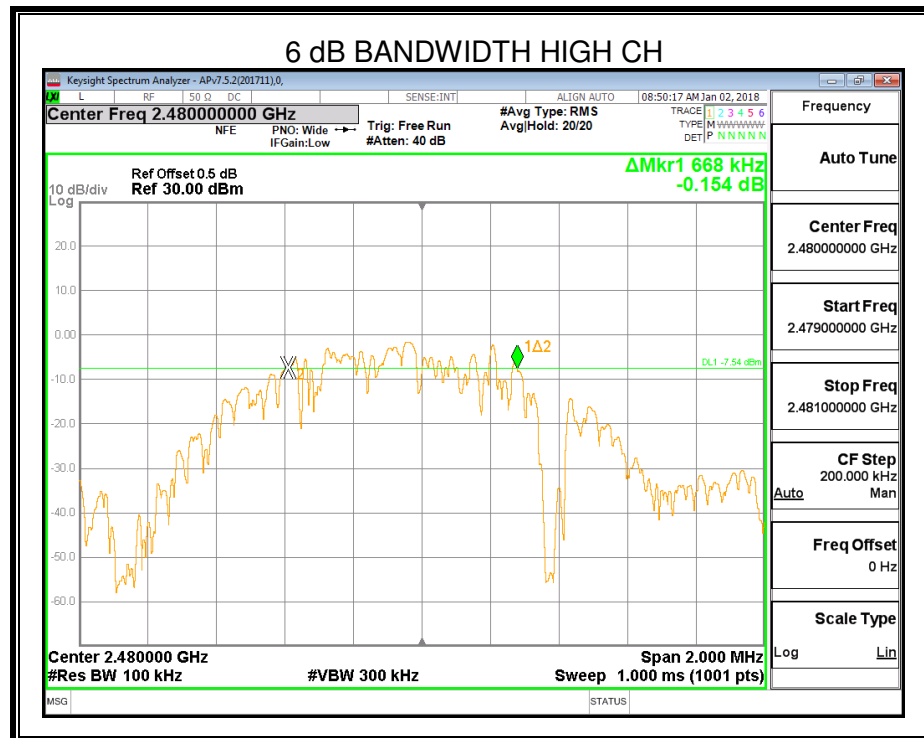
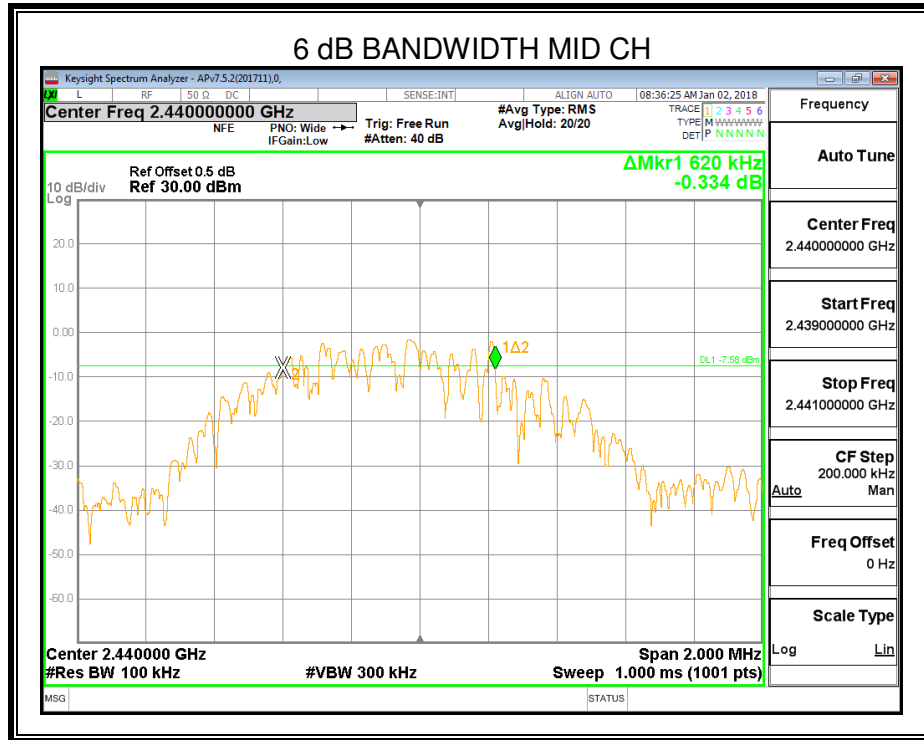
TEST SETUP

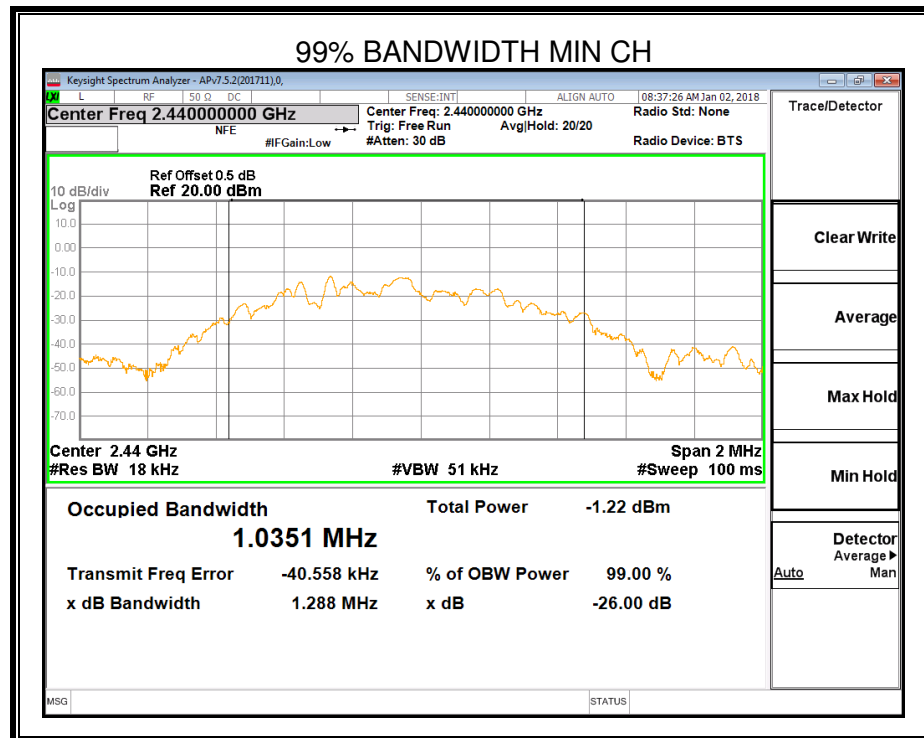
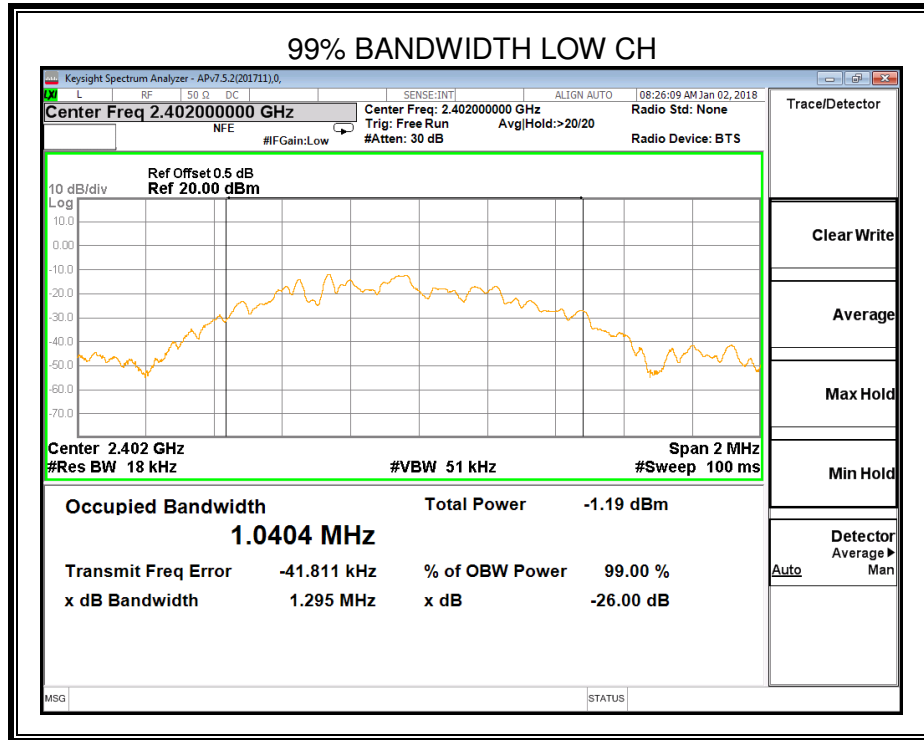


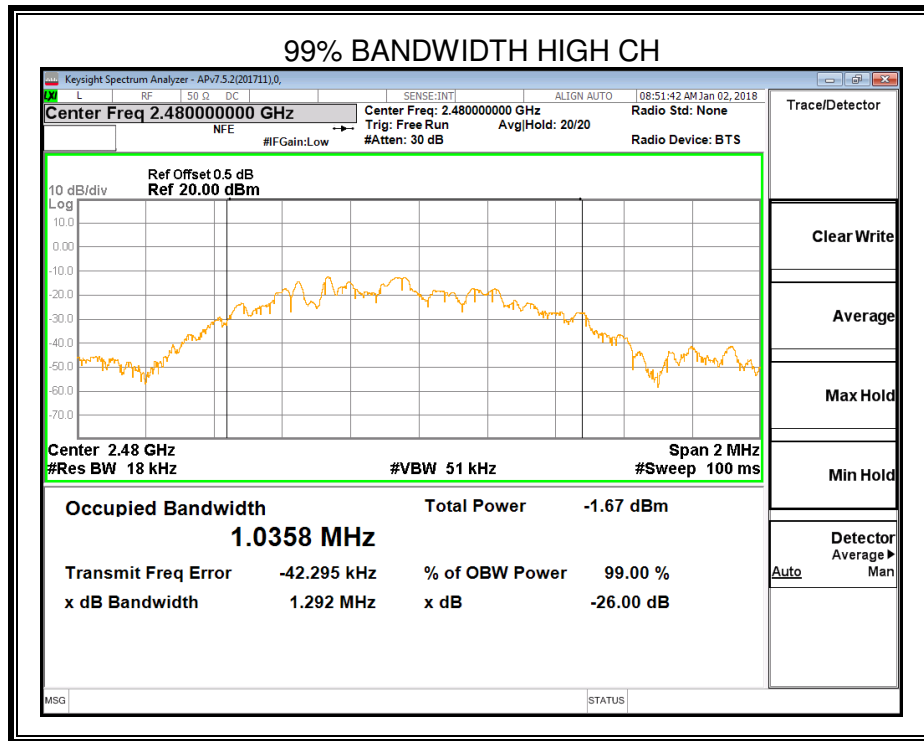
RESULTS

Channel	Frequency (MHz)	6dB bandwidth (MHz)	99% bandwidth (MHz)	Limit (kHz)	Result
Low	2402	0.630	1.0404	500	Pass
Middle	2440	0.620	1.0351	500	Pass
High	2480	0.668	1.0358	500	Pass









7.3. PEAK CONDUCTED OUTPUT POWER

LIMITS

FCC Part15 (15.247) Subpart C RSS-247 ISSUE 2			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247(b)(3) RSS-247 5.4 (e)	Peak Output Power	1 watt or 30dBm	2400-2483.5

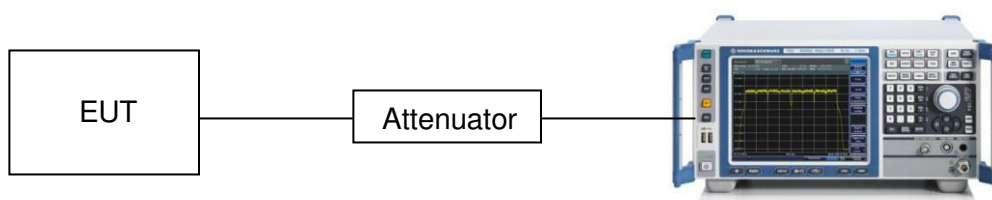
TEST PROCEDURE

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

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	$\geq$ DTS bandwidth(e.g. 1 MHz for BLE)
VBW	$\geq 3 \times$ RBW
Span	$3 \times$ RBW
Trace	Max hold
Sweep time	Auto couple.

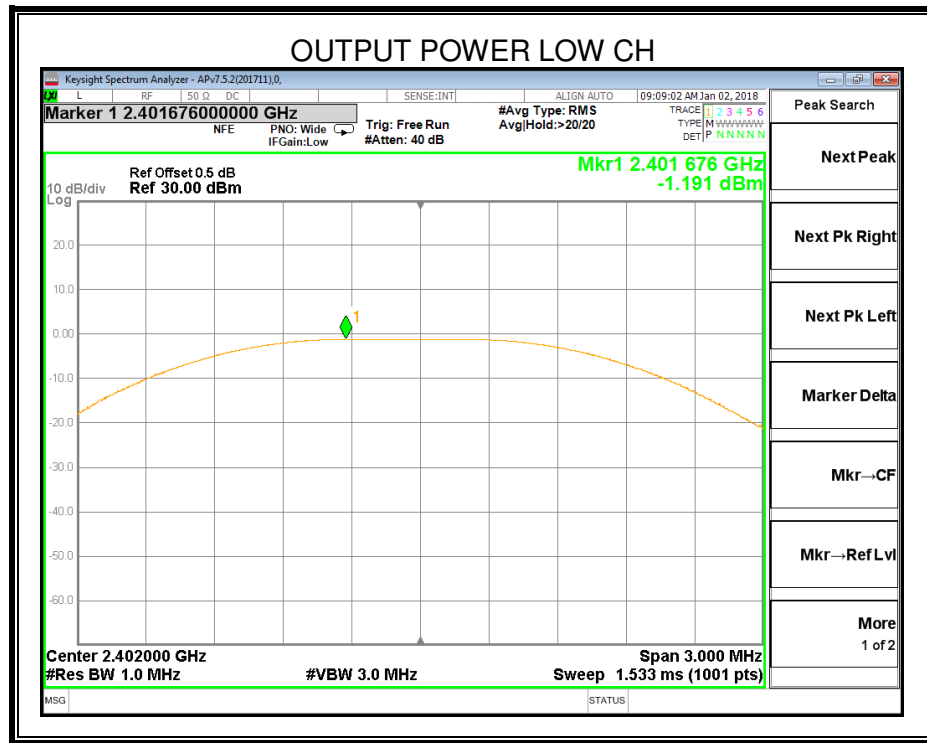
Allow trace to fully stabilize and use peak marker function to determine the peak amplitude level.

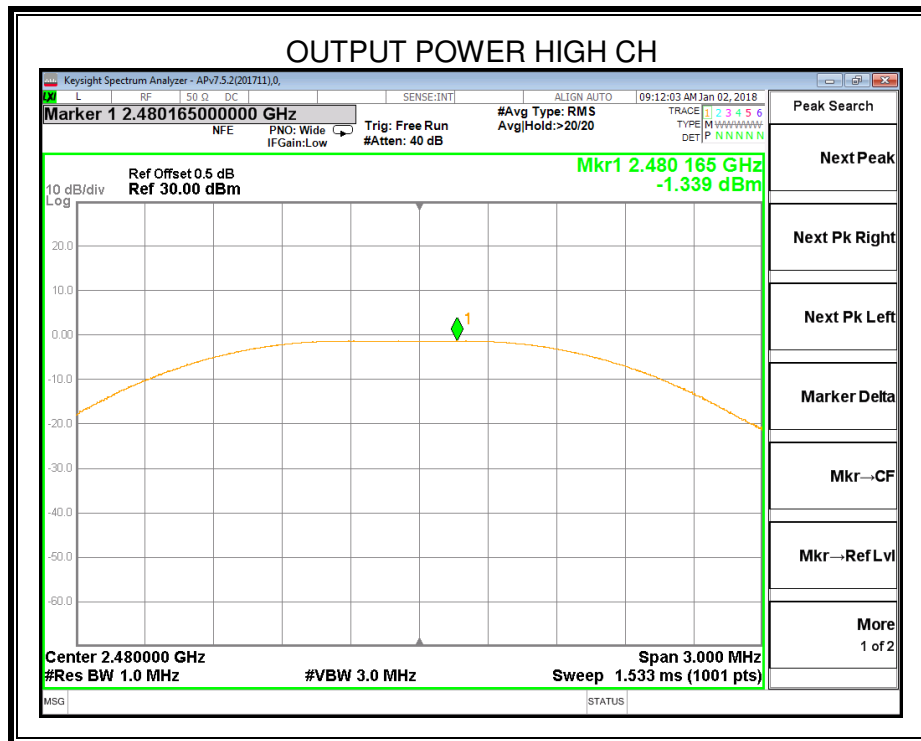
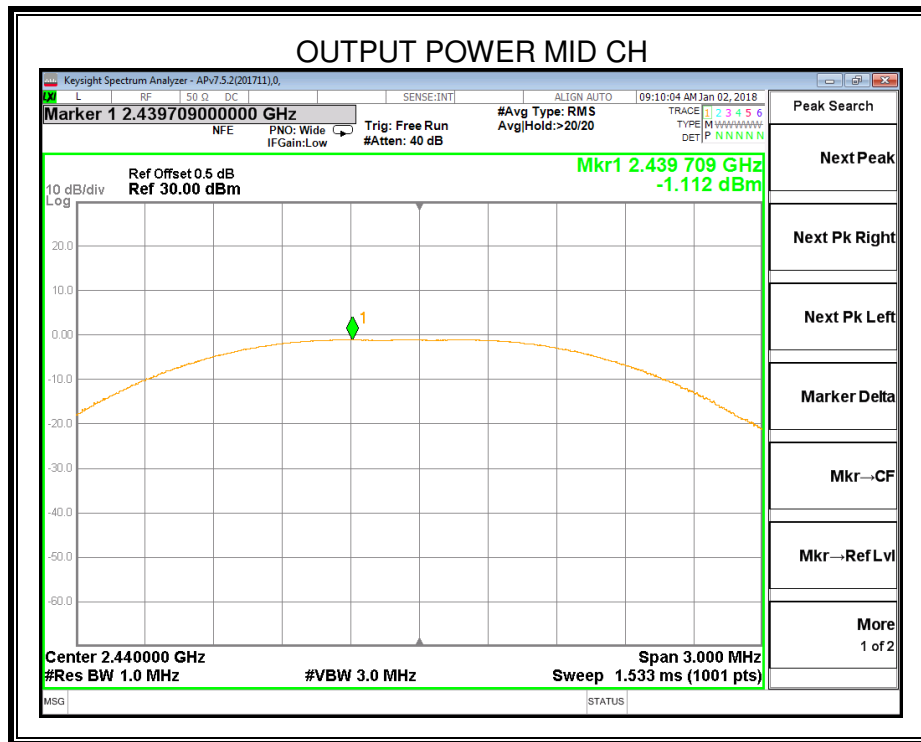
TEST SETUP



RESULTS

Test Channel	Frequency	Maximum Conducted Output Power(PK)	EIRP	LIMIT
	(MHz)	(dBm)	(dBm)	dBm
CH00	2402	-1.191	-1.191	30
CH19	2440	-1.112	-1.112	30
CH39	2480	-1.339	-1.339	30





7.4. POWER SPECTRAL DENSITY

LIMITS

FCC Part15 (15.247) Subpart C RSS-247 ISSUE 2			
Section	Test Item	Limit	Frequency Range (MHz)
FCC §15.247 (e) RSS-247 5.2 (b)	Power Spectral Density	8 dBm in any 3 kHz band	2400-2483.5

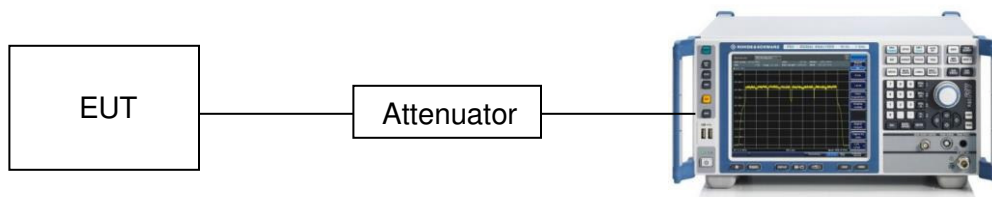
TEST PROCEDURE

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

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	$3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
VBW	$\geq 3 \times \text{RBW}$
Span	$1.5 \times \text{DTS bandwidth}$
Trace	Max hold
Sweep time	Auto couple.

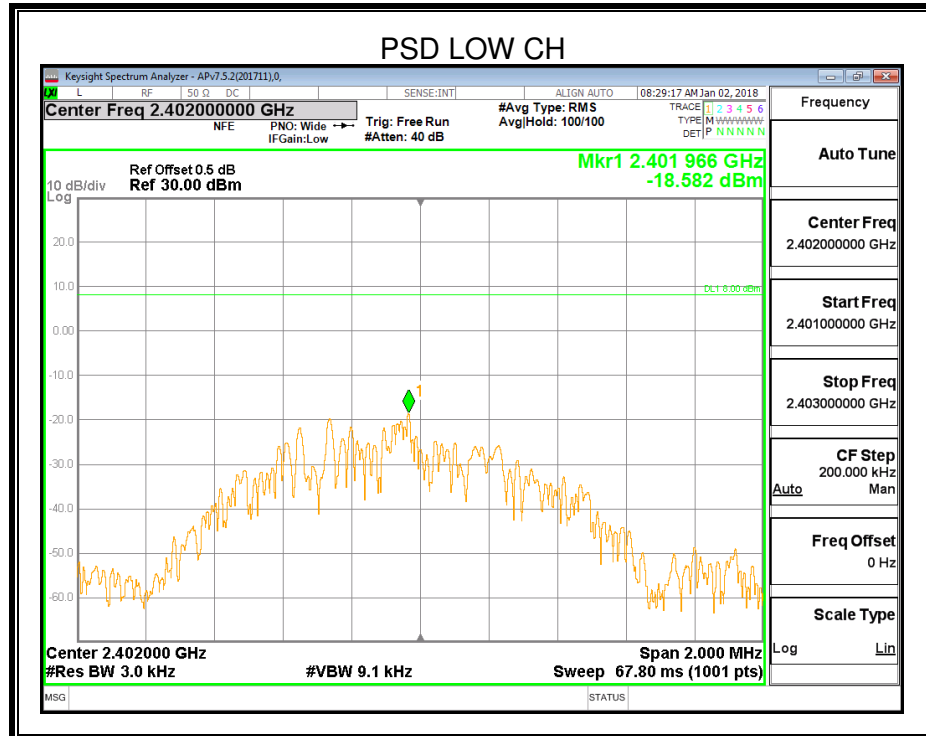
Allow trace to fully stabilize and use the peak marker function to determine the maximum amplitude level within the RBW.
If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

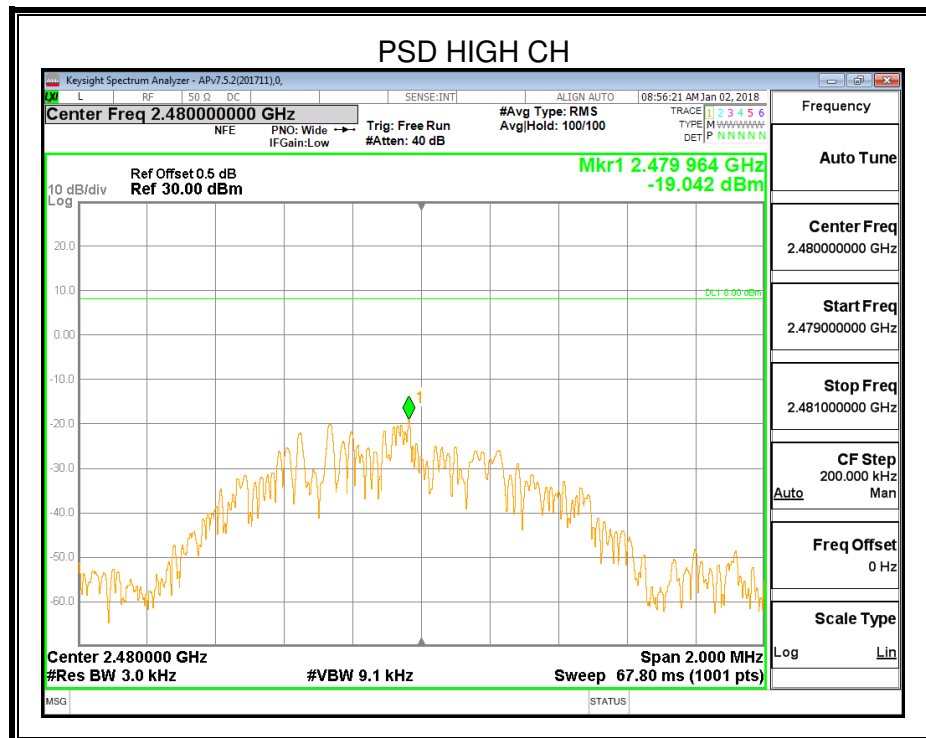
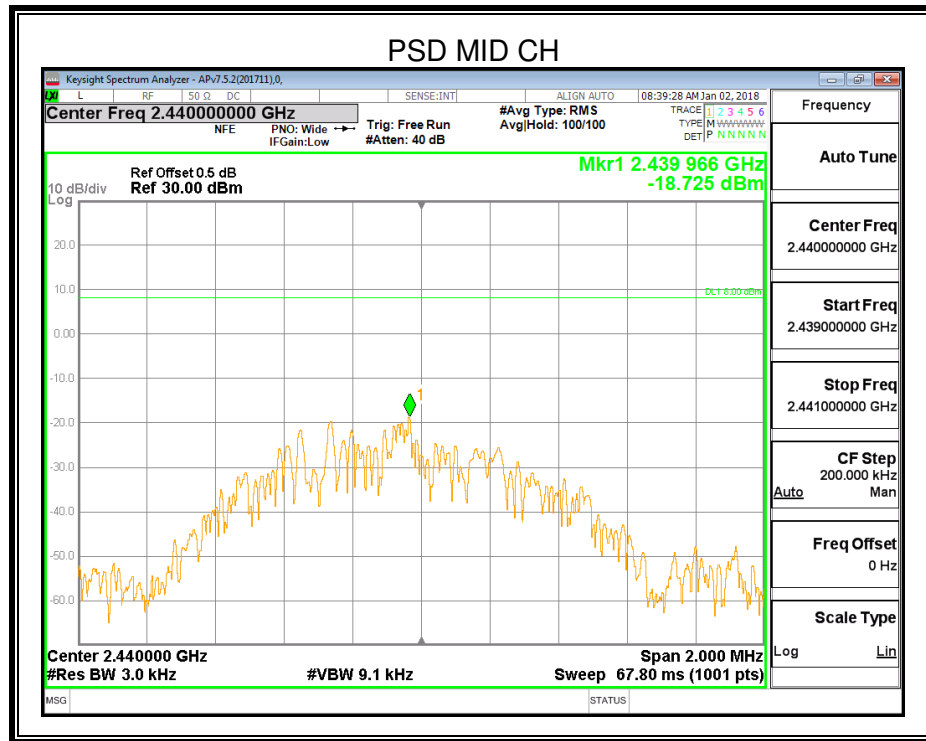
TEST SETUP



RESULTS

Frequency	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
2402 MHz	-18.582	8	PASS
2440 MHz	-18.725	8	PASS
2480 MHz	-19.042	8	PASS





7.5. CONDUCTED BANDEGE AND SPURIOUS EMISSIONS

LIMITS

FCC Part15 (15.247) Subpart C RSS-247 ISSUE 2		
Section	Test Item	Limit
FCC §15.247 (d) RSS-247 5.5	Conducted Bandedge and Spurious Emissions	at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

TEST PROCEDURE

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

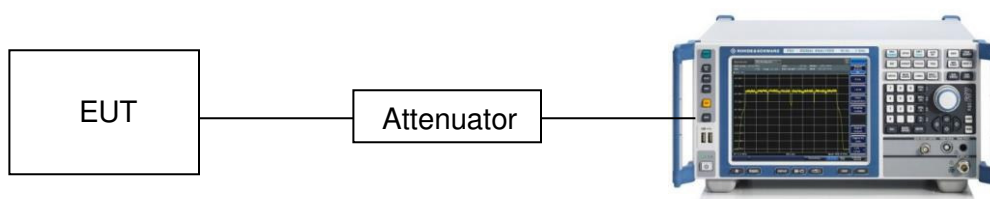
Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	100K
VBW	$\geq 3 \times \text{RBW}$
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

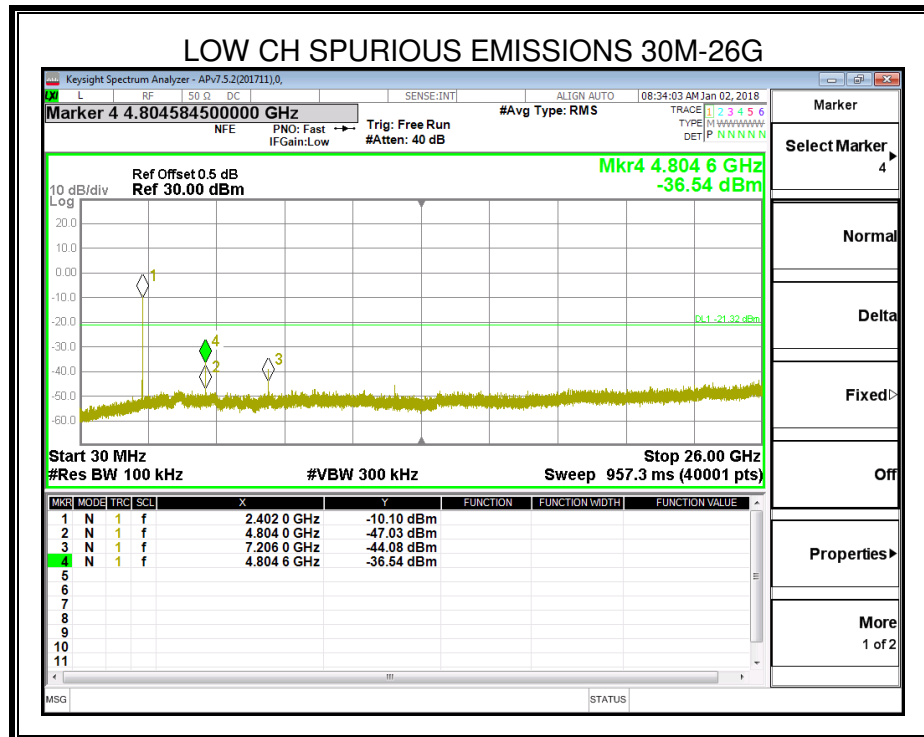
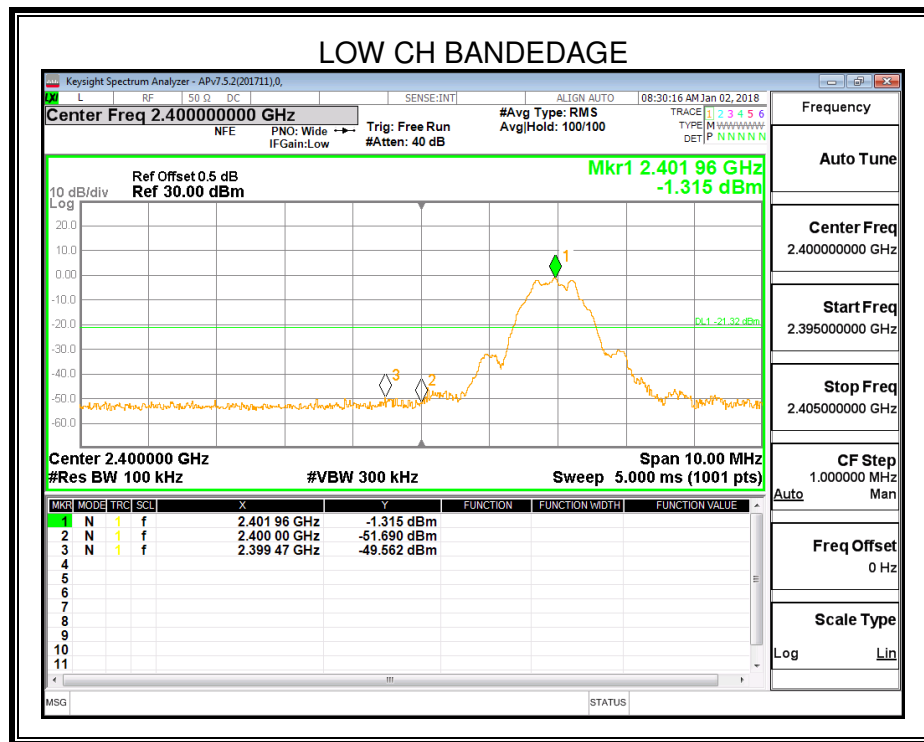
Use the peak marker function to determine the maximum PSD level.

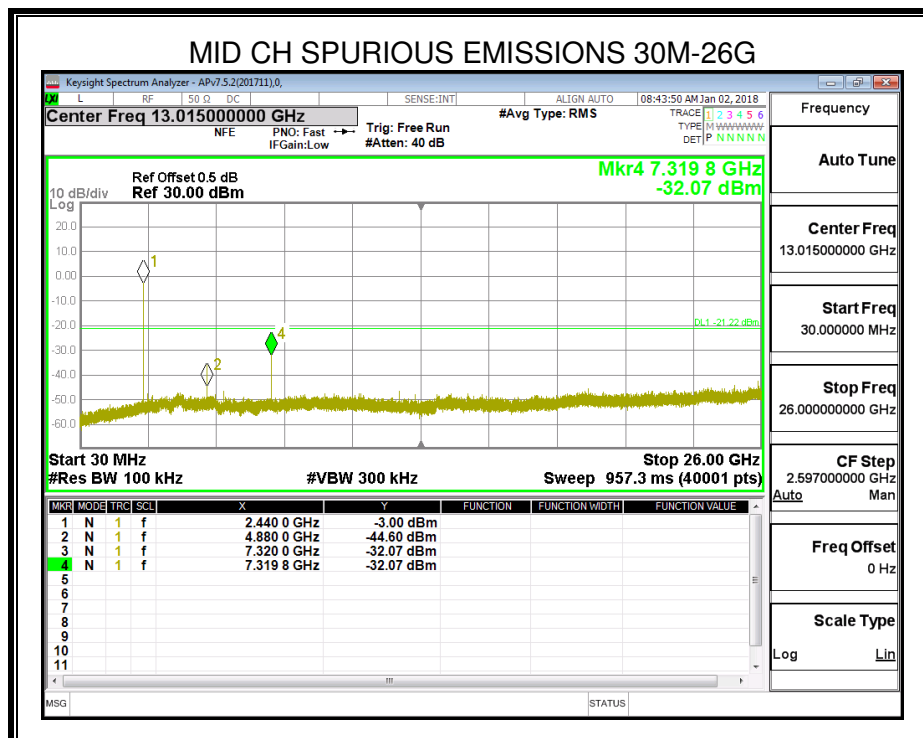
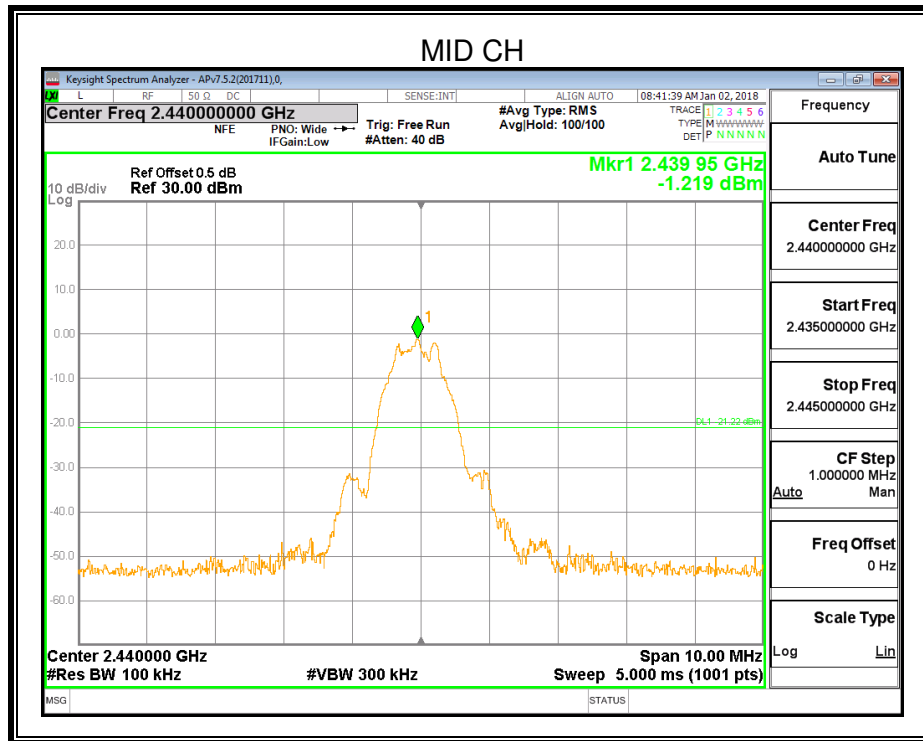
Span	Set the center frequency and span to encompass frequency range to be measured
Detector	Peak
RBW	100K
VBW	$\geq 3 \times \text{RBW}$
measurement points	$\geq \text{span}/\text{RBW}$
Trace	Max hold
Sweep time	Auto couple.

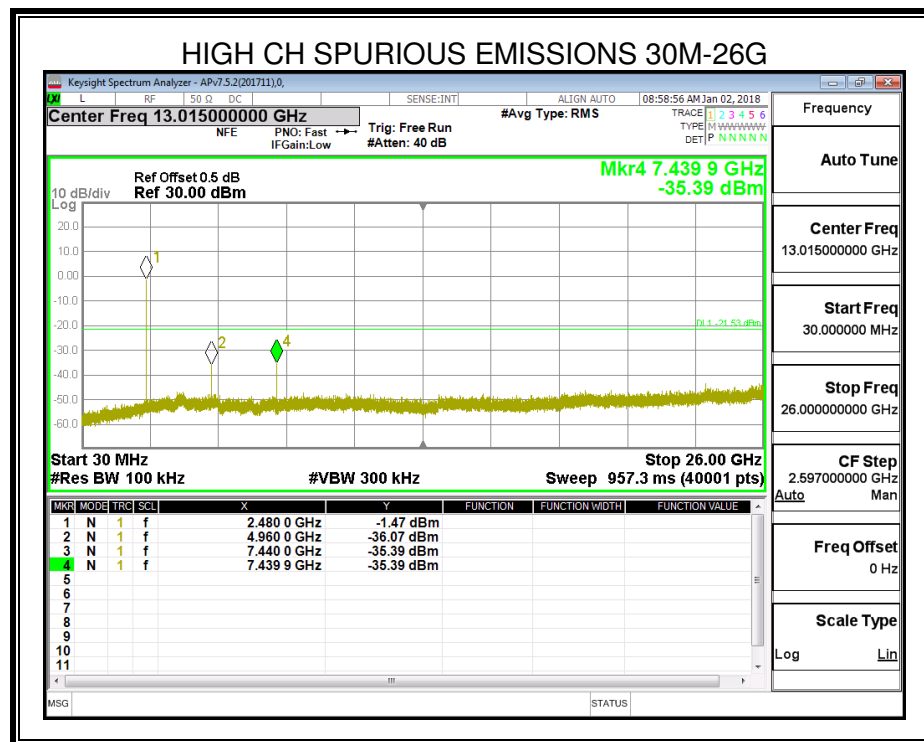
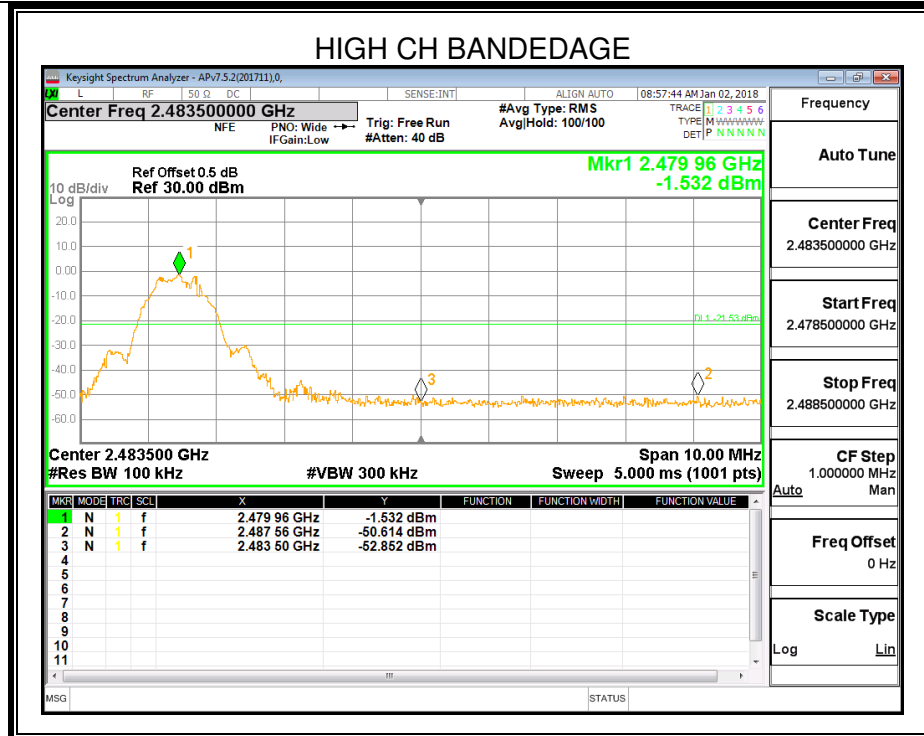
Use the peak marker function to determine the maximum amplitude level.

TEST SETUP



RESULTS





8. RADIATED TEST RESULTS

LIMITS

Please refer to FCC §15.205 and §15.209

Please refer to RSS-GEN Clause 8.9 and Clause 8.10

Radiation Disturbance Test Limit for FCC (Class B)(9KHz-1GHz)

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

Note: 1) At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

(2) At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). This paragraph (f) shall not apply to Access BPL devices operating below 30 MHz.

Radiation Disturbance Test Limit for FCC (Above 1G)

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

Restricted bands of operation

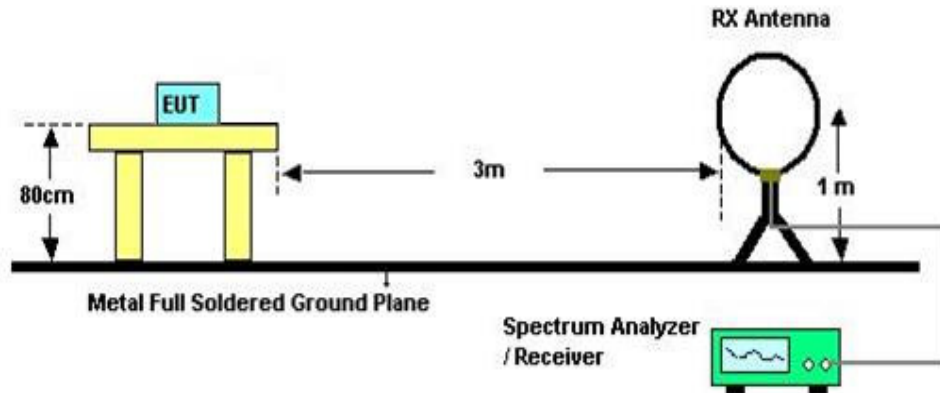
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
¹ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	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	(²)
13.36-13.41			

Note: ¹Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

²Above 38.6c

TEST SETUP AND PROCEDURE

Below 30MHz

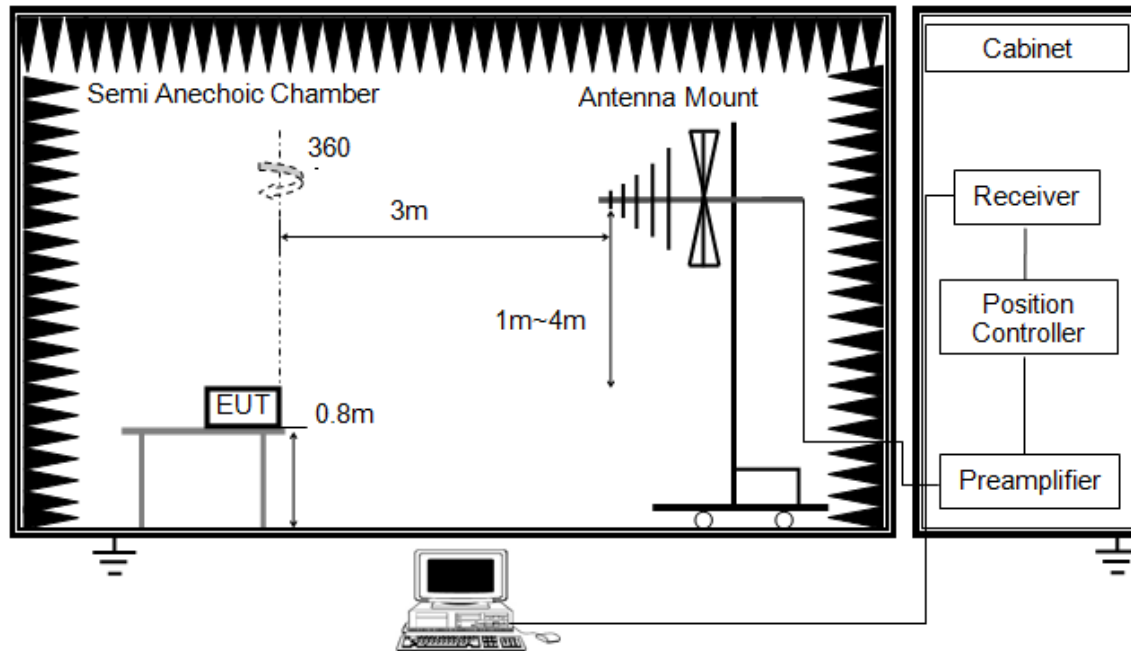


The setting of the spectrum analyser

RBW	200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz)
VBW	200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz)
Sweep	Auto
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013
2. The EUT was arranged to its worst case and then turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 80cm above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. The radiated emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
6. For measurement below 1GHz, 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 and average detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak and average detector and reported.
7. For the actual test configuration, please refer to the related item in this test report (Photographs of the Test Configuration)

Below 1G and above 30MHz

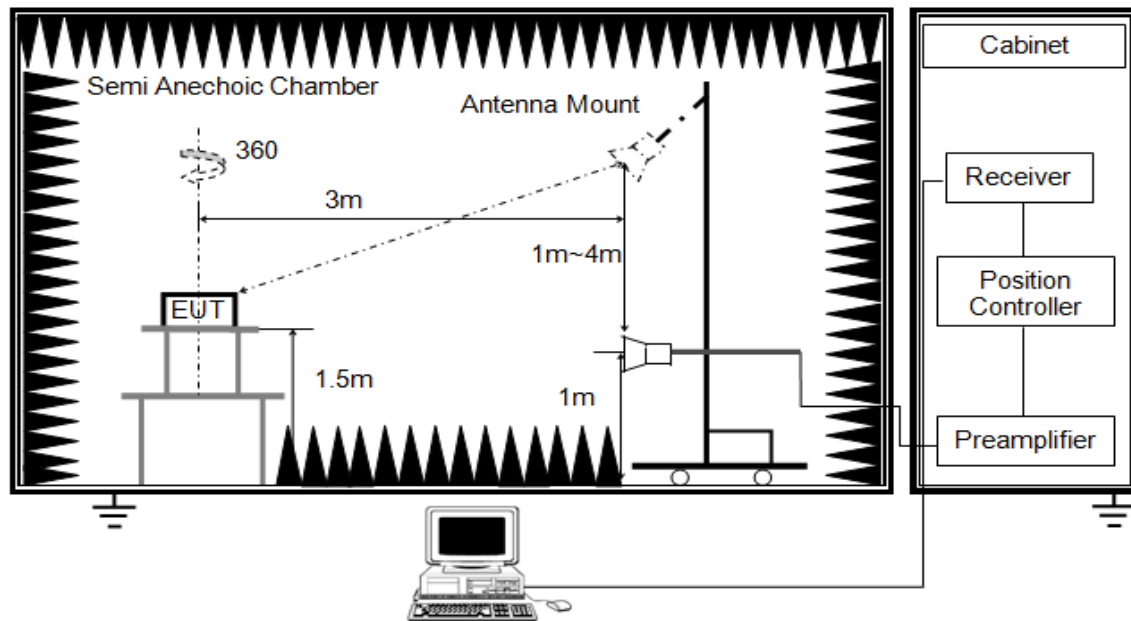


The setting of the spectrum analyser

RBW	120K
VBW	300K
Sweep	Auto
Detector	Peak/QP
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 80cm above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. For measurement below 1GHz, 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. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
6. For the actual test configuration, please refer to the related item in this test report (Photographs of the Test Configuration)

Above 1G

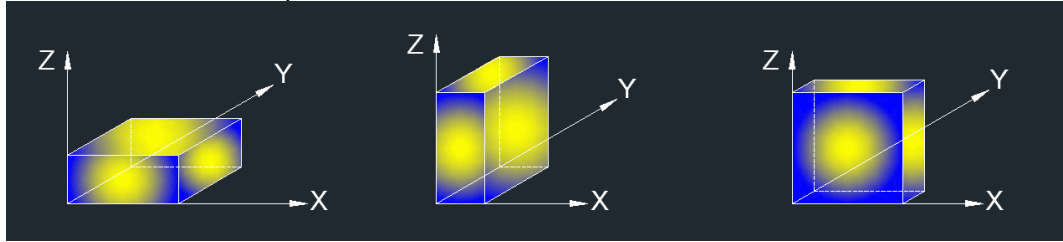


The setting of the spectrum analyser

RBW	1M
VBW	PEAK: 3M AVG: see note 6
Sweep	Auto
Detector	Peak
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013.
2. The EUT was arranged to its worst case and then tune the antenna tower (1.5 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 80cm above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. For measurement above 1GHz, the emission measurement will be measured by the peak detector. This peak level, once corrected, must comply with the limit specified in Section 15.209.
6. For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements, for average measurements, if the duty cycle of the EUT is less than 98%, set $VBW \geq 1 / T$, where T is defined in clause 7.1.ON TIME AND DUTY CYCLE.
7. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration)

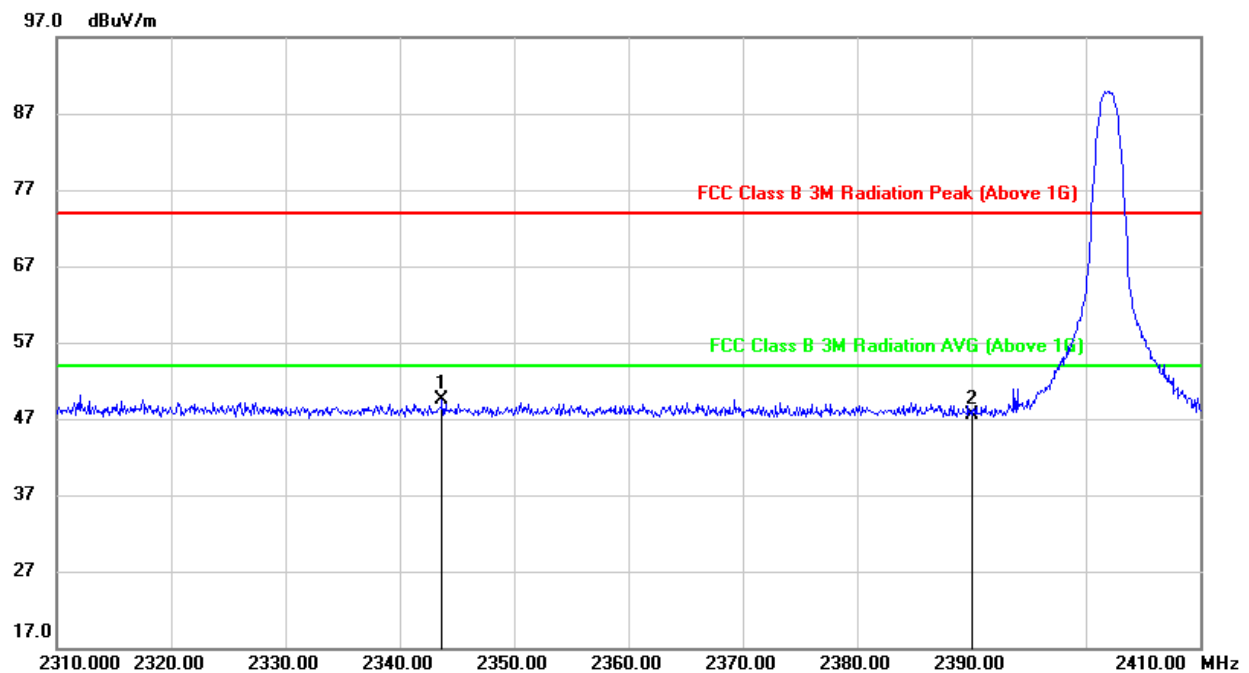
X axis, Y axis, Z axis positions:



Note: For all radiated test, EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

8.1. RESTRICTED BANDEDGE

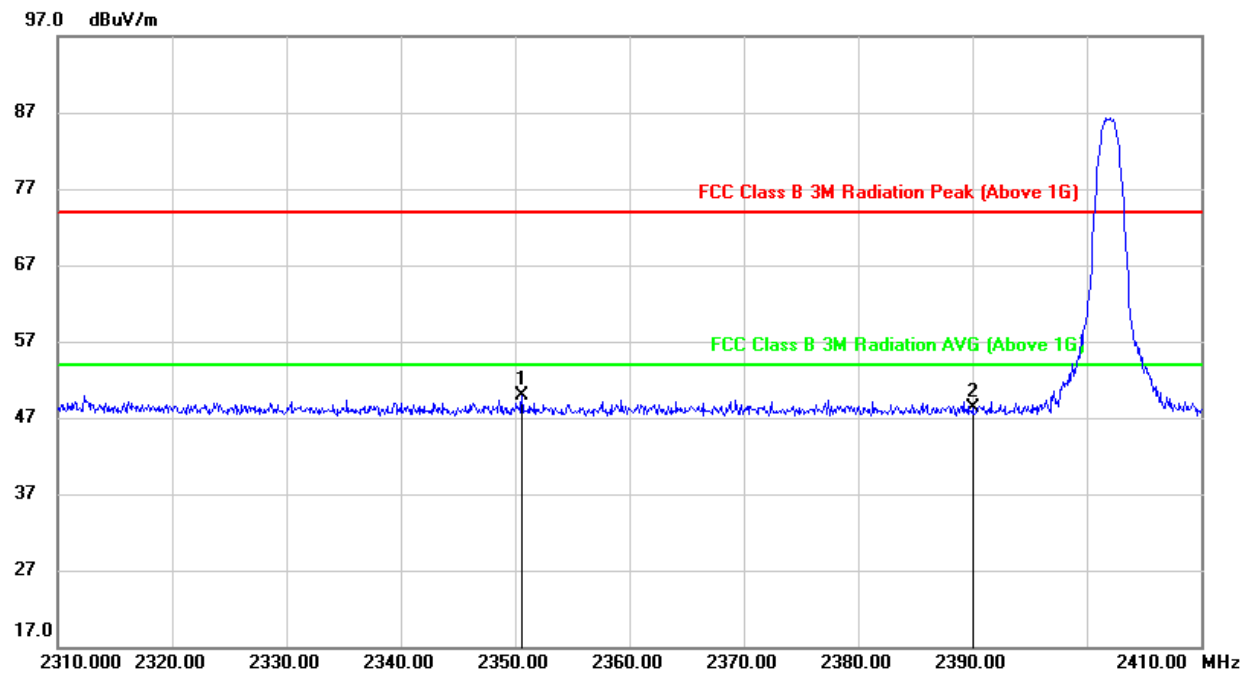
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2343.700	16.02	33.47	49.49	74.00	-24.51	peak
2	2390.000	14.45	33.14	47.59	74.00	-26.41	peak

Note: 1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.

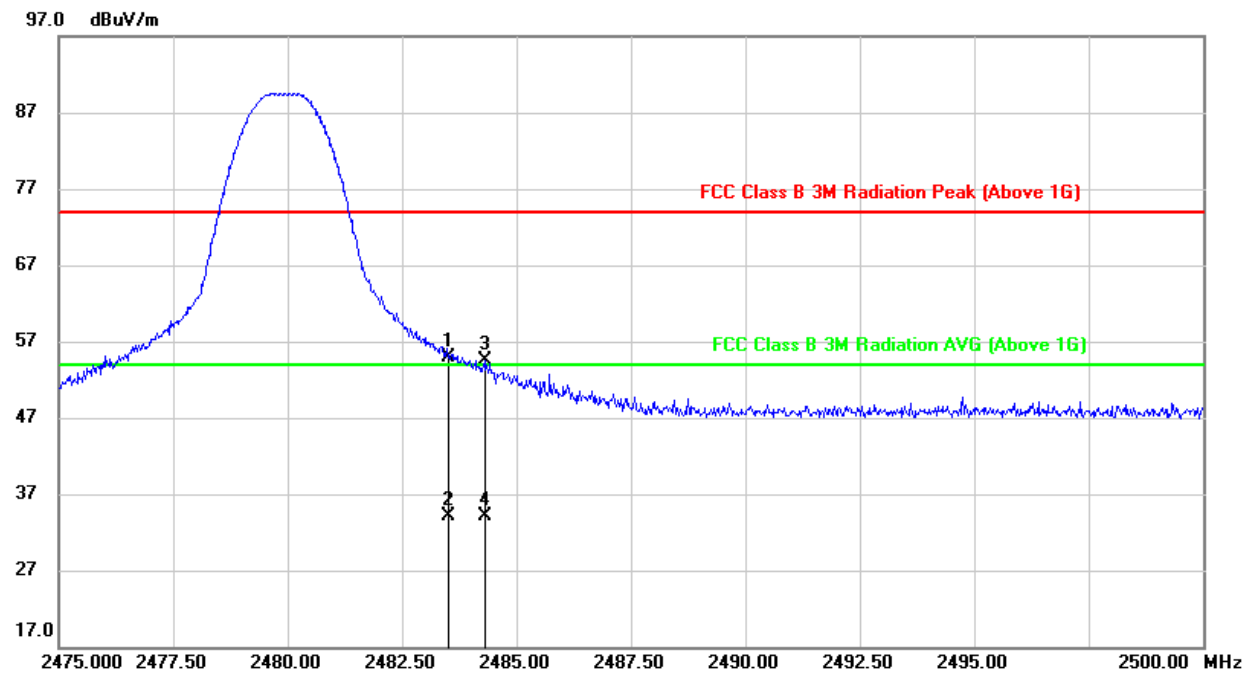
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2350.600	16.45	33.53	49.98	74.00	-24.02	peak
2	2390.000	15.10	33.24	48.34	74.00	-25.66	peak

Note: 1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.

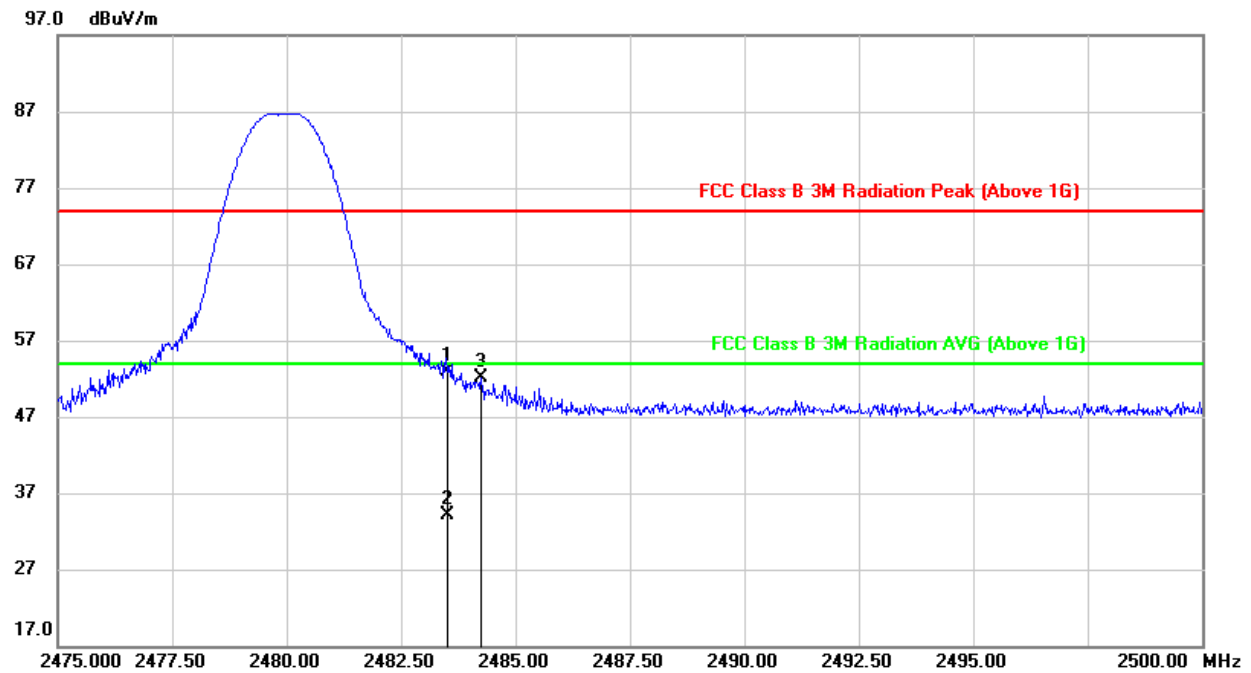
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	22.22	32.78	55.00	74.00	-19.00	peak
2	2483.500	1.25	32.78	34.03	54.00	-19.97	AVG
3	2484.300	21.69	32.78	54.47	74.00	-19.53	peak
4	2484.300	1.28	32.78	34.06	54.00	-19.94	AVG

Note: 1. Measurement = Reading Level + Correct Factor.
 2. Peak: Peak detector.
 3. AVG: VBW=1/Ton where: ton is transmit duration.
 4. For transmit duration, please refer to clause 7.1.

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

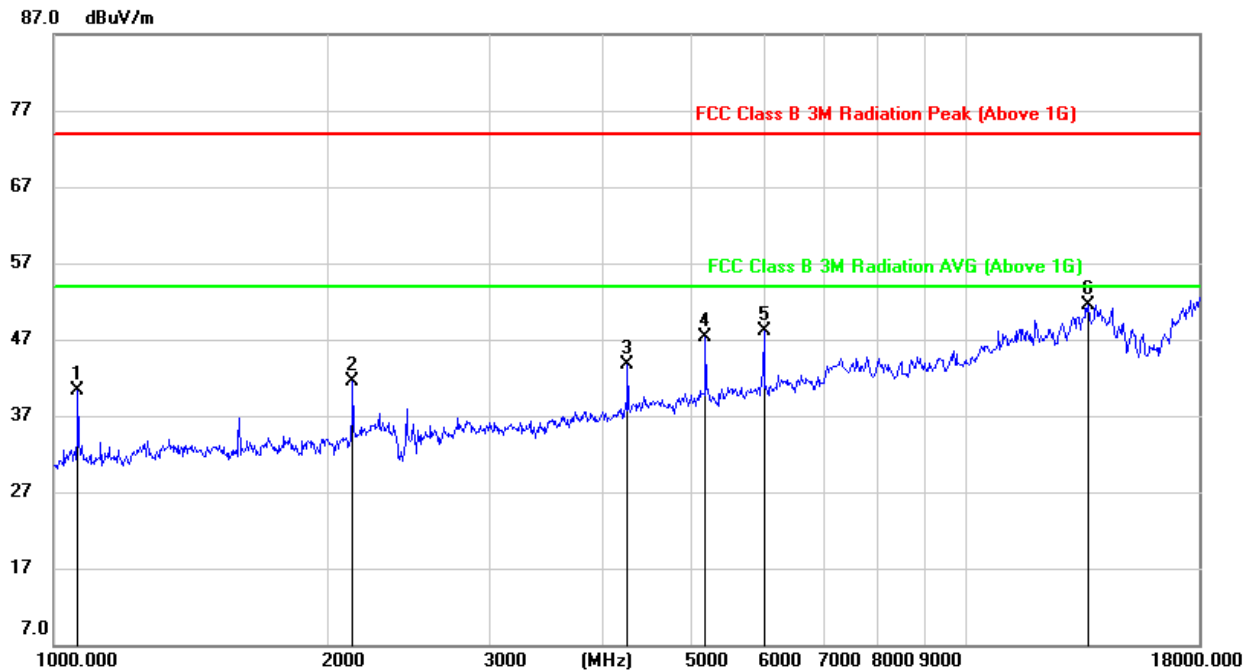


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	19.97	32.88	52.85	74.00	-21.15	peak
2	2483.500	1.21	32.88	34.09	54.00	-19.91	AVG
3	2484.250	19.18	32.88	52.06	74.00	-21.94	peak

Note: 1. Measurement = Reading Level + Correct Factor.
2. Peak: Peak detector.
3. AVG: VBW=1/Ton where: ton is transmit duration.
4. For transmit duration, please refer to clause 7.1.

8.2. SPURIOUS EMISSIONS (1~18GHz)

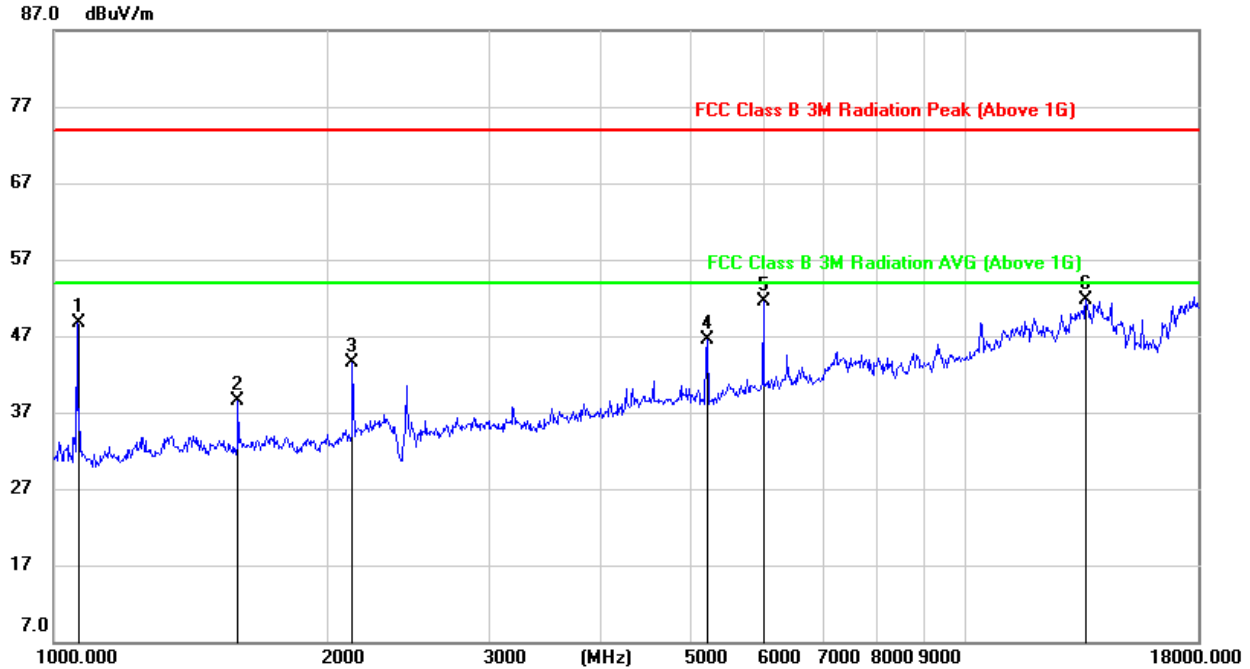
HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1062.578	54.44	-14.07	40.37	74.00	-33.63	peak
2	2132.462	51.37	-9.78	41.59	74.00	-32.41	peak
3	4254.921	47.03	-3.31	43.72	74.00	-30.28	peak
4	5179.049	47.50	-0.20	47.30	74.00	-26.70	peak
5	6001.626	46.03	2.00	48.03	74.00	-25.97	peak
6	13599.128	32.52	19.04	51.56	74.00	-22.44	peak

Note: 1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.

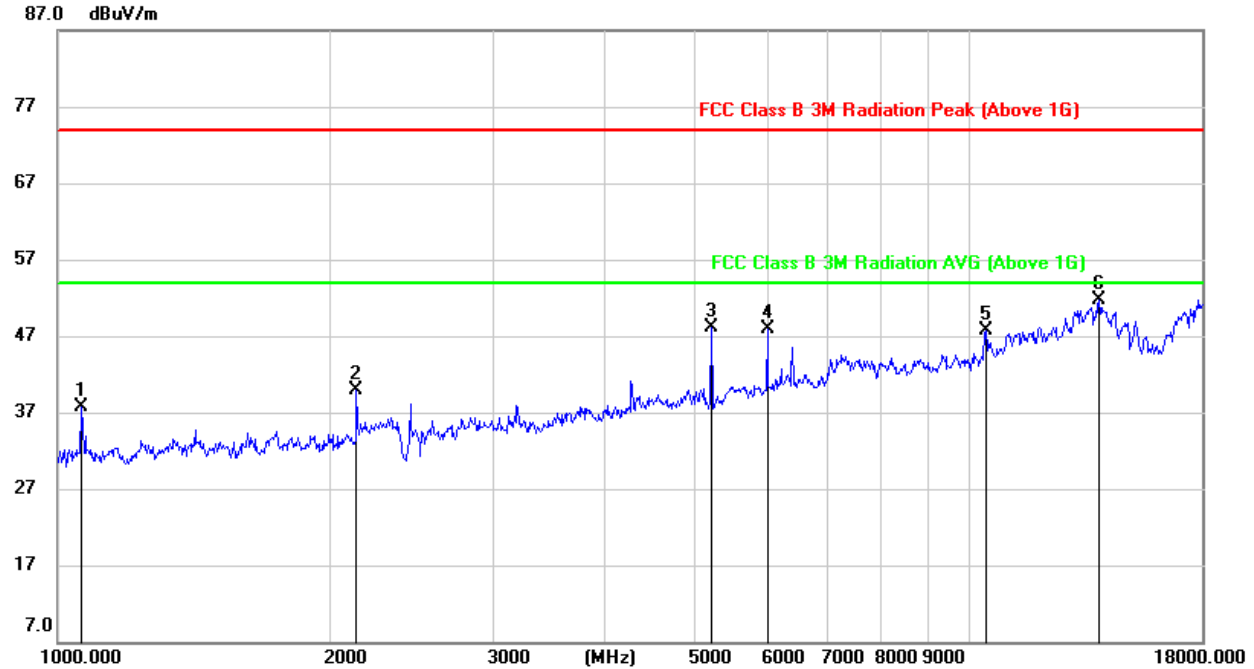
HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1062.578	63.11	-14.37	48.74	74.00	-25.26	peak
2	1592.571	51.29	-12.71	38.58	74.00	-35.42	peak
3	2132.462	53.30	-9.88	43.42	74.00	-30.58	peak
4	5209.075	46.51	-0.01	46.50	74.00	-27.50	peak
5	6001.626	49.39	2.10	51.49	74.00	-22.51	peak
6	13559.879	32.46	19.29	51.75	74.00	-22.25	peak

Note: 1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.

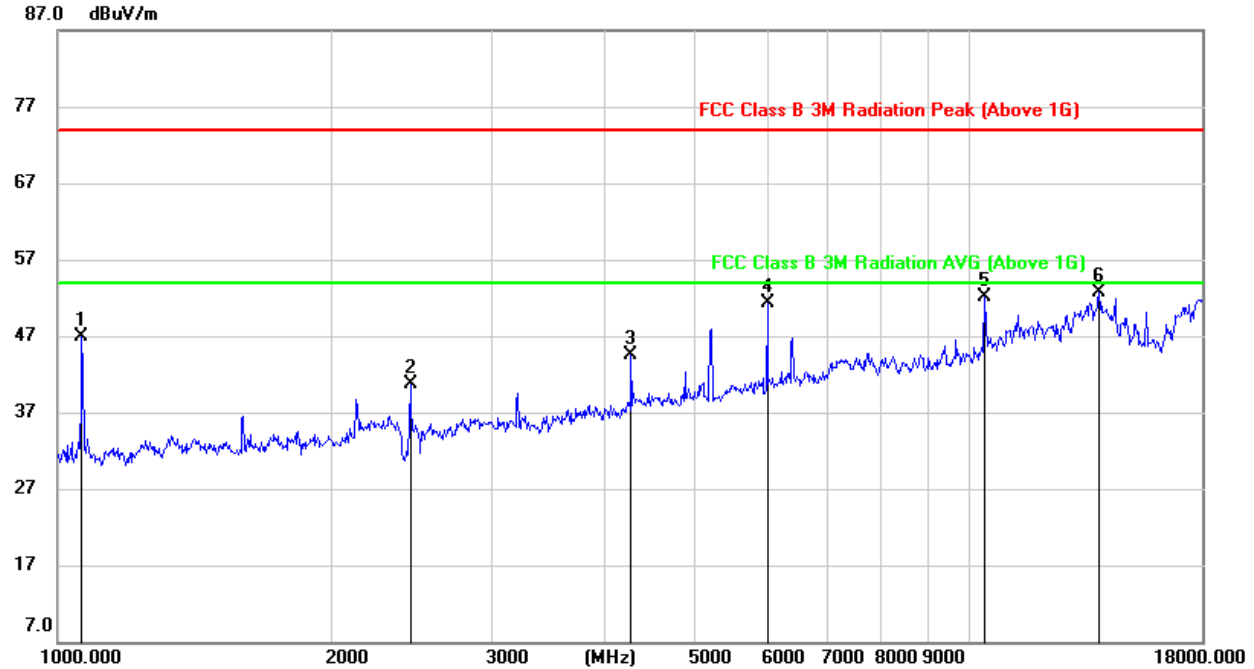
HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1062.578	51.79	-14.07	37.72	74.00	-36.28	peak
2	2132.462	49.63	-9.78	39.85	74.00	-34.15	peak
3	5209.075	48.23	-0.17	48.06	74.00	-25.94	peak
4	6001.626	45.86	2.00	47.86	74.00	-26.14	peak
5	10453.970	36.33	11.37	47.70	74.00	-26.30	peak
6	13877.076	32.69	18.99	51.68	74.00	-22.32	peak

Note: 1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.

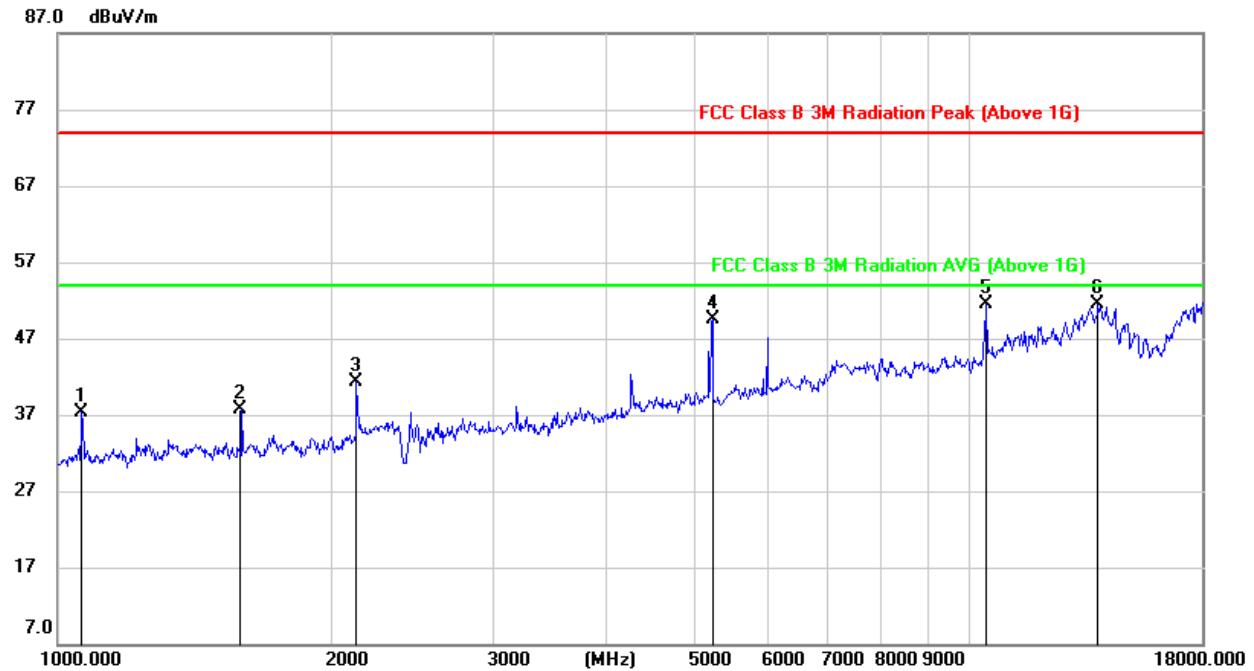
HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1062.578	61.36	-14.37	46.99	74.00	-27.01	peak
2	2435.701	49.65	-9.03	40.62	74.00	-33.38	peak
3	4254.921	47.78	-3.21	44.57	74.00	-29.43	peak
4	6001.626	49.25	2.10	51.35	74.00	-22.65	peak
5	10393.713	41.01	11.08	52.09	74.00	-21.91	peak
6	13877.076	33.45	19.19	52.64	74.00	-21.36	peak

Note: 1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.

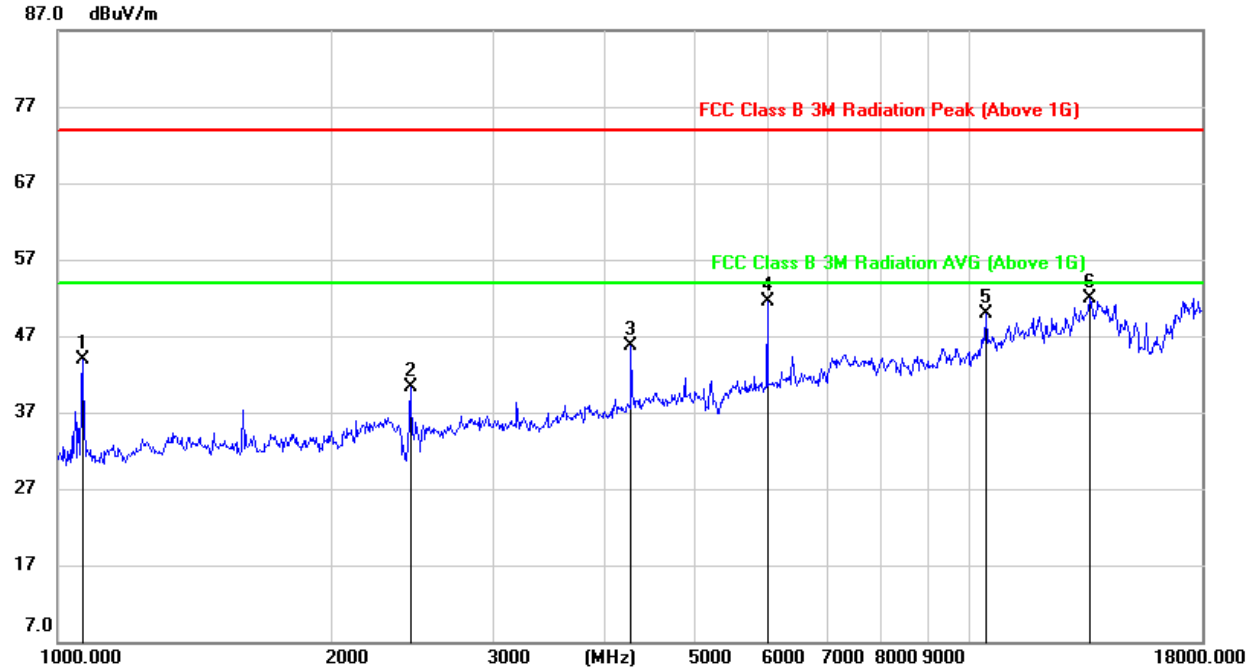
HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1062.578	51.40	-14.07	37.33	74.00	-36.67	peak
2	1592.571	50.41	-12.73	37.68	74.00	-36.32	peak
3	2132.462	51.07	-9.78	41.29	74.00	-32.71	peak
4	5224.153	49.72	-0.19	49.53	74.00	-24.47	peak
5	10453.970	40.15	11.37	51.52	74.00	-22.48	peak
6	13837.024	32.44	19.01	51.45	74.00	-22.55	peak

Note: 1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.

HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, VERTICAL)

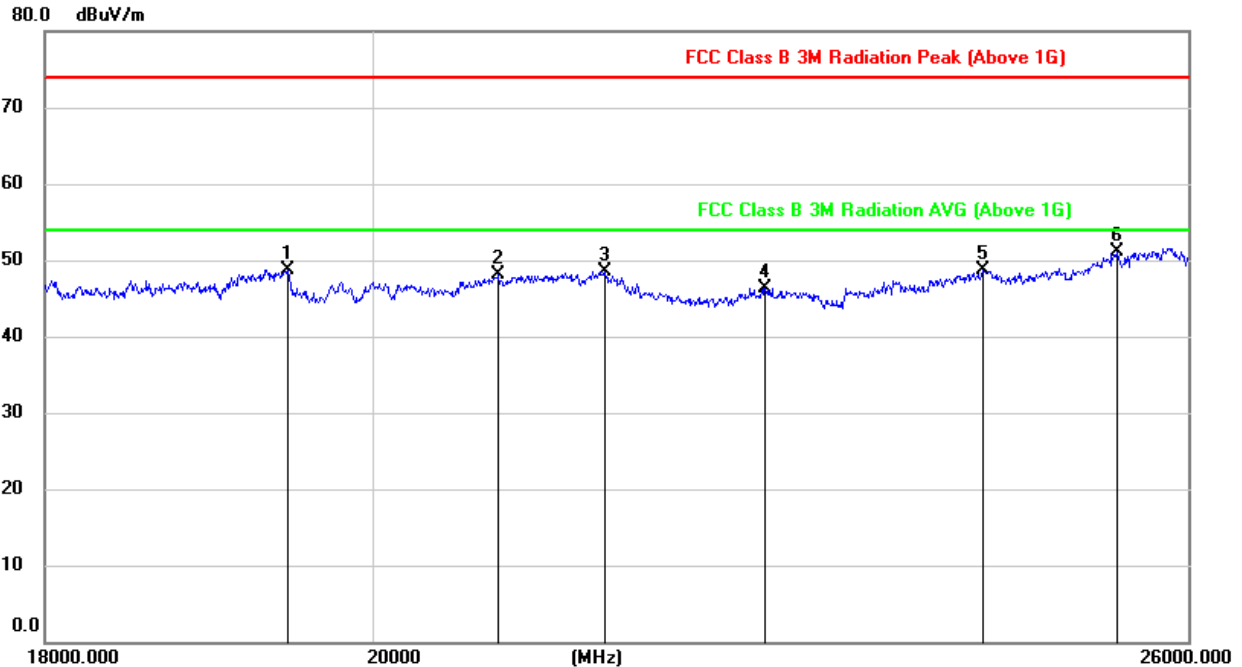


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1065.653	58.33	-14.36	43.97	74.00	-30.03	peak
2	2435.701	49.42	-9.03	40.39	74.00	-33.61	peak
3	4254.921	48.98	-3.21	45.77	74.00	-28.23	peak
4	6001.626	49.36	2.10	51.46	74.00	-22.54	peak
5	10453.971	38.40	11.47	49.87	74.00	-24.13	peak
6	13559.879	32.58	19.29	51.87	74.00	-22.13	peak

Note: 1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.

8.3. SPURIOUS EMISSIONS 18G ~ 26GHz

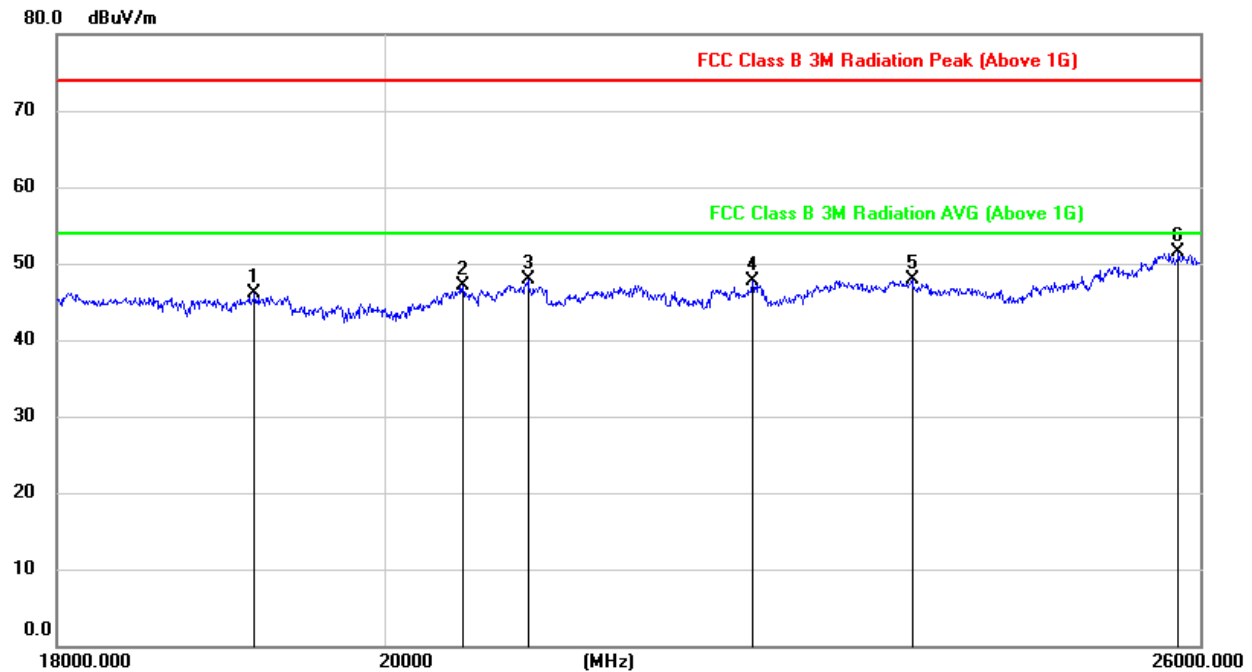
SPURIOUS EMISSIONS (MID CHANNEL, WORST-CASE CONFIGURATION, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	19466.541	54.35	-5.55	48.80	74.00	-25.20	peak
2	20829.255	53.05	-5.04	48.01	74.00	-25.99	peak
3	21553.903	53.10	-4.61	48.49	74.00	-25.51	peak
4	22692.588	50.04	-3.74	46.30	74.00	-27.70	peak
5	24334.767	51.45	-2.65	48.80	74.00	-25.20	peak
6	25413.934	52.82	-1.74	51.08	74.00	-22.92	peak

Note: 1. Peak Result = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Peak: Peak detector.
4. All the modes had been tested, but only the worst data were recorded in the report.

SPURIOUS EMISSIONS (MID CHANNEL, WORST-CASE CONFIGURATION, VERTICAL)

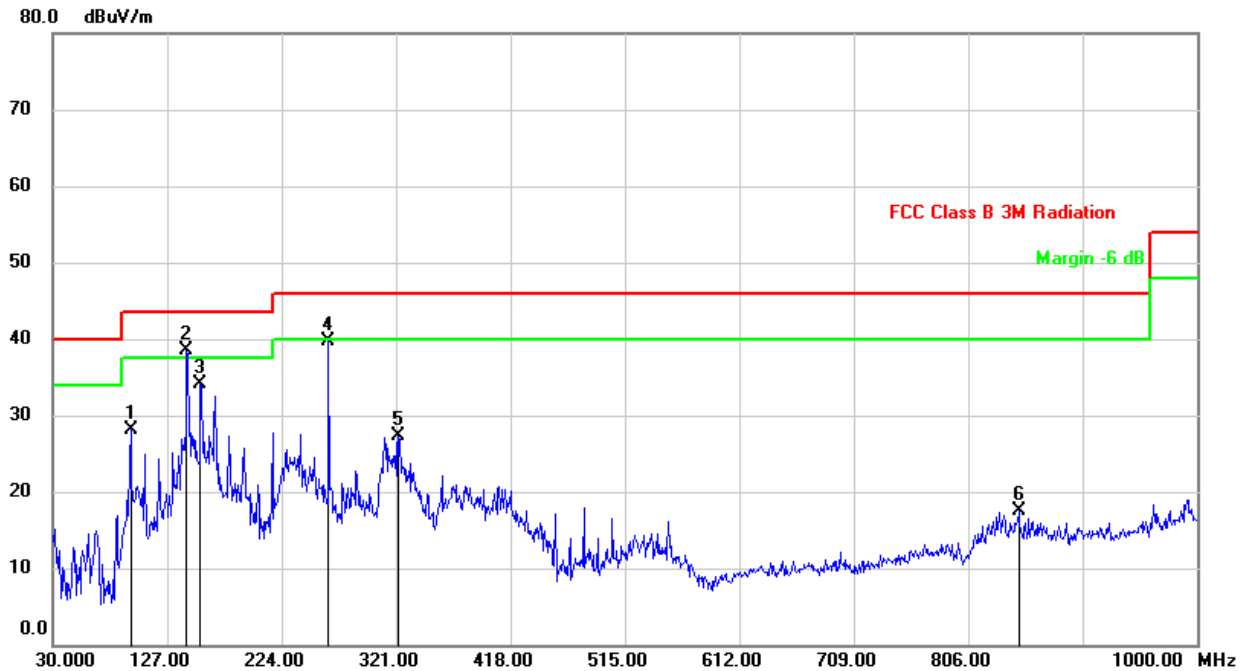


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	19182.303	51.58	-5.49	46.09	74.00	-27.91	peak
2	20510.030	52.36	-5.35	47.01	74.00	-26.99	peak
3	20944.464	52.74	-4.93	47.81	74.00	-26.19	peak
4	22518.026	51.55	-3.87	47.68	74.00	-26.32	peak
5	23698.930	51.04	-3.18	47.86	74.00	-26.14	peak
6	25818.977	52.23	-0.74	51.49	74.00	-22.51	peak

- Note: 1. Peak Result = Reading Level + Correct Factor.
 2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
 3. Peak: Peak detector.
 4. All the modes had been tested, but only the worst data were recorded in the report.

8.4. SPURIOUS EMISSIONS 30M ~ 1 GHz

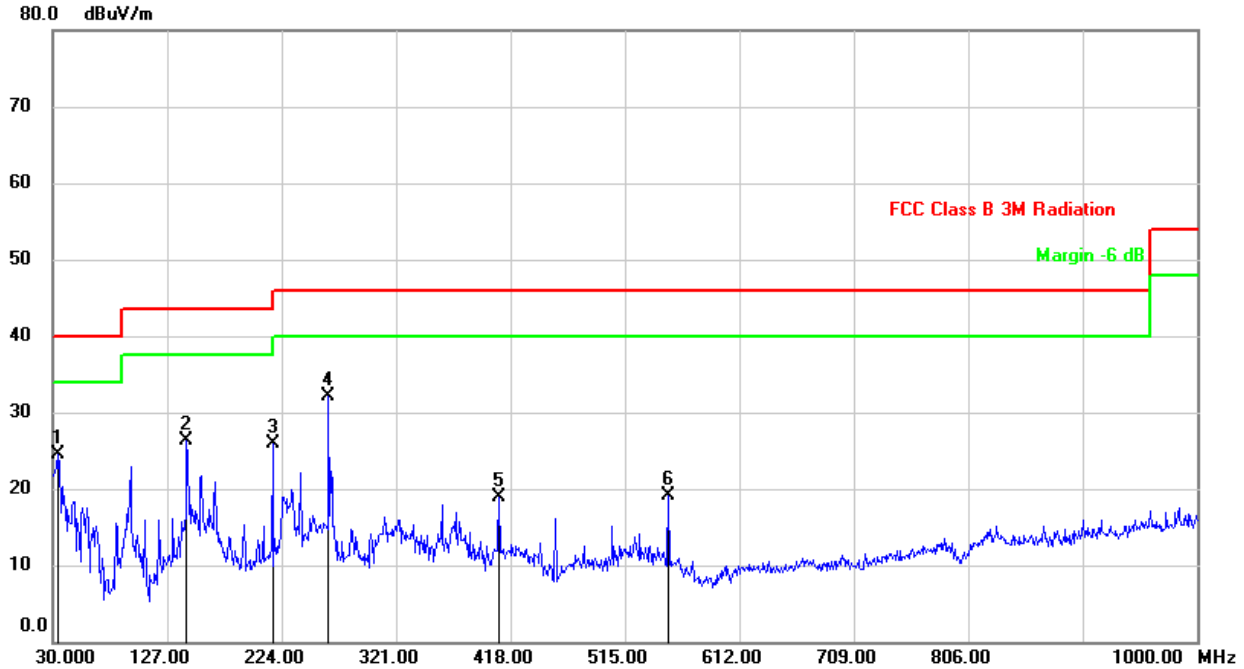
SPURIOUS EMISSIONS (MID CHANNEL, WORST-CASE CONFIGURATION, HORIZONTAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	95.9600	61.37	-33.17	28.20	43.50	-15.30	QP
2	143.4900	67.57	-29.07	38.50	43.50	-5.00	QP
3	155.1300	63.31	-29.28	34.03	43.50	-9.47	QP
4	263.7700	68.20	-28.55	39.65	46.00	-6.35	QP
5	322.9400	54.95	-27.72	27.23	46.00	-18.77	QP
6	848.6800	34.94	-17.39	17.55	46.00	-28.45	QP

- Note: 1. Result Level = Read Level + Correct Factor.
2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.
3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.
4. All the modes had been tested, but only the worst data were recorded in the report.

SPURIOUS EMISSIONS (MID CHANNEL, WORST-CASE CONFIGURATION, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	33.8800	53.64	-29.18	24.46	40.00	-15.54	QP
2	143.4900	55.30	-29.07	26.23	43.50	-17.27	QP
3	216.2400	54.28	-28.45	25.83	46.00	-20.17	QP
4	263.7700	60.61	-28.55	32.06	46.00	-13.94	QP
5	408.3000	43.64	-24.79	18.85	46.00	-27.15	QP
6	551.8600	40.51	-21.34	19.17	46.00	-26.83	QP

- Note: 1. Result Level = Read Level + Correct Factor.
 2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.
 3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto
 4. All the modes had been tested, but only the worst data were recorded in the report.

9. ANTENNA REQUIREMENTS

Applicable requirements

Please refer to FCC §15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Please refer to FCC §15.247(b)(4)

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector

EUT has a chip antenna without antenna connector.

Antenna Gain

The antenna gain of EUT is less than 6 dBi.

END OF REPORT

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