FCC Test Report

Report No.: ACON-ESH-P19112701B-2

FCC ID: 2AVHC-OEM-05146

Product: Bluetooth Audio Amplifier Board

Model: OEM-05146

Received Date: Nov.27, 2019

Test Date: Dec.02 to Dec.15, 2019

Issued Date: Dec.28, 2019

Applicant: Sure Electronics Co.,Ltd.

Address: 3F,Building F6,No.9,Weidi Road,Qixia Dist.,Nanjing,China

Manufacturer: Sure Electronics Co.,Ltd.

Address: 3F,Building F6,No.9,Weidi Road,Qixia Dist.,Nanjing,China

Issued By: BUREAU VERITAS ADT (Shanghai) Corporation

Address: No. 829, Xinzhuan Road, Shanghai, P.R.China (201612)

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Release Control Record

Issue No.	Description	Date Issued
ACON-ESH-P19112701B-2	Original release	Dec.28, 2019

1 Certificate of Conformity

Product: Bluetooth Audio Amplifier Board

Brand: Robern

Model: OEM-05146

Applicant: Sure Electronics Co.,Ltd.

Test Date: Dec.02 to Dec.10, 2019

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10:2013

The above equipment has been tested by **BUREAU VERITAS ADT (Shanghai) Corporation**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : , **Date:** Dec.28, 2019

Will YAN

Project Engineer

Approved by : , **Date:** Dec.28, 2019

Daniel SUN

RF Supervisor

2 Summary of Test Results

The EUT has been tested according to the following specifications:

47 CFR FCC Part 15, Subpart C (SECTION 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit.
15.247(a)(1)(iii)	Number of Hopping Frequency Used	PASS	Meet the requirement of limit.
15.247(a)(1)(iii)	Dwell Time on Each Channel	PASS	Meet the requirement of limit.
15.247(a)(1)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	PASS	Meet the requirement of limit.
15.247(b)	Maximum Peak Output Power	PASS	Meet the requirement of limit.
15.205 / 15.209 / 15.247(d)	Radiated Emissions & Band Edge Measurement	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

Note: The data shown in the report is the worst case data when the EUT is powered by AC120V, 60Hz(Via Adaptor)

2.1 Test Instruments

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Hybrid antenna(25MHz-1.5GHz)	Schwarzbeck	VULB9168	E1A1012	Aug.26,19	Aug.25,20
Horn Antenna(1GHz -18GHz)	Schwarzbeck	BBHA9120D	E1A1017	Aug.26,19	Aug.25,20
Pre-Amplifier(100kHz-1.3GHz)	Agilent	8447D	E1A2001	Oct.18, 19	Oct.17, 20
Pre-Amplifier(1GHz-26.5GHz)	Agilent	8449B	E1A2002	Mar. 25, 19	Mar. 25, 20
EMI test recerver	R&S	ESR7	E1R1005	Dec.04, 19	Dec.03, 20
Spectrum Analyzer	Keysight	N9030B	E1S1003	Jul.23,19	Jul.22, 20
EMI test recerver	R&S	ESCS30	E1R1001	Mar.26, 19	Mar.25, 20
LISN	R&S	ENV216	E1L1011	Jul.18, 19	Jul.17, 20
Humidity&Temp Tester	Baolima	WS508	E1H1011	Apr. 04, 19	Apr. 03, 20
Test Software	ADT	ADT_COND_V 7.3.1	N/A	N/A	N/A
Test Software	Toscend	JS32-RE	N/A	N/A	N/A
Test Software	Toscend	JS1120	N/A	N/A	N/A

2.2 Measurement Uncertainty

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

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.83 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.36 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	3.47 dB
	6GHz ~ 18GHz	3.75 dB
	18GHz ~ 40GHz	3.30 dB

2.3 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Bluetooth Audio Amplifier Board
Brand	--
Test Model	OEM-05146
Model Difference	--
Power Rating	12~24Vdc,0~2A
Modulation Type	GFSK, π/4-DQPSK,8DPSK
Modulation Technology	BT-EDR, FHSS
Operating Frequency	2402MHz ~ 2480MHz
Number of Channel	79
Output Power	0.69dBm
Antenna Type	PCB antenna
Antenna Connector	--
Antenna Gain	4dBi

Note: For more details, please refer to the User's manual of the EUT.

3.2 Description of Test Modes

79 channels are provided for BT-EDR mode:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

3.2.1 Test Mode Applicability:

EUT Configure Mode	Applicable to				Description
	RE ≥ 1G	RE < 1G	PLC	APCM	
-	√	√	-	√	-

Where **RE≥1G:** Radiated Emission above 1GHz **RE≤1G:** Radiated Emission below 1GHz

PLC: Power Line Conducted Emission **APCM:** Antenna Port Conducted Measurement

Radiated Emission Test (Above 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	0, 39, 78	FHSS	GFSK	DH5
-	0 to 78	0, 39, 78	FHSS	π/4-DQPSK	2DH5

Radiated Emission Test (Below 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	78	FHSS	π/4-DQPSK	2DH5

Power Line Conducted Emission Test:

☐ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☐ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	78	FHSS	π/4-DQPSK	2DH5

Antenna Port Conducted Measurement

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	0, 39, 78	FHSS	GFSK	DH5
-	0 to 78	0, 39, 78	FHSS	π/4-DQPSK	2DH5

3.2.2 Test Condition:

Applicable to	Normal Environmental Conditions	Normal Input Power
RE ≥ 1G	23deg. C, 58%RH	AC120V 60Hz
RE < 1G	23deg. C, 58%RH	AC120V 60Hz
PLC	22deg. C, 54%RH	AC120V 60Hz
APCM	25deg. C, 60%RH	AC120V 60Hz

3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units.

3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standard:

FCC Part 15, Subpart C (15.247)

FCC DA 00705

ANSI C63.10:2013

All relaxed test items have been performed and recorded as per the above standard.

4 Test Procedure and Results

4.1 Conducted Emission Measurement

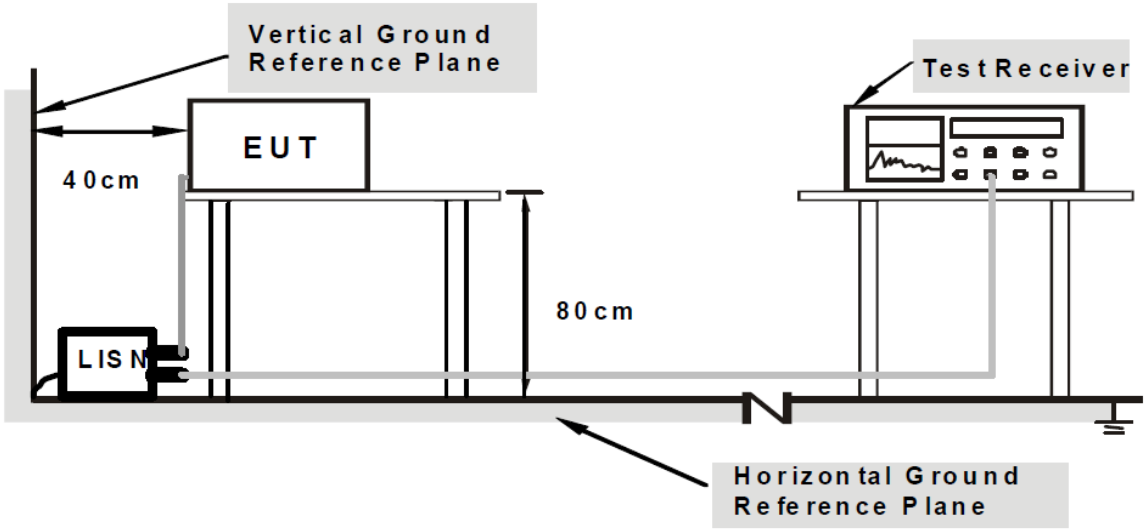
4.1.1 Limit

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.1.2 Test Setup



4.1.3 Test Procedures

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.1.4 Deviation of Test Standard

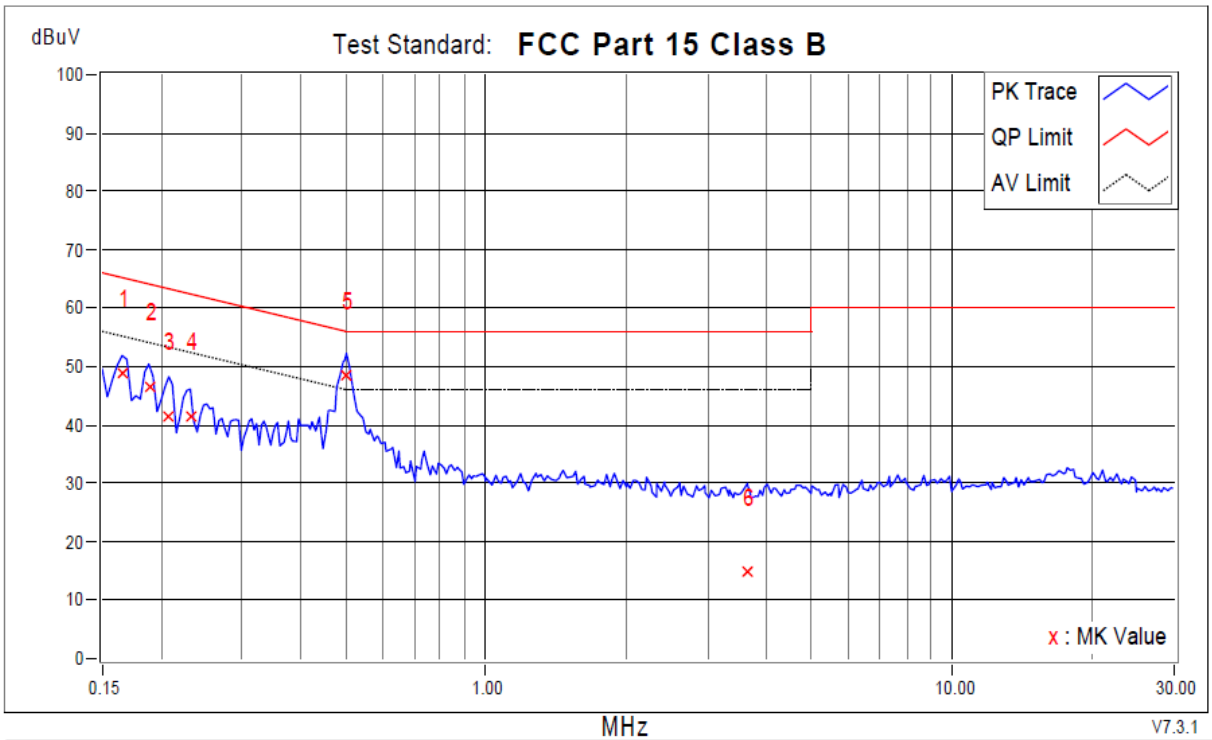
No deviation.

4.1.5 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)

Location: Conduction 1 Date: 12/5/2019 Time: 2:20:49 PM Phase L1

Temperatuer (C): 19 Humidity (%): 53 Approved by:



	Frequency	Corr. Factor	Reading dBuV		Emission dBuV		Limit dBuV		Margins dB		Notes
No.	MHz	dB	QP	AV	QP	AV	QP	AV	QP	AV	
1	0.16564	9.85	38.87	27.40	48.72	37.25	65.18	55.18	-16.46	-17.93	
2	0.18910	9.86	36.64	26.76	46.50	36.62	64.08	54.08	-17.58	-17.46	
3	0.20865	9.85	31.45	20.06	41.30	29.91	63.26	53.26	-21.96	-23.35	
4	0.23211	9.81	31.64	20.56	41.45	30.37	62.37	52.37	-20.93	-22.01	
+5	0.50190	9.72	38.86	30.65	48.58	40.37	56.00	46.00	-7.42	-5.63	
6	3.63925	9.92	4.97	-4.25	14.89	5.67	56.00	46.00	-41.11	-40.33	

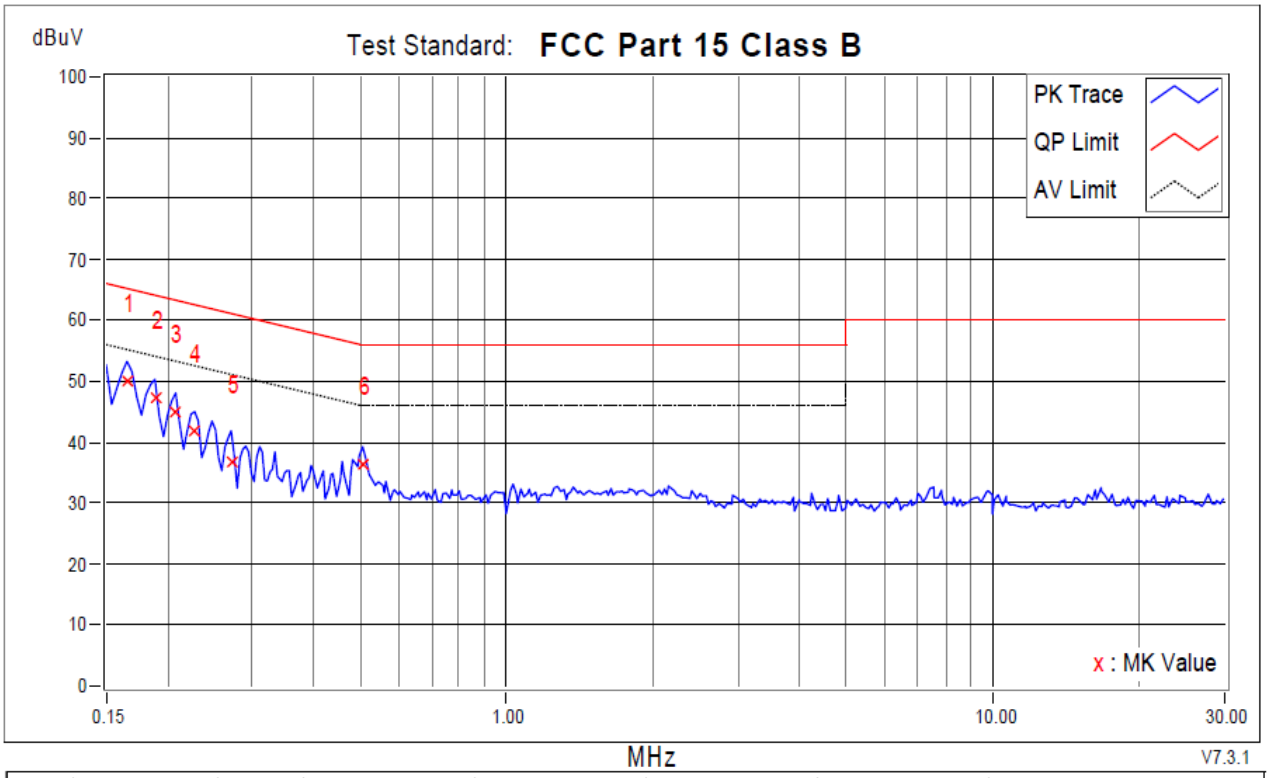
REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

Location: Conduction 1 Date: 12/5/2019 Time: 2:22:54 PM Phase N

Temperatuer (C): 19 Humidity (%): 53 Approved by:



No.	Frequency MHz	Corr. Factor dB	Reading dBuV QP	Reading dBuV AV	Emission dBuV QP	Emission dBuV AV	Limit dBuV QP	Limit dBuV AV	Margins dB QP	Margins dB AV	Notes
+1	0.16564	9.83	40.10	28.41	49.93	38.24	65.18	55.18	-15.24	-16.93	
2	0.18910	9.81	37.35	27.45	47.16	37.26	64.08	54.08	-16.92	-16.82	
3	0.20865	9.81	35.14	25.27	44.95	35.08	63.26	53.26	-18.31	-18.18	
4	0.22820	9.82	31.95	24.05	41.77	33.87	62.51	52.51	-20.75	-18.65	
5	0.27121	9.85	26.97	13.41	36.82	23.26	61.08	51.08	-24.26	-27.82	
6	0.50581	9.84	26.39	20.01	36.23	29.85	56.00	46.00	-19.77	-16.15	

REMARKS:

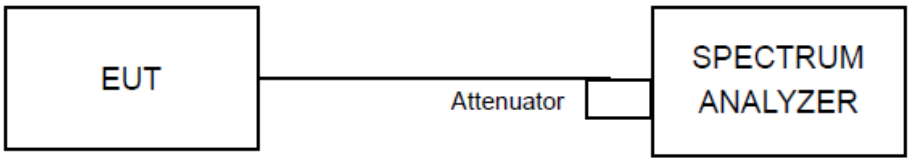
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

4.2 Number of Hopping Frequency Used

4.2.1 Limit

At least 15 channels frequencies, and should be equally spaced.

4.2.2 Test Setup



4.2.3 Test Procedures

a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.

b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.

c. Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.

d. Set the SA on View mode and then plot the result on SA screen.

e. Repeat above procedures until all frequencies measured were complete.

4.2.4 Deviation of Test Standard

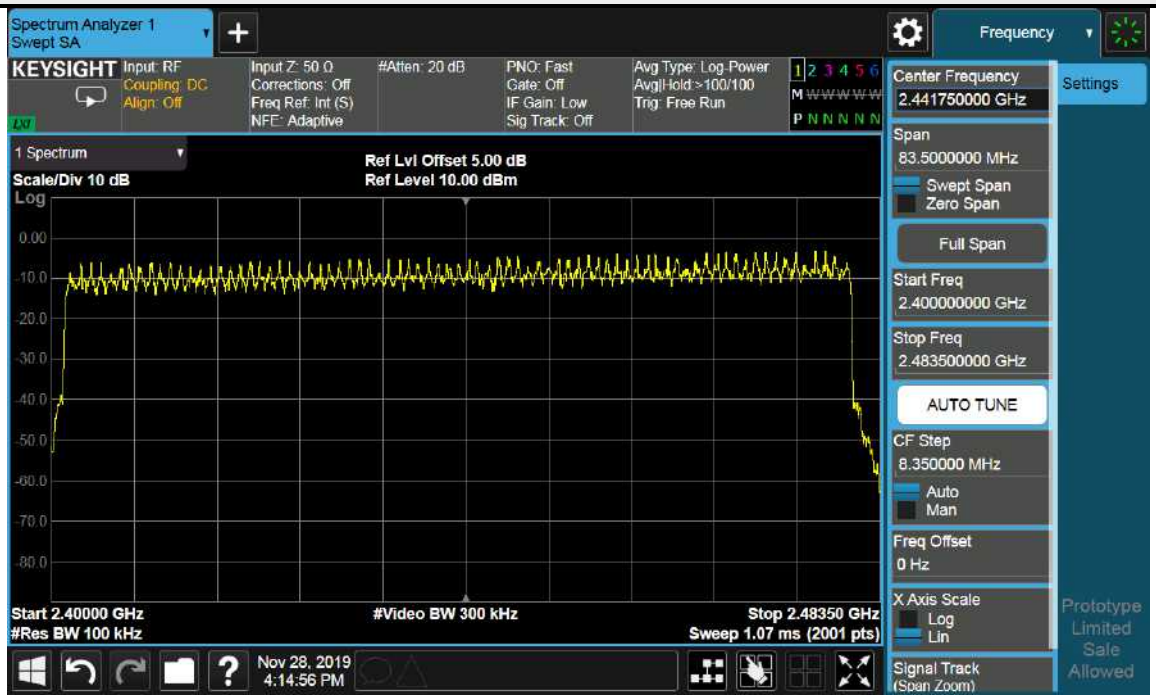
No deviation.

4.2.5 Test Results

There are 79 hopping frequencies in the hopping mode. Please refer to next page for the test result. On the plots, it shows that the hopping frequencies are equally spaced.

GFSK

π/4DQPSK



8DPSK

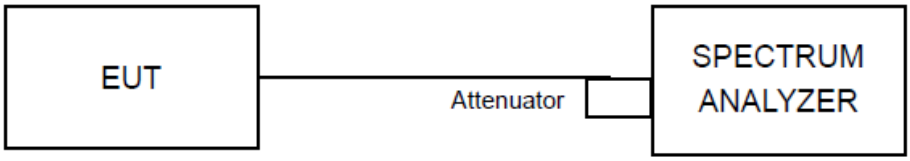

Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Start 2.40000 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Stop 2.48350 GHz
Sweep 1.07 ms (2001 pts)
Nov 28, 2019
4:12:08 PM
Frequency
Center Frequency
2.441750000 GHz
Span
83.5000000 MHz
Swept Span
Zero Span
Full Span
Start Freq
2.400000000 GHz
Stop Freq
2.483500000 GHz
AUTO TUNE
CF Step
8.350000 MHz
Auto
Man
Freq Offset
0 Hz
X Axis Scale
Log
Lin
Signal Track
(Span Zoom)
Settings
Prototype
Limited
Sale
Allowed

4.3 Dwell Time on Each Channel

4.3.1 Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

4.3.2 Test Setup



4.3.3 Test Procedures

a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
c. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
d. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
e. Repeat above procedures until all different time-slot modes have been completed.

4.3.4 Deviation of Test Standard

No deviation.

4.3.5 Test Results

GFSK

Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (sec)	Limit (sec)
DH1	322	0.40	0.129	0.4
DH3	158	1.65	0.261	0.4
DH5	108	2.90	0.313	0.4

π/4DQPSK

Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (sec)	Limit (sec)
DH1	322	0.41	0.132	0.4
DH3	165	1.68	0.276	0.4
DH5	158	1.65	0.313	0.4

8DPSK

Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (sec)	Limit (sec)
DH1	316	0.41	0.132	0.4
DH3	158	1.68	0.265	0.4
DH5	108	2.90	0.313	0.4

NOTE: Test plots of the transmitting time slot are shown on next page.

GFSK

DH1


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Trig: Free Run
Marker
Select Marker
Marker 1
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 5.00 dB
Ref Level 13.00 dBm
ΔMkr1 400.0 µs
0.12 dB
Marker Δ Time
400.000 µs
Marker Mode
Normal
Delta (Δ)
Fixed
Off
Delta Marker (Reset Delta)
Marker Table
On
Off
Marker Settings Diagram
All Markers Off
Couple Markers
On
Off
Settings
Peak Search
Pk Search Config
Properties
Marker Function
Marker→
Counter
Center 2.441000000 GHz
Res BW 1.0 MHz
#Video BW 3.0 MHz
Span 0 Hz
Sweep 20.00 ms (2001 pts)
Nov 29, 2019
8:57:32 AM
Prototype Limited Sale Allowed


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Trig: Free Run
Frequency
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 5.00 dB
Ref Level 13.00 dBm
Center Frequency
2.441000000 GHz
Span
0.00000000 Hz
Swept Span
Zero Span
Full Span
Start Freq
2.441000000 GHz
Stop Freq
2.441000000 GHz
AUTO TUNE
CF Step
1.000000 MHz
Auto
Man
Freq Offset
0 Hz
X Axis Scale
Log
Lin
Signal Track
(Span Zoom)
Settings
Center 2.441000000 GHz
Res BW 1.0 MHz
#Video BW 3.0 MHz
Span 0 Hz
Sweep 5.000 s (2001 pts)
Nov 29, 2019
8:58:51 AM
Prototype Limited Sale Allowed

DH3


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Trig: Free Run
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 5.00 dB
Ref Level 13.00 dBm
ΔMkr1 1.650 ms
-0.05 dB
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#Video BW 3.0 MHz
Span 0 Hz
Sweep 50.00 ms (2001 pts)
Nov 29, 2019
9:01:54 AM
Marker
Select Marker
Marker 1
Marker Δ Time
1.65000 ms
Marker Mode
Normal
Delta (Δ)
Fixed
Off
Delta Marker (Reset Delta)
Marker Table
On
Off
Marker Settings Diagram
All Markers Off
Couple Markers
On
Off
Settings
Peak Search
Pk Search Config
Properties
Marker Function
Marker→
Counter
Prototype Limited Sale Allowed


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Trig: Free Run
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 5.00 dB
Ref Level 13.00 dBm
Center 2.441000000 GHz
Res BW 1.0 MHz
#Video BW 3.0 MHz
Span 0 Hz
Sweep 5.000 s (2001 pts)
Nov 29, 2019
9:00:35 AM
Frequency
Center Frequency
2.441000000 GHz
Span
0.00000000 Hz
Swept Span
Zero Span
Full Span
Start Freq
2.441000000 GHz
Stop Freq
2.441000000 GHz
AUTO TUNE
CF Step
1.000000 MHz
Auto
Man
Freq Offset
0 Hz
X Axis Scale
Log
Lin
Signal Track
(Span Zoom)
Settings
Prototype Limited Sale Allowed

DH5


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Trig: Free Run
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 5.00 dB
Ref Level 13.00 dBm
ΔMkr1 2.900 ms
-0.06 dB
1Δ2
X2
Center 2.441000000 GHz
Res BW 1.0 MHz
#Video BW 3.0 MHz
Span 0 Hz
Sweep 50.00 ms (2001 pts)
Nov 29, 2019
8:55:20 AM
Marker
Select Marker
Marker 1
Marker Δ Time
2.90000 ms
Marker Mode
Normal
Delta (Δ)
Fixed
Off
Delta Marker (Reset Delta)
Marker Table
On
Off
Marker Settings Diagram
All Markers Off
Couple Markers
On
Off
Settings
Peak Search
Pk Search Config
Properties
Marker Function
Marker→
Counter
Prototype Limited Sale Allowed


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Trig: Free Run
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 5.00 dB
Ref Level 13.00 dBm
Center 2.441000000 GHz
Res BW 1.0 MHz
#Video BW 3.0 MHz
Span 0 Hz
Sweep 5.000 s (2001 pts)
Nov 29, 2019
9:03:35 AM
Frequency
Center Frequency
2.441000000 GHz
Span
0.00000000 Hz
Swept Span
Zero Span
Full Span
Start Freq
2.441000000 GHz
Stop Freq
2.441000000 GHz
AUTO TUNE
CF Step
1.000000 MHz
Auto
Man
Freq Offset
0 Hz
X Axis Scale
Log
Lin
Settings
Prototype Limited Sale Allowed

π/4DQPSK

2DH1

2DH3

2DH5

8DPSK

3DH1


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Trig: Free Run
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 5.00 dB
Ref Level 13.00 dBm
ΔMkr1 410.4 µs
-5.13 dB
Center 2.441000000 GHz
Res BW 1.0 MHz
#Video BW 3.0 MHz
Span 0 Hz
Sweep 5.067 ms (2001 pts)
Nov 29, 2019
9:22:33 AM
Marker
Select Marker
Marker 1
Marker Δ Time
410.400 µs
Marker Mode
Normal
Delta (Δ)
Fixed
Off
Delta Marker (Reset Delta)
Marker Table
On
Off
Marker Settings Diagram
All Markers Off
Couple Markers
On
Off
Settings
Peak Search
Pk Search Config
Properties
Marker Function
Marker→
Counter
Prototype Limited Sale Allowed


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Trig: Free Run
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 5.00 dB
Ref Level 13.00 dBm
Center 2.441000000 GHz
Res BW 1.0 MHz
#Video BW 3.0 MHz
Span 0 Hz
Sweep 5.000 s (2001 pts)
Nov 29, 2019
9:23:24 AM
Frequency
Center Frequency
2.441000000 GHz
Span
0.00000000 Hz
Swept Span
Zero Span
Full Span
Start Freq
2.441000000 GHz
Stop Freq
2.441000000 GHz
AUTO TUNE
CF Step
1.000000 MHz
Auto
Man
Freq Offset
0 Hz
X Axis Scale
Log
Lin
Signal Track
(Span Zoom)
Settings
Prototype Limited Sale Allowed

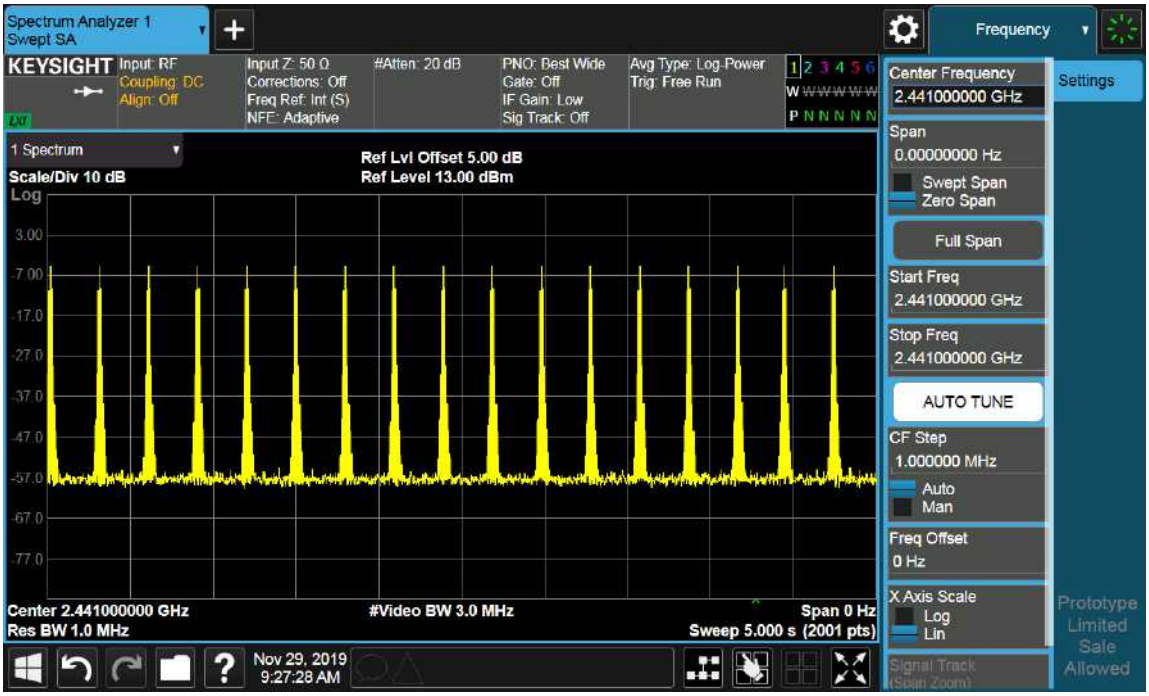
3DH3


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Trig: Free Run
Marker
Select Marker
Marker 1
1 Spectrum
Ref Lvl Offset 5.00 dB
Ref Level 13.00 dBm
ΔMkr1 1.675 ms
-0.63 dB
Scale/Div 10 dB
Log
1Δ2
Marker Δ Time
1.67500 ms
Marker Mode
Normal
Delta (Δ)
Fixed
Off
Delta Marker (Reset Delta)
Marker Table
On
Off
Marker Settings Diagram
All Markers Off
Couple Markers
On
Off
Settings
Peak Search
Pk Search Config
Properties
Marker Function
Marker→
Counter
Prototype Limited Sale Allowed
Center 2.441000000 GHz
Res BW 1.0 MHz
#Video BW 3.0 MHz
Span 0 Hz
Sweep 50.00 ms (2001 pts)
Nov 29, 2019
9:25:32 AM


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Trig: Free Run
Frequency
Center Frequency
2.441000000 GHz
Span
0.00000000 Hz
Swept Span
Zero Span
Full Span
Start Freq
2.441000000 GHz
Stop Freq
2.441000000 GHz
AUTO TUNE
CF Step
1.000000 MHz
Auto
Man
Freq Offset
0 Hz
X Axis Scale
Log
Lin
Signal Track
(Span Zoom)
1 Spectrum
Ref Lvl Offset 5.00 dB
Ref Level 13.00 dBm
Scale/Div 10 dB
Log
Settings
Prototype Limited Sale Allowed
Center 2.441000000 GHz
Res BW 1.0 MHz
#Video BW 3.0 MHz
Span 0 Hz
Sweep 5.000 s (2001 pts)
Nov 29, 2019
9:24:32 AM

3DH5


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Trig: Free Run
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 5.00 dB
Ref Level 13.00 dBm
ΔMkr1 2.900 ms
-0.66 dB
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#Video BW 3.0 MHz
Span 0 Hz
Sweep 50.00 ms (2001 pts)
Nov 29, 2019
9:26:47 AM
Marker
Select Marker
Marker 1
Marker Δ Time
2.90000 ms
Marker Mode
Normal
Delta (Δ)
Fixed
Off
Delta Marker (Reset Delta)
Marker Table
On
Off
Marker Settings Diagram
All Markers Off
Couple Markers
On
Off
Settings
Peak Search
Pk Search Config
Properties
Marker Function
Marker→
Counter
Prototype Limited Sale Allowed

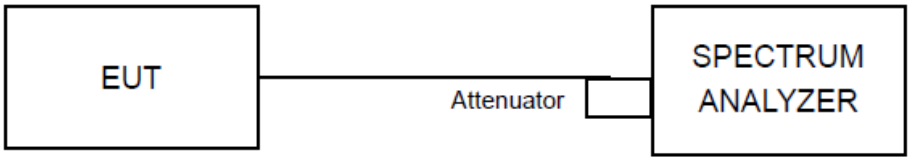

Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Trig: Free Run
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 5.00 dB
Ref Level 13.00 dBm
Center 2.441000000 GHz
Res BW 1.0 MHz
#Video BW 3.0 MHz
Span 0 Hz
Sweep 5.000 s (2001 pts)
Nov 29, 2019
9:27:28 AM
Frequency
Center Frequency
2.441000000 GHz
Span
0.00000000 Hz
Swept Span
Zero Span
Full Span
Start Freq
2.441000000 GHz
Stop Freq
2.441000000 GHz
AUTO TUNE
CF Step
1.000000 MHz
Auto
Man
Freq Offset
0 Hz
X Axis Scale
Log
Lin
Settings
Prototype Limited Sale Allowed

4.4 Channel Bandwidth

4.4.1 Limit

For frequency hopping system operating in the 2400-2483.5MHz, If the 20dB bandwidth of hopping channel is greater than 25kHz, two-thirds 20dBbandwidth of hopping channel shell be a minimum limit for the hopping channel separation.

4.4.2 Test Setup



4.4.3 Test Procedures

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.

d. Repeat above procedures until all frequencies measured were complete.

4.4.4 Deviation of Test Standard

No deviation.

4.4.5 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.4.6 Test Results

Channel	Frequency (MHz)	20dB Bandwidth (MHz)		
		GFSK	π/4DQPSK	8DPSK
0	2402	0.9313	1.259	1.276
39	2441	0.9309	1.245	1.259
78	2480	0.9290	1.245	1.258

Spectrum Plot
GFSK,2402MHz

GFSK,2441MHz

GFSK,2480MHz

π/4DQPSK,2402MHz

π/4DQPSK,2441MHz

π/4DQPSK,2480MHz

8DPSK,2402MHz

8DPSK,2441MHz

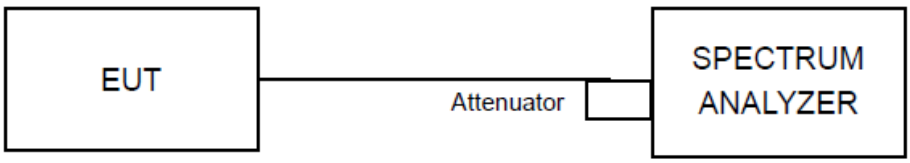
8DPSK,2480MHz

4.5 Hopping Channel Separation

4.5.1 Limit

At least 25kHz or two-third of 20dB hopping channel bandwidth (whichever is greater)

4.5.2 Test Setup



4.5.3 Test Procedures

Measurement Procedure REF

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal

from an external generator.

b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.

c. By using the MaxHold function record the separation of two adjacent channels.

d. Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.

e. Repeat above procedures until all frequencies measured were complete.

4.5.4 Deviation of Test Standard

No deviation.

4.5.5 Test Results

Test Mode	Channel	Result	Limit	Pass / Fail
GFSK	HOP	0.9945	0.9313	PASS
π/4DQPSK	HOP	1.0080	0.8393	PASS
8DPSK	HOP	1.0035	0.8507	PASS

Spectrum Plot
GFSK

π/4DQPSK

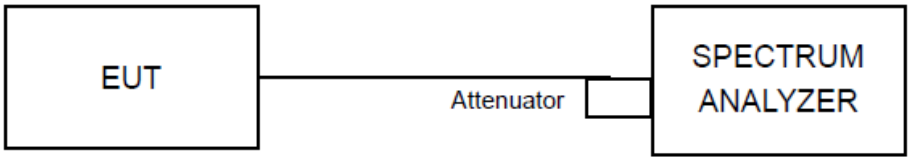
8DPSK

4.6 Maximum Output Power

4.6.1 Limit

The Maximum Output Power Measurement is 125mW(21dBm).

4.6.2 Test Setup



4.6.3 Test Procedures

1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.

2) RBW > 20 dB bandwidth of the emission being measured.

3) VBW ≥ RBW.

4) Sweep: Auto.

5) Detector function: Peak.

6) Trace: Max hold.

b) Allow trace to stabilize.

c) Use the marker-to-peak function to set the marker to the peak of the emission.

d) The indicated level is the peak output power, after any corrections for external attenuators and cables.

e) A plot of the test results and setup description shall be included in the test report.

4.6.4 Deviation of Test Standard

No deviation.

4.6.5 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.6.6 Test Results

Test Mode	Channel	Result (dBm)	Limit (dBm)	Pass / Fail
GFSK	0	-11.65	30	PASS
GFSK	39	-10.46	30	PASS
GFSK	78	-8.78	30	PASS
π/4DQPSK	0	-2.12	21	PASS
π/4DQPSK	39	-0.82	21	PASS
π/4DQPSK	78	0.24	21	PASS
8DPSK	0	-2.16	21	PASS
8DPSK	39	-0.89	21	PASS
8DPSK	78	0.69	21	PASS
Spectrum Plot of Worst Value				
GFSK / CH 78				

π/4DQPSK / CH 78

8DPSK / CH 78

4.7 Conducted Out of Band Emission Measurement

4.7.1 Limit

Below –20dB of the highest emission level of operating band (in 100kHz RBW).

4.7.2 Test Procedures

The transmitter output was connected to the spectrum analyzer via a low lose cable. Set both RBW and VBW of spectrum analyzer to 100 kHz and 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. The band edges was measured and recorded.

4.7.3 Deviation of Test Standard

No deviation.

4.7.4 Test Result

TestMode	ChName	Channel	Max. Level	Result	Limit	Verdict
DH5	Low	2402	-12.33	-53.68	-32.33	PASS
DH5	High	2480	-8.85	-55.36	-28.85	PASS
DH5	Low	HOP	-2.54	-41.57	-22.54	PASS
DH5	High	HOP	-2.19	-61.73	-22.19	PASS
2DH5	Low	2402	-2.78	-44.20	-22.78	PASS
2DH5	High	2480	-1.35	-59.21	-21.35	PASS
2DH5	Low	HOP	-6.43	-45.66	-26.43	PASS
2DH5	High	HOP	-3.72	-60.11	-3.72	PASS
3DH5	Low	2402	-3.12	-41.09	-23.12	PASS
3DH5	High	2480	-1.80	-58.76	-21.80	PASS
3DH5	Low	HOP	-6.29	-44.48	-26.29	PASS
3DH5	High	HOP	-1.35	-60.56	-21.35	PASS

GFSK

Hopping disabled_ Low Channel


Hopping disabled_ High Channel


Hopping enabled_ Low Channel

Hopping enabled_ High Channel

π/4DQPSK

Hopping disabled_ Low Channel


Hopping disabled_ High Channel


Hopping enabled_ Low Channel

Hopping enabled_ High Channel

8DPSK

Hopping disabled_ Low Channel

Hopping disabled_ High Channel

Hopping enabled_ Low Channel

Hopping enabled_ High Channel

4.8 Out of Band Emission

TestMode	Channel	FreqRange	RefLevel	Result	Limit	Verdict
DH5	2402	30~1000	-12.33	-52.50	-32.33	PASS
DH5	2402	1000~26500	-12.33	-46.14	-32.33	PASS
DH5	2441	30~1000	-10.92	-49.58	-30.92	PASS
DH5	2441	1000~26500	-10.92	-51.18	-30.92	PASS
DH5	2480	30~1000	-8.85	-52.17	-28.85	PASS
DH5	2480	1000~26500	-8.85	-51.30	-28.85	PASS
2DH5	2402	30~1000	-2.78	-49.00	-22.78	PASS
2DH5	2402	1000~26500	-2.78	-52.73	-22.78	PASS
2DH5	2441	30~1000	-1.80	-48.79	-21.80	PASS
2DH5	2441	1000~26500	-1.80	-53.05	-21.80	PASS
2DH5	2480	30~1000	-1.35	-46.80	-21.35	PASS
2DH5	2480	1000~26500	-1.35	-40.70	-21.35	PASS
3DH5	2402	30~1000	-3.12	-53.88	-23.12	PASS
3DH5	2402	1000~26500	-3.12	-50.28	-23.12	PASS
3DH5	2441	30~1000	-2.43	-39.33	-22.43	PASS
3DH5	2441	1000~26500	-2.43	-45.26	-22.43	PASS
3DH5	2480	30~1000	-1.80	-34.17	-21.80	PASS
3DH5	2480	1000~26500	-1.80	-58.74	-21.80	PASS

GFSK

2402MHz


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 30 dB
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
Marker
Select Marker
Marker 1
1 Spectrum
Scale/Div 10 dB
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr1 4.803 3 GHz
-46.14 dBm
Start 1.00 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Stop 25.00 GHz
Sweep 78.0 ms (30000 pts)
5 Marker Table
Mode Trace Scale X Y Function Function Width Function Value
1 N 1 f 4.803 3 GHz -46.14 dBm
Marker Frequency
4.803326778 GHz
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Continuous Peak Search
On
Off
Settings
Peak Search
Pk Search Config
Properties
Marker Function
Marker→
Counter
Prototype Limited Sale Allowed
Dec 20, 2019
9:25:30 AM

2441MHz


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 30 dB
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
Marker
Select Marker
Marker 1
1 Spectrum
Scale/Div 10 dB
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr1 2.441 010 0 GHz
-10.92 dBm
Center 2.441000 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Span 5.000 MHz
Sweep 8.40 ms (2001 pts)
Marker Frequency
2.441010000 GHz
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Continuous Peak Search
On
Off
Settings
Peak Search
Pk Search Config
Properties
Marker Function
Marker→
Counter
Prototype Limited Sale Allowed
Dec 20, 2019
9:42:14 AM


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 30 dB
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
Marker
Select Marker
Marker 1
1 Spectrum
Scale/Div 10 dB
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr1 953.37 MHz
-49.58 dBm
Start 0.0300 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Stop 1.0000 GHz
Sweep 4.00 ms (30000 pts)
5 Marker Table
Mode Trace Scale X Y Function Function Width Function Value
1 N 1 f 953.37 MHz -49.58 dBm
Marker Frequency
953.373779 MHz
Settings
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Pk Search Config
Properties
Marker Function
Marker→
Counter
Continuous Peak Search
On
Off
Prototype Limited Sale Allowed
Dec 20, 2019
9:44:59 AM


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 30 dB
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
Marker
Select Marker
Marker 1
1 Spectrum
Scale/Div 10 dB
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr1 3.898 5 GHz
-51.18 dBm
Start 1.00 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Stop 25.00 GHz
Sweep 78.0 ms (30000 pts)
5 Marker Table
Mode Trace Scale X Y Function Function Width Function Value
1 N 1 f 3.898 5 GHz -51.18 dBm
Marker Frequency
3.898496617 GHz
Settings
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Pk Search Config
Properties
Marker Function
Marker→
Counter
Continuous Peak Search
On
Off
Prototype Limited Sale Allowed
Dec 20, 2019
9:46:17 AM

2480MHz


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 30 dB
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
Marker
Select Marker
Marker 1
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr1 2.480 005 0 GHz
-8.85 dBm
Center 2.480000 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Span 5.000 MHz
Sweep 8.40 ms (2001 pts)
Marker Frequency
2.480005000 GHz
Settings
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Pk Search Config
Properties
Marker Function
Marker→
Counter
Continuous Peak Search
On
Off
Prototype Limited Sale Allowed
Dec 20, 2019
9:51:11 AM


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 30 dB
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
Marker
Select Marker
Marker 1
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr1 953.54 MHz
-52.17 dBm
DL1 -28.85 dBm
Start 0.0300 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Stop 1.0000 GHz
Sweep 4.00 ms (30000 pts)
5 Marker Table
Mode Trace Scale X Y Function Function Width Function Value
1 N 1 f 953.54 MHz -52.17 dBm
Marker Frequency
953.535451 MHz
Settings
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Pk Search Config
Properties
Marker Function
Marker→
Counter
Continuous Peak Search
On
Off
Prototype Limited Sale Allowed
Dec 20, 2019
10:05:39 AM

π/4DQPSK

2402MHz


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
1 Spectrum
Scale/Div 10 dB
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr1 953.41 MHz
-49.00 dBm
DL1 -22.78 dBm
Start 0.0300 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Stop 1.0000 GHz
Sweep 4.00 ms (30001 pts)
5 Marker Table
Mode Trace Scale X Y Function Function Width Function Value
1 N 1 f 953.41 MHz -49.00 dBm
Nov 28, 2019
1:58:49 PM
Marker
Select Marker
Marker 1
Marker Frequency
953.407667 MHz
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Continuous Peak Search
On
Off
Settings
Peak Search
Pk Search Config
Properties
Marker Function
Marker→
Counter
Prototype Limited Sale Allowed


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
1 Spectrum
Scale/Div 10 dB
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr2 3.204 0 GHz
-59.99 dBm
DL1 -22.78 dBm
Start 1.00 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Stop 25.00 GHz
Sweep 78.0 ms (30001 pts)
5 Marker Table
Mode Trace Scale X Y Function Function Width Function Value
1 N 1 f 4.804 0 GHz -52.73 dBm
2 N 1 f 3.204 0 GHz -59.99 dBm
Nov 28, 2019
2:00:36 PM
Marker
Select Marker
Marker 2
Marker Frequency
3.204000000 GHz
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Continuous Peak Search
On
Off
Settings
Peak Search
Pk Search Config
Properties
Marker Function
Marker→
Counter
Prototype Limited Sale Allowed

2441MHz


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
Marker
Select Marker
Marker 1
1 Spectrum
Scale/Div 10 dB
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr1 2.440 990 0 GHz
-1.80 dBm
Center 2.441000 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Span 5.000 MHz
Sweep 8.40 ms (2001 pts)
Marker Frequency
2.440990000 GHz
Settings
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Pk Search Config
Properties
Marker Function
Marker→
Counter
Continuous Peak Search
On
Off
Prototype Limited Sale Allowed
Nov 28, 2019
2:09:51 PM


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
Marker
Select Marker
Marker 1
1 Spectrum
Scale/Div 10 dB
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr1 172.11 MHz
-48.79 dBm
DL1 -21.80 dBm
Start 0.0300 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Stop 1.0000 GHz
Sweep 4.00 ms (30001 pts)
5 Marker Table
Mode Trace Scale X Y Function Function Width Function Value
1 N 1 f 172.11 MHz -48.79 dBm
Marker Frequency
172.105000 MHz
Settings
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Pk Search Config
Properties
Marker Function
Marker→
Counter
Continuous Peak Search
On
Off
Prototype Limited Sale Allowed
Nov 28, 2019
2:10:51 PM


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
Marker
Select Marker
Marker 2
1 Spectrum
Scale/Div 10 dB
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr2 1.727 2 GHz
-59.36 dBm
Start 1.00 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Stop 25.00 GHz
Sweep 78.0 ms (30001 pts)
5 Marker Table
Mode Trace Scale X Y Function Function Width Function Value
1 N 1 f 4.881 6 GHz -53.05 dBm
2 N 1 f 1.727 2 GHz -59.36 dBm
Marker Frequency
1.727200000 GHz
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Continuous Peak Search
On
Off
Settings
Peak Search
Pk Search Config
Properties
Marker Function
Marker→
Counter
Prototype Limited Sale Allowed
Nov 28, 2019
2:13:34 PM

2480MHz


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
Marker
Select Marker
Marker 1
1 Spectrum
Scale/Div 10 dB
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr1 2.480 012 5 GHz
-1.35 dBm
Center 2.480000 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Span 5.000 MHz
Sweep 8.40 ms (2001 pts)
Marker Frequency
2.480012500 GHz
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Continuous Peak Search
On
Off
Settings
Peak Search
Pk Search Config
Properties
Marker Function
Marker→
Counter
Prototype Limited Sale Allowed
Nov 28, 2019
2:16:26 PM


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
Marker
Select Marker
Marker 1
1 Spectrum
Scale/Div 10 dB
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr1 120.73 MHz
-46.80 dBm
Start 0.0300 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Stop 1.0000 GHz
Sweep 4.00 ms (30001 pts)
5 Marker Table
Mode Trace Scale X Y Function Function Width Function Value
1 N 1 f 120.73 MHz -46.80 dBm
Marker Frequency
120.727333 MHz
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Continuous Peak Search
On
Off
Settings
Peak Search
Pk Search Config
Properties
Marker Function
Marker→
Counter
Prototype Limited Sale Allowed
Nov 28, 2019
2:19:24 PM


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
Marker
Select Marker
Marker 2
1 Spectrum
Scale/Div 10 dB
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr2 1.956 0 GHz
-40.70 dBm
Start 1.00 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Stop 25.00 GHz
Sweep 78.0 ms (30001 pts)
5 Marker Table
Mode Trace Scale X Y Function Function Width Function Value
1 N 1 f 3.305 6 GHz -59.32 dBm
2 N 1 f 1.956 0 GHz -40.70 dBm
Marker Frequency
1.956000000 GHz
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Continuous Peak Search
On
Off
Settings
Peak Search
Pk Search Config
Properties
Marker Function
Marker→
Counter
Prototype Limited Sale Allowed
Nov 28, 2019
2:21:20 PM

8DPSK

2402MHz


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
Marker
Select Marker
Marker 2
1 Spectrum
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr2 1.711 2 GHz
-55.66 dBm
Scale/Div 10 dB
Log
Start 1.00 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Stop 25.00 GHz
Sweep 78.0 ms (30001 pts)
5 Marker Table
Mode Trace Scale X Y Function Function Width Function Value
1 N 1 f 4.804 0 GHz -50.28 dBm
2 N 1 f 1.711 2 GHz -55.66 dBm
Marker Frequency
1.711200000 GHz
Settings
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Pk Search Config
Properties
Marker Function
Marker→
Counter
Continuous Peak Search
On
Off
Prototype Limited Sale Allowed
Nov 28, 2019
2:27:58 PM

2441MHz


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
Marker
Select Marker
Marker 1
1 Spectrum
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr1 2.441 025 0 GHz
-2.43 dBm
Scale/Div 10 dB
Log
Center 2.441000 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Span 5.000 MHz
Sweep 8.40 ms (2001 pts)
Marker Frequency
2.441025000 GHz
Settings
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Pk Search Config
Properties
Marker Function
Marker→
Counter
Continuous Peak Search
On
Off
Prototype Limited Sale Allowed
Nov 28, 2019
2:28:54 PM


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
Marker
Select Marker
Marker 1
1 Spectrum
Scale/Div 10 dB
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr1 913.96 MHz
-39.33 dBm
Start 0.0300 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Stop 1.0000 GHz
Sweep 4.00 ms (30001 pts)
5 Marker Table
Mode Trace Scale X Y Function Function Width Function Value
1 N 1 f 913.96 MHz -39.33 dBm
Marker Frequency
913.961000 MHz
Settings
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Pk Search Config
Properties
Marker Function
Marker→
Counter
Continuous Peak Search
On
Off
Prototype Limited Sale Allowed
Nov 28, 2019
2:29:46 PM


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
Marker
Select Marker
Marker 2
1 Spectrum
Scale/Div 10 dB
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr2 1.725 6 GHz
-45.26 dBm
Start 1.00 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Stop 25.00 GHz
Sweep 78.0 ms (30001 pts)
5 Marker Table
Mode Trace Scale X Y Function Function Width Function Value
1 N 1 f 4.882 4 GHz -53.13 dBm
2 N 1 f 1.725 6 GHz -45.26 dBm
Marker Frequency
1.725600000 GHz
Settings
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Pk Search Config
Properties
Marker Function
Marker→
Counter
Continuous Peak Search
On
Off
Prototype Limited Sale Allowed
Nov 28, 2019
2:30:50 PM

2480MHz


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
Marker
Select Marker
Marker 1
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr1 2.480 175 0 GHz
-1.80 dBm
Marker Frequency
2.480175000 GHz
Settings
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Pk Search Config
Properties
Marker Function
Marker→
Counter
Continuous Peak Search
On
Off
Center 2.480000 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Span 5.000 MHz
Sweep 8.40 ms (2001 pts)
Nov 28, 2019
2:31:37 PM
Prototype Limited Sale Allowed


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
Marker
Select Marker
Marker 1
1 Spectrum
Scale/Div 10 dB
Log
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr1 910.53 MHz
-34.17 dBm
Marker Frequency
910.533667 MHz
Settings
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Pk Search Config
Properties
Marker Function
Marker→
Counter
Continuous Peak Search
On
Off
Start 0.0300 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Stop 1.0000 GHz
Sweep 4.00 ms (30001 pts)
5 Marker Table
Mode Trace Scale X Y Function Function Width Function Value
1 N 1 f 910.53 MHz -34.17 dBm
Nov 28, 2019
2:35:17 PM
Prototype Limited Sale Allowed


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: DC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
NFE: Adaptive
#Atten: 20 dB
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold:>100/100
Trig: Free Run
Marker
Select Marker
Marker 2
1 Spectrum
Ref Lvl Offset 5.00 dB
Ref Level 10.00 dBm
Mkr2 3.812 0 GHz
-60.46 dBm
Scale/Div 10 dB
Log
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
D[1 -21.80 dBm
Start 1.00 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Stop 25.00 GHz
Sweep 78.0 ms (30001 pts)
5 Marker Table
Mode Trace Scale X Y Function Function Width Function Value
1 N 1 f 3.305 6 GHz -58.74 dBm
2 N 1 f 3.812 0 GHz -60.46 dBm
3
4
5
6
Nov 28, 2019
2:36:50 PM
Marker Frequency
3.812000000 GHz
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Minimum Peak
Pk-Pk Search
Marker Delta
Mkr→CF
Mkr→Ref Lvl
Continuous Peak Search
On
Off
Settings
Peak Search
Pk Search Config
Properties
Marker Function
Marker→
Counter
Prototype Limited Sale Allowed

4.9 Radiated Emission Measurement

4.9.1 Limits

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

Frequencies (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
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

4.9.2 Test Procedures

For Radiated emission below 30MHz

a. The EUT was placed on a 80cm height table above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. Both X and Y axes of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and the rotate table was turned from 0 degree to 360 degree to find the maximum reading.

e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a The EUT was placed on a 80cm height(above 1GHz is 1.5m height) table above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

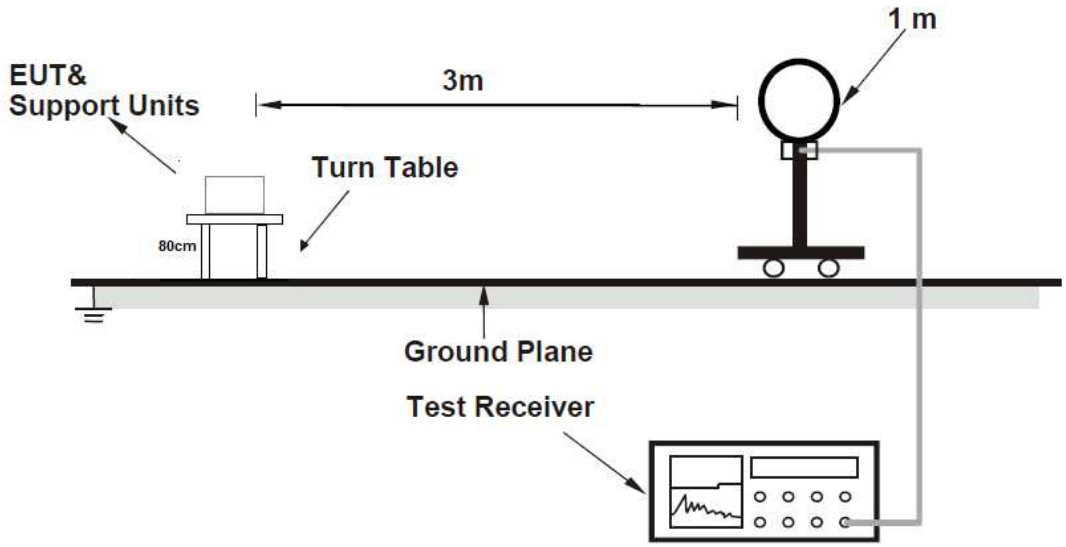
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz & 360 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 1/T for RMS Average (Duty cycle < 98 %) for Peak detection at frequency above 1 GHz.
4. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz (Duty cycle $\geqslant$ 98 %) for Average detection (AV) at frequency above 1 GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

4.9.3 Deviation from Test Standard

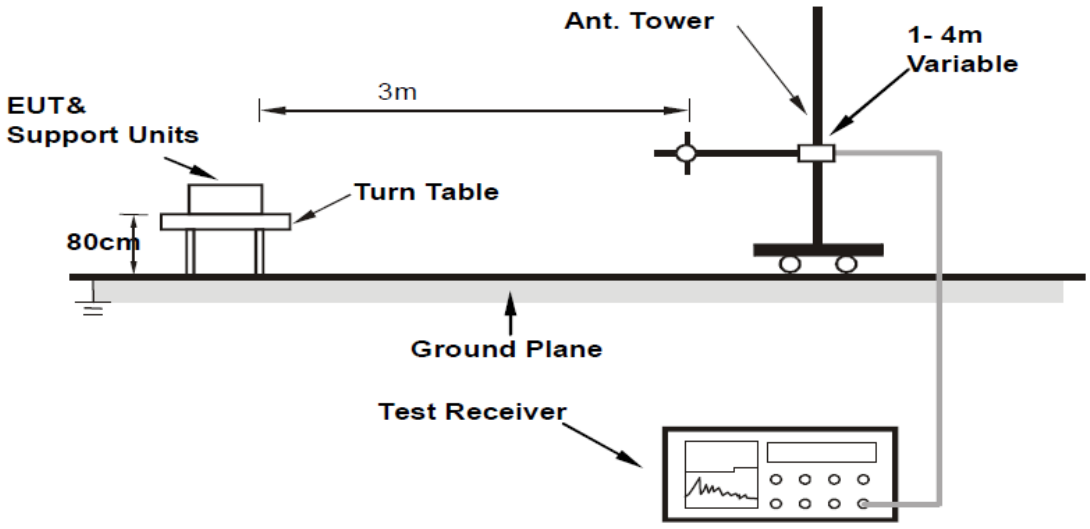
No deviation.

4.9.4 Test Setup

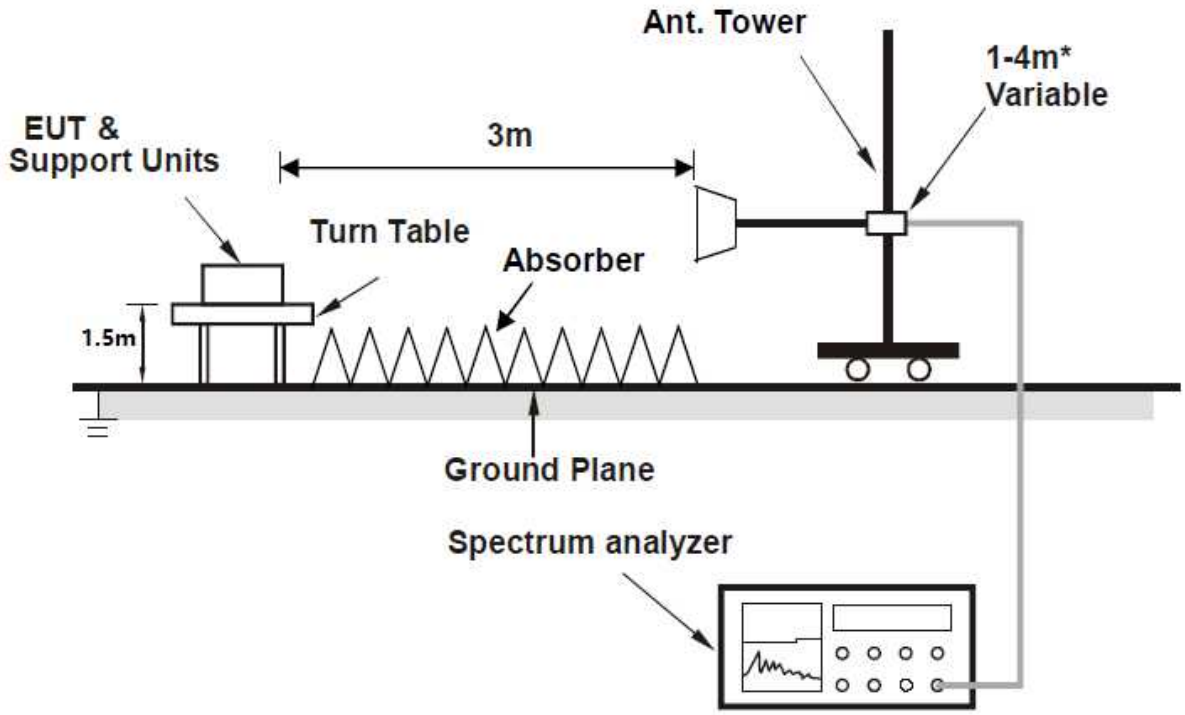
For Radiated emission between 30MHz~1000MHz



For Radiated emission between 30MHz~1000MHz



For Radiated emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.9.5 EUT Operating Conditions

a. Placed the EUT on a testing table.

b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

4.9.6 Test Results

Radiated Emissions Range 9kHz~30MHz

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Radiated Emissions Range 30MHz~1GHz

Channel	TX Channel 0	Detector Function	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz	Antenna Polarity	Horizontal

Spurious Emission Level

No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)
1	127.9700	34.30	43.50	-9.20	-10.94
2	167.7400	22.93	43.50	-20.57	-9.27
3	213.3300	33.52	43.50	-9.98	-11.77
4	314.4040	32.46	46.50	-14.04	-8.80
5	360.1880	36.65	46.50	-9.85	-8.49
6	391.4220	34.91	46.50	-11.59	-7.83

REMARKS:

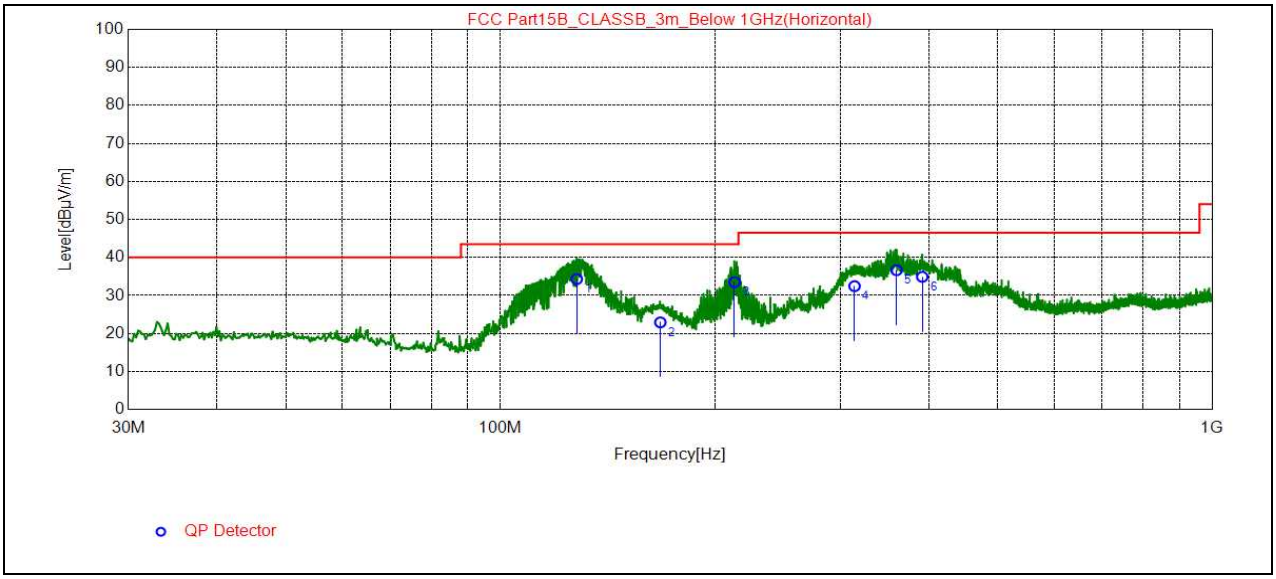
1. Emission Level(dBuV/m) = Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value

Test Plot:



Channel	TX Channel 0	Detector Function	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz	Antenna Polarity	Vertical

Spurious Emission Level

No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)
1	70.7400	27.47	40.00	-12.53	-12.23
2	130.2980	36.76	43.50	-6.74	-10.73
3	151.8320	30.45	43.50	-13.05	-9.23
4	214.6880	30.11	43.50	-13.39	-11.70
5	336.1320	34.49	46.50	-12.01	-8.90
6	508.4040	30.06	46.50	-16.44	-5.66

REMARKS:

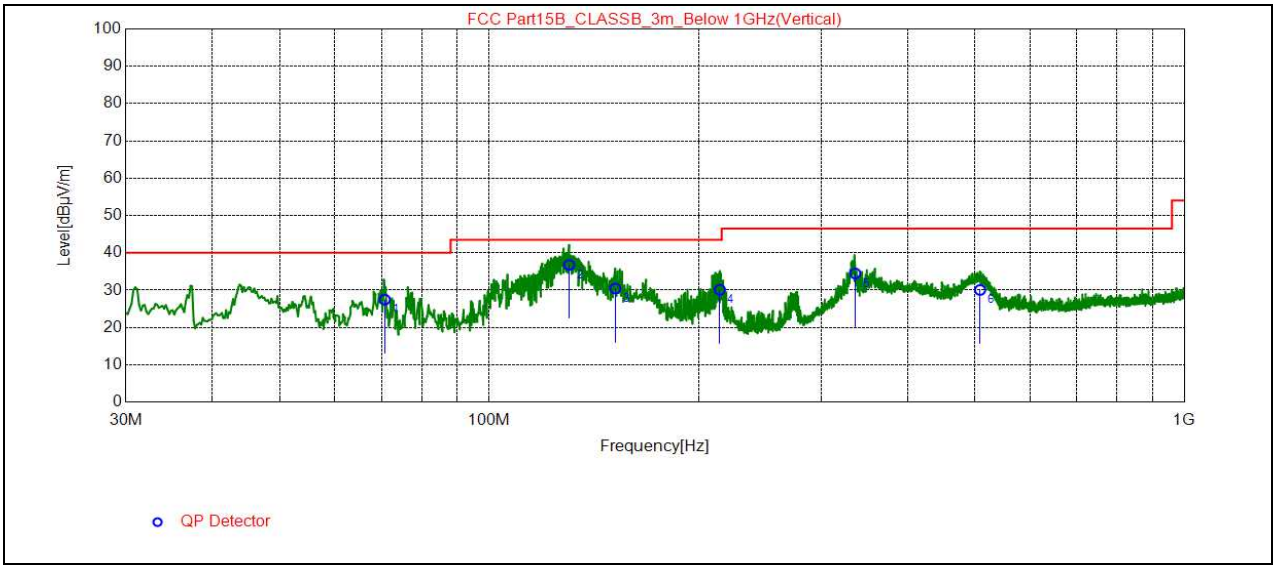
1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value

Test Plot:



Radiated Emission Range 1GHz~10th Harmonic

GFSK

Channel	TX Channel 0	Detector Function	Peak (PK)
Frequency Range	1GHz ~ 25GHz		Average (AV)

Spurious Emission Level							
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	4803.75	52.50	74.00	-21.50	9.42	H	PK
2	4804.60	51.01	54.00	-2.99	9.42	H	AV
3	4803.75	53.01	74.00	-20.99	9.42	V	PK
4	4804.60	52.28	54.00	-1.72	9.42	V	AV

Channel	TX Channel 39	Detector Function	Peak (PK)
Frequency Range	1GHz ~ 25GHz		Average (AV)

Spurious Emission Level							
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	4881.95	51.71	74.00	-22.29	9.32	H	PK
2	4882.80	50.75	54.00	-3.25	9.32	H	AV
3	4881.95	53.04	74.00	-20.96	9.32	V	PK
4	4882.80	51.81	54.00	-2.19	9.32	V	AV

Channel	TX Channel 78	Detector Function	Peak (PK)
Frequency Range	1GHz ~ 25GHz		Average (AV)

Spurious Emission Level							
No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	4959.30	50.02	74.00	-23.98	9.23	H	PK
2	4961.00	48.26	54.00	-5.74	9.22	H	AV
3	4960.15	51.71	74.00	-22.29	9.23	V	PK
4	4961.00	50.41	54.00	-3.59	9.22	V	AV

REMARKS:

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value

π/4DQPSK

Channel	TX Channel 0	Detector Function	Peak (PK)
Frequency Range	1GHz ~ 25GHz		Average (AV)

Spurious Emission Level

No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	4804.60	52.79	74.00	-21.21	9.42	H	PK
2	4804.60	48.39	54.00	-5.61	9.42	H	AV
3	4804.60	52.12	74.00	-21.88	9.42	V	PK
4	4804.60	47.97	54.00	-6.03	9.42	V	AV

Channel	TX Channel 39	Detector Function	Peak (PK)
Frequency Range	1GHz ~ 25GHz		Average (AV)

Spurious Emission Level

No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	4881.95	51.31	74.00	-22.69	9.32	H	PK
2	4882.80	47.71	54.00	-6.29	9.32	H	AV
3	4881.95	51.65	74.00	-22.35	9.32	V	PK
4	4882.80	50.03	54.00	-3.97	9.32	V	AV

Channel	TX Channel 78	Detector Function	Peak (PK)
Frequency Range	1GHz ~ 25GHz		Average (AV)

Spurious Emission Level

No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	4960.15	48.22	74.00	-25.78	9.23	H	PK
2	4961.00	44.09	54.00	-9.91	9.22	H	AV
3	4960.15	49.08	74.00	-24.92	9.23	V	PK
4	4961.00	45.94	54.00	-8.06	9.22	V	AV

REMARKS:

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value

8DPSK

Channel	TX Channel 0	Detector Function	Peak (PK)
Frequency Range	1GHz ~ 25GHz		Average (AV)

Spurious Emission Level

No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	4803.75	50.38	74.00	-23.62	9.42	H	PK
2	4804.60	47.38	54.00	-6.62	9.42	H	AV
3	4804.60	51.54	74.00	-22.46	9.42	V	PK
4	4804.60	47.48	54.00	-6.52	9.42	V	AV

Channel	TX Channel 39	Detector Function	Peak (PK)
Frequency Range	1GHz ~ 25GHz		Average (AV)

Spurious Emission Level

No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	4881.95	50.14	74.00	-23.86	9.32	H	PK
2	4882.80	47.52	54.00	-6.48	9.32	H	AV
3	4881.95	51.63	74.00	-22.37	9.32	V	PK
4	4882.80	47.95	54.00	-6.05	9.32	V	AV

Channel	TX Channel 78	Detector Function	Peak (PK)
Frequency Range	1GHz ~ 25GHz		Average (AV)

Spurious Emission Level

No.	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Correction Factor (dB/m)	Antenna Polarity	Detector
1	4959.30	47.91	74.00	-26.09	9.23	H	PK
2	4961.00	43.08	54.00	-10.92	9.22	H	AV
3	4959.30	49.25	74.00	-24.75	9.23	V	PK
4	4960.15	45.68	54.00	-8.32	9.22	V	AV

REMARKS:

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value

4.10 Radiated Restricted Band Edge Measurement

4.10.1Test Limit

For 15.205 requirement:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part15, must also comply with the radiated emission limits specified in Section 15.209(a).

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (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 - 156.525	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	--	--	--

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [uV/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

4.10.2Test Procedure Reference

ANSI C63.10 Section 6.3 (General Requirements)

ANSI C63.10 Section 6.6 (Standard test method above 1GHz)

4.10.3Test Procedures

Peak Field Strength Measurements

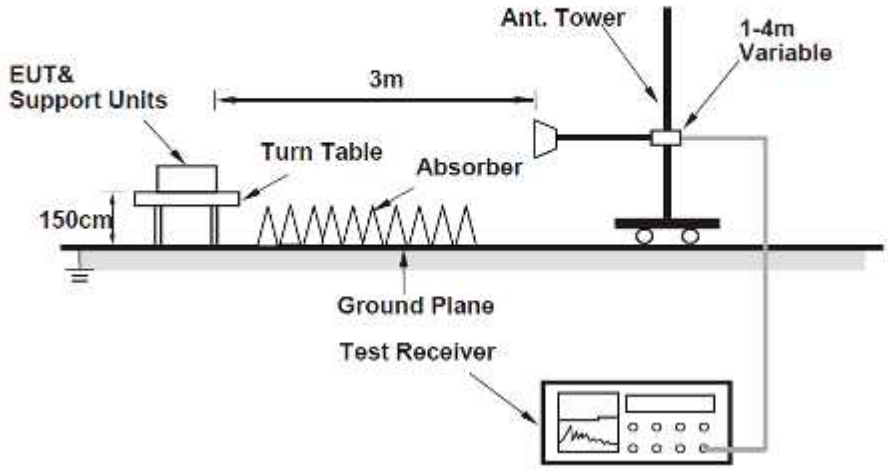
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Average Measurements above 1GHz (Method VB)

8. 1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
9. 2. RBW = 1MHz
10. 3. VBW; If the EUT is configured to transmit with duty cycle ≥ 98%, set VBW = 10 Hz.
11. If the EUT duty cycle is < 98%, set VBW ≥ 1/T. T is the minimum transmission duration.
12. 4. Detector = Peak
13. 5. Sweep time = auto
14. 6. Trace mode = max hold
15. 7. Trace was allowed to stabilize

4.10.4Test Setup

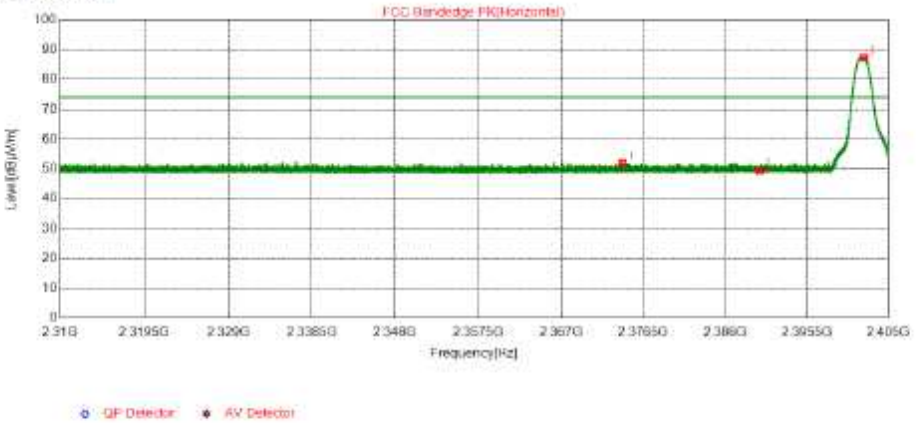
For Radiated emission above 1GHz



4.10.5Test Results

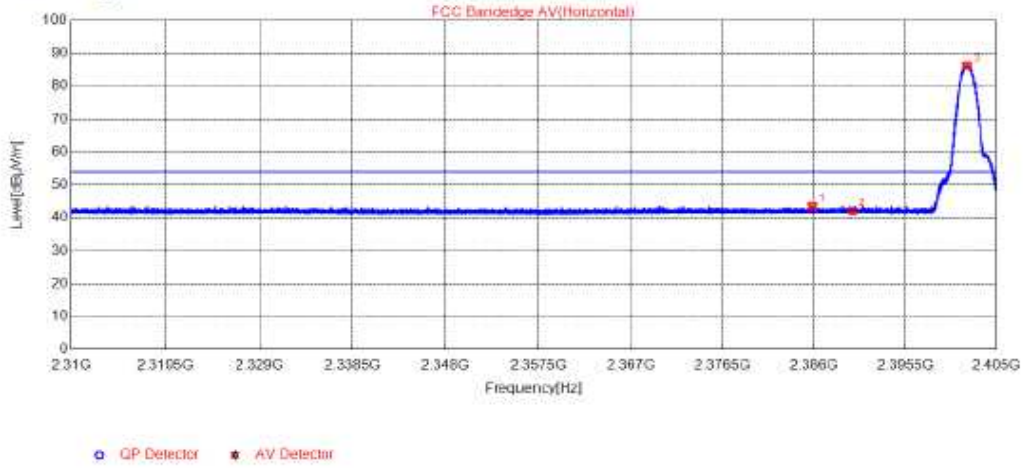
Test Plot
DH5 2402MHz/ Horizontal

Test Graph



NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2374.1108	47.04	51.93	74.00	22.07	155	326	Horizontal	PK
2	2390.0043	44.49	49.41	74.00	24.59	175	159	Horizontal	PK
3	2402.1500	82.32	87.27	74.00	-13.27	155	61	Horizontal	PK

Test Graph

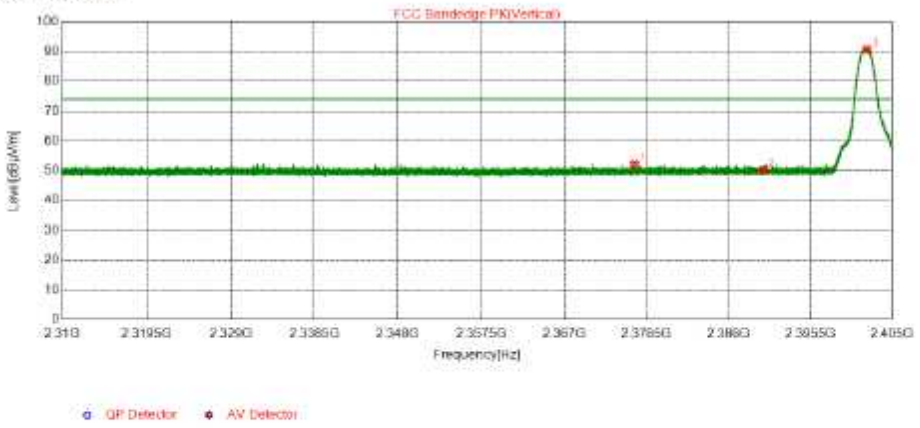


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2385.8243	38.54	43.45	54.00	10.55	155	307	Horizontal	AV
2	2390.0043	37.22	42.14	54.00	11.86	175	128	Horizontal	AV
3	2401.9268	81.23	86.18	54.00	-32.18	155	77	Horizontal	AV

Test Plot

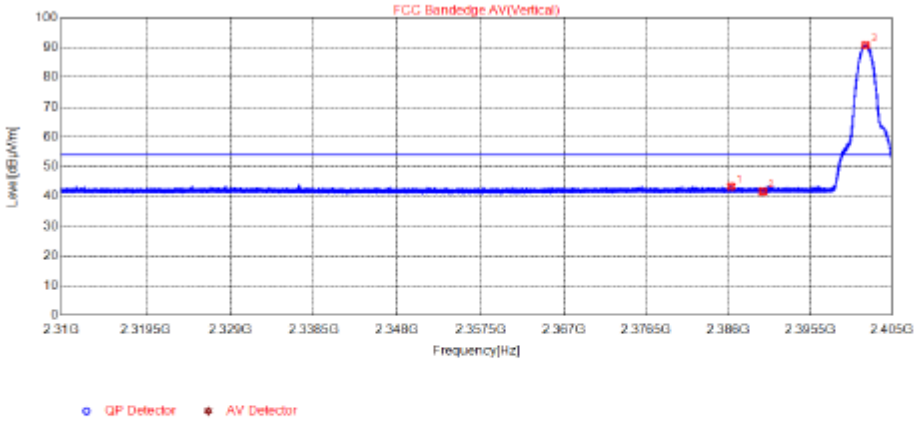
DH5 2402MHz/ Vertical

Test Graph



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2375.1415	47.14	52.03	74.00	21.97	155	43	Vertical	PK
2	2390.0043	45.19	50.11	74.00	23.89	175	210	Vertical	PK
3	2402.0883	85.70	90.65	74.00	-16.65	175	143	Vertical	PK

Test Graph

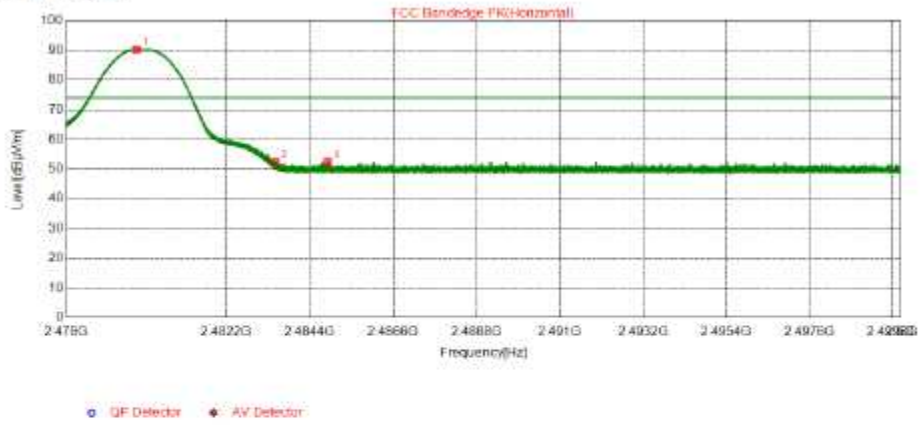


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2386.3135	38.42	43.34	54.00	10.66	155	180	Vertical	AV
2	2390.0043	36.74	41.66	54.00	12.34	155	126	Vertical	AV
3	2401.9458	85.87	90.82	54.00	-36.82	175	162	Vertical	AV

Test Plot

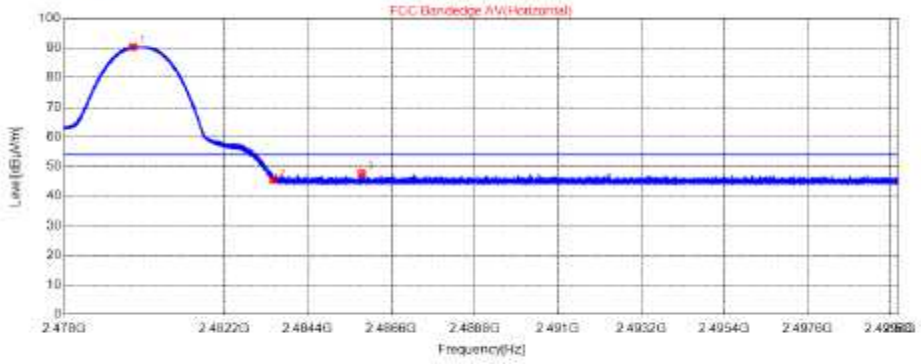
DH5 2480MHz/ Horizontal

Test Graph



NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.8458	85.17	90.25	74.00	-16.25	175	310	Horizontal	PK
2	2483.5000	47.29	52.38	74.00	21.62	175	343	Horizontal	PK
3	2484.8761	47.30	52.39	74.00	21.61	175	9	Horizontal	PK

Test Graph

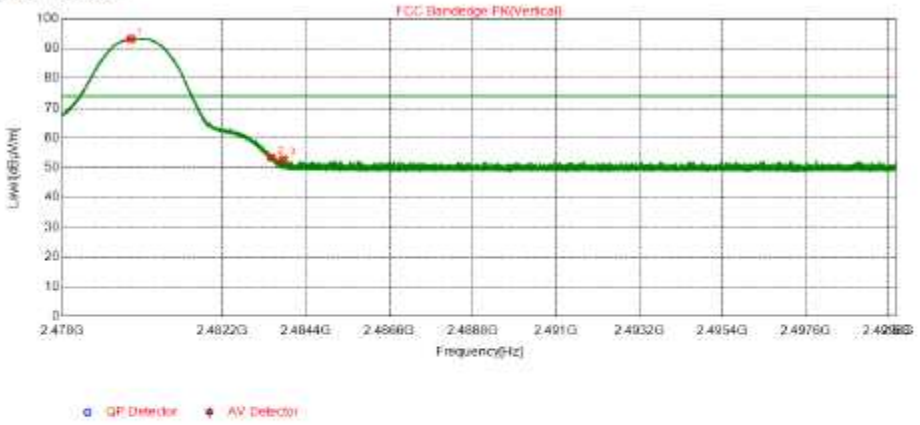


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.8194	85.29	90.37	54.00	-36.37	175	331	Horizontal	AV
2	2483.5000	40.36	45.45	54.00	8.55	175	331	Horizontal	AV
3	2485.8265	42.52	47.62	54.00	6.38	175	108	Horizontal	AV

Test Plot

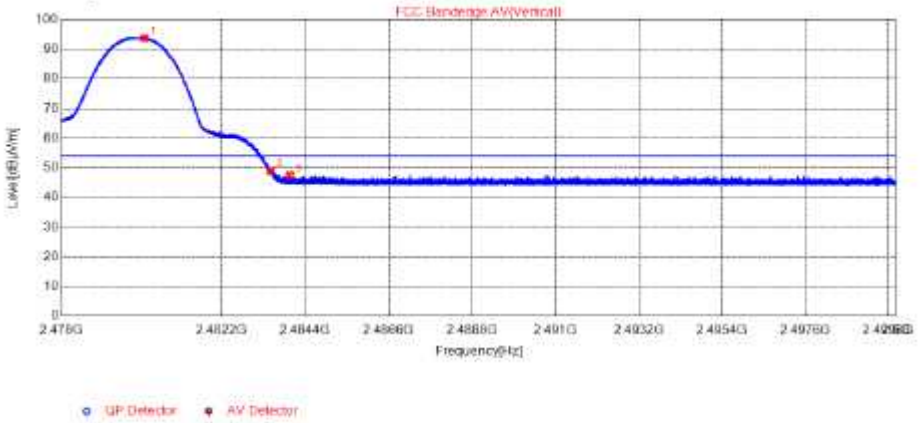
DH5 2480MHz/ Vertical

Test Graph



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.8128	88.20	93.28	74.00	-19.28	175	210	Vertical	PK
2	2483.5000	48.33	53.42	74.00	20.58	165	150	Vertical	PK
3	2483.8201	47.70	52.79	74.00	21.21	175	126	Vertical	PK

Test Graph

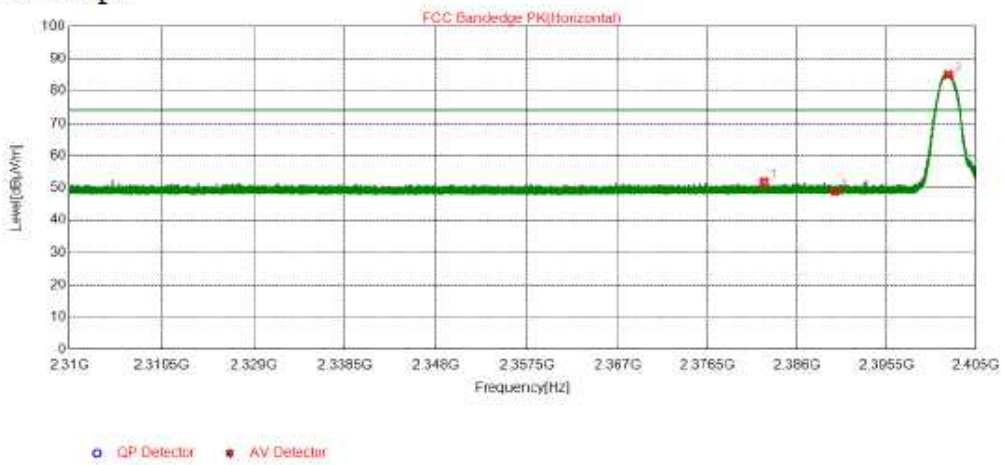


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2480.1835	88.69	93.78	54.00	-39.78	175	224	Vertical	AV
2	2483.5000	43.89	48.98	54.00	5.02	175	206	Vertical	AV
3	2484.0038	42.42	47.51	54.00	6.49	165	154	Vertical	AV

Test Plot

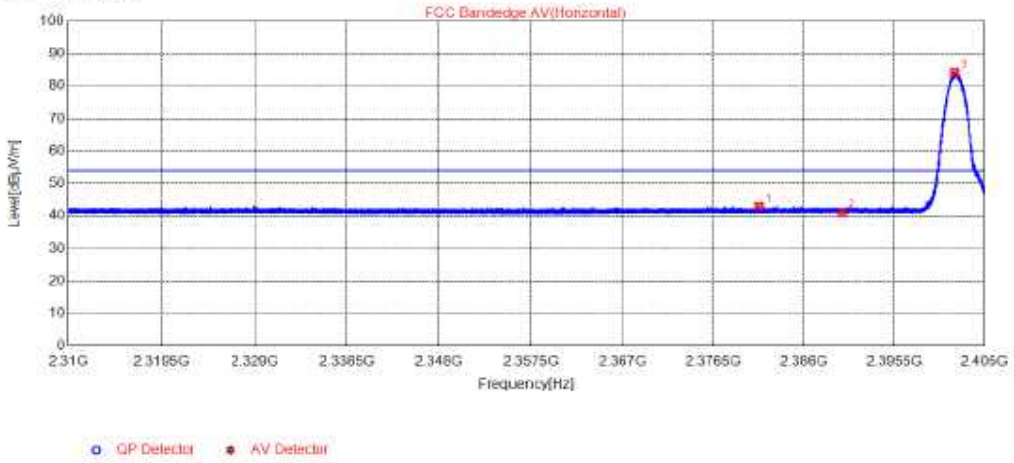
2DH5 2402MHz/ Horizontal

Test Graph



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2382.4708	46.91	51.82	74.00	22.18	165	67	Horizontal	PK
2	2390.0043	43.86	48.78	74.00	25.22	175	226	Horizontal	PK
3	2402.0978	80.18	85.13	74.00	-11.13	155	59	Horizontal	PK

Test Graph

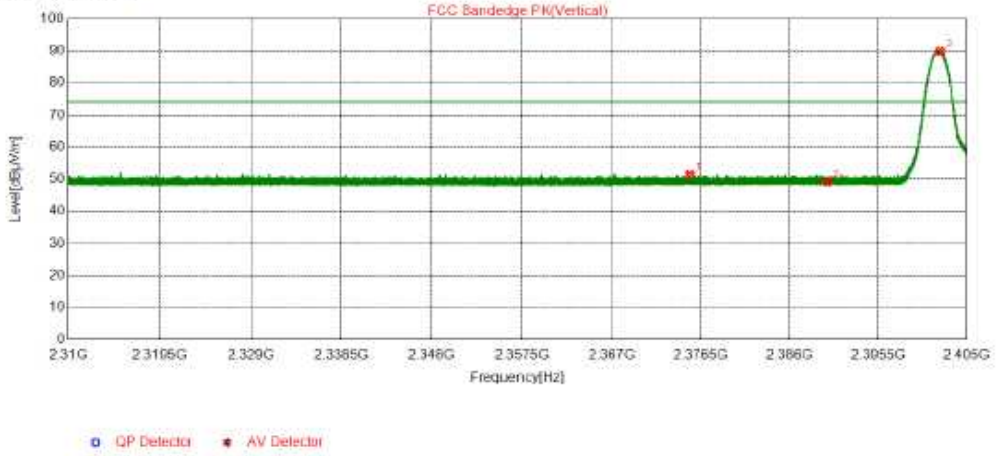


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2381.3023	38.07	42.97	54.00	11.03	175	232	Horizontal	AV
2	2390.0090	36.14	41.06	54.00	12.94	155	134	Horizontal	AV
3	2401.8650	79.29	84.24	54.00	-30.24	155	72	Horizontal	AV

Test Plot

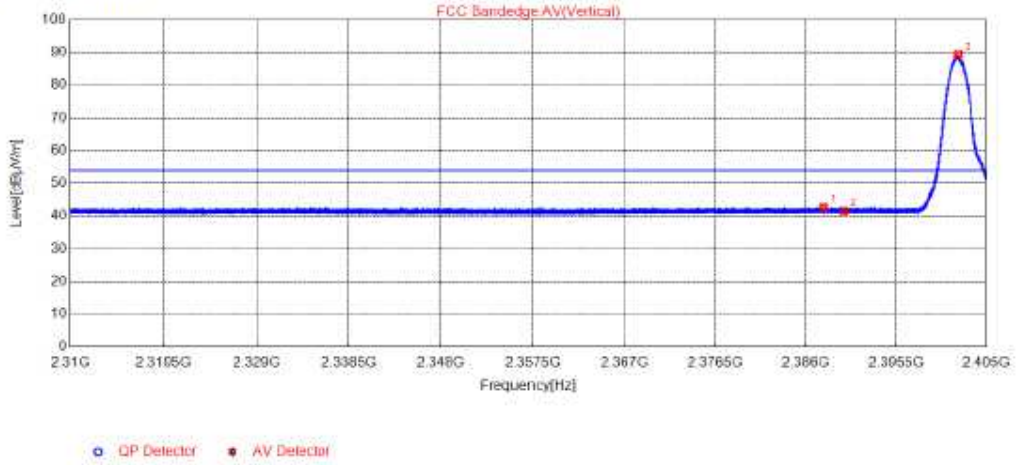
2DH5 2402MHz/ Vertical

Test Graph



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2375.3268	46.47	51.36	74.00	22.64	175	293	Vertical	PK
2	2390.0043	44.12	49.04	74.00	24.96	175	193	Vertical	PK
3	2402.1643	84.83	89.78	74.00	-15.78	175	143	Vertical	PK

Test Graph

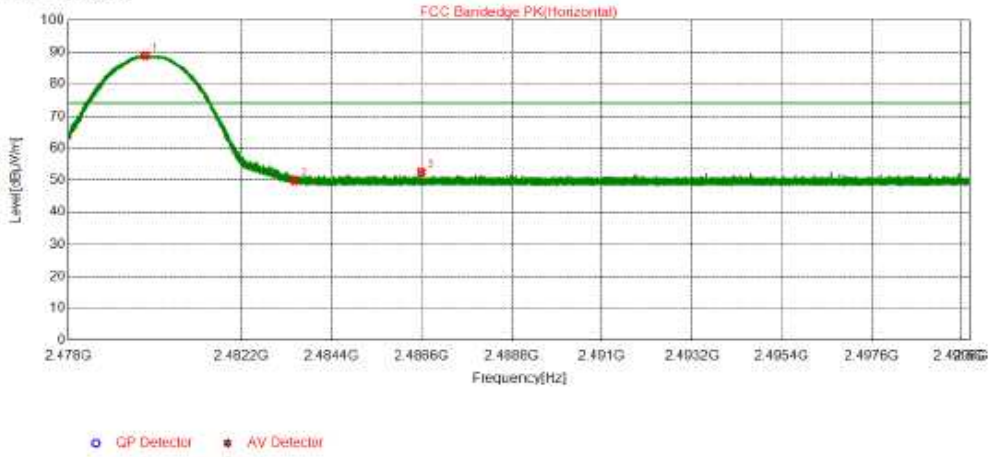


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2387.8430	37.70	42.62	54.00	11.38	165	306	Vertical	AV
2	2390.0043	36.62	41.54	54.00	12.46	165	244	Vertical	AV
3	2402.0503	84.36	89.31	54.00	-35.31	175	161	Vertical	AV

Test Plot

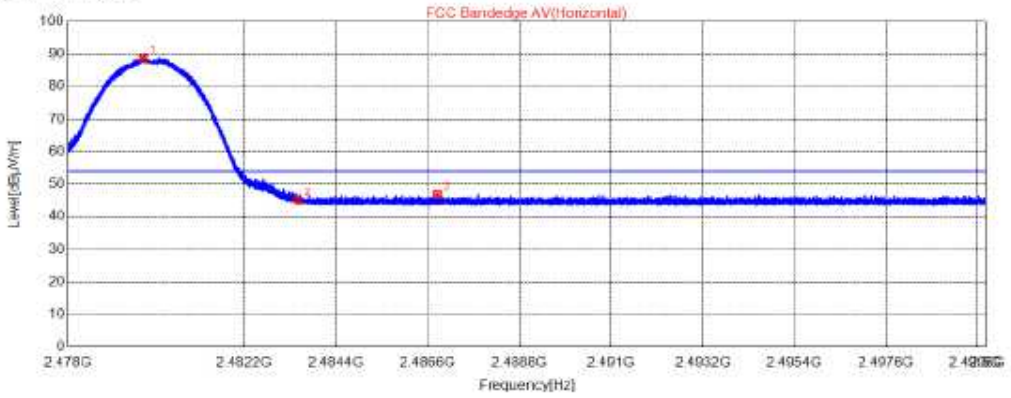
2DH5 2480MHz/ Horizontal

Test Graph



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.8634	83.83	88.91	74.00	-14.91	175	310	Horizontal	PK
2	2483.5000	44.90	49.99	74.00	24.01	175	227	Horizontal	PK
3	2486.5899	47.43	52.53	74.00	21.47	165	34	Horizontal	PK

Test Graph

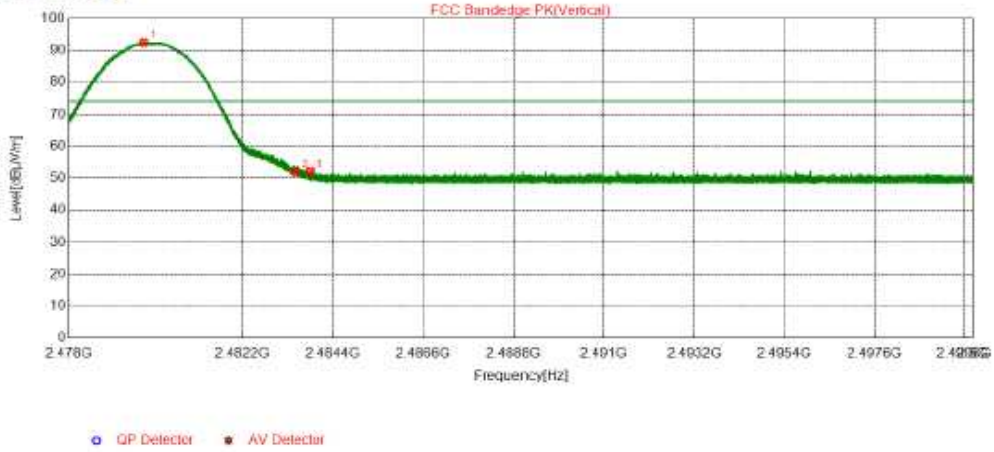


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.8040	83.64	88.72	54.00	-34.72	175	329	Horizontal	AV
2	2483.5000	40.02	45.11	54.00	8.89	165	351	Horizontal	AV
3	2486.8341	41.80	46.90	54.00	7.10	175	99	Horizontal	AV

Test Plot

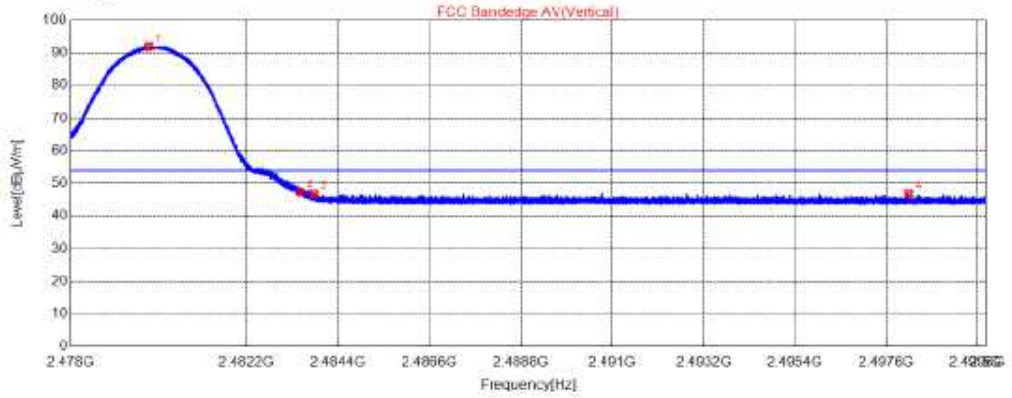
2DH5 2480MHz/ Vertical

Test Graph



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.8161	87.31	92.39	74.00	-18.39	165	117	Vertical	PK
2	2483.5000	46.80	51.89	74.00	22.11	155	227	Vertical	PK
3	2483.8531	46.90	51.99	74.00	22.01	165	17	Vertical	PK

Test Graph

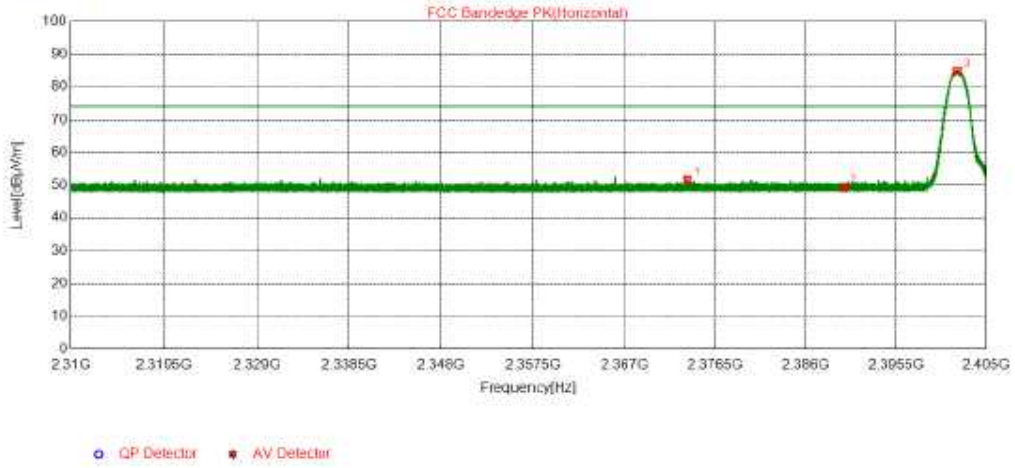


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.8722	86.90	91.98	54.00	-37.98	175	231	Vertical	AV
2	2483.5000	42.24	47.33	54.00	6.67	165	324	Vertical	AV
3	2483.8234	41.73	46.82	54.00	7.18	175	312	Vertical	AV
4	2498.1432	41.71	46.83	54.00	7.17	165	315	Vertical	AV

Test Plot

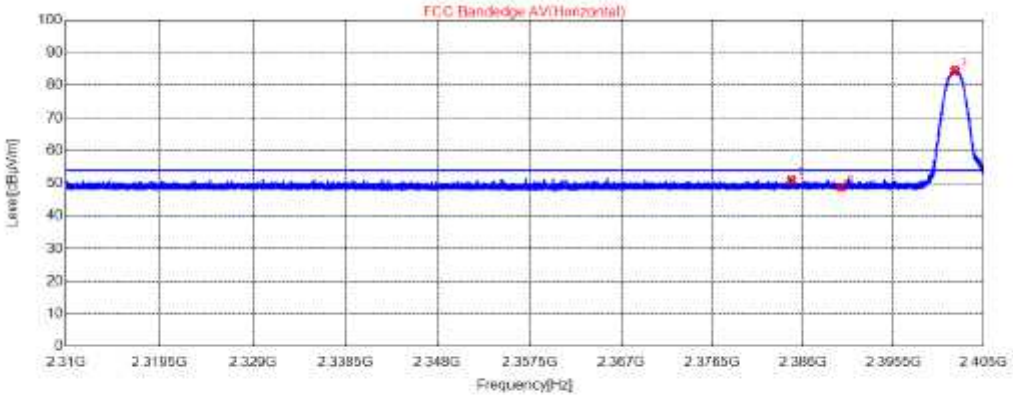
3DH5 2402MHz/ Horizontal

Test Graph



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2373.5740	46.71	51.60	74.00	22.40	175	127	Horizontal	PK
2	2390.0043	44.24	49.16	74.00	24.84	165	183	Horizontal	PK
3	2401.9600	79.88	84.83	74.00	-10.83	155	57	Horizontal	PK

Test Graph

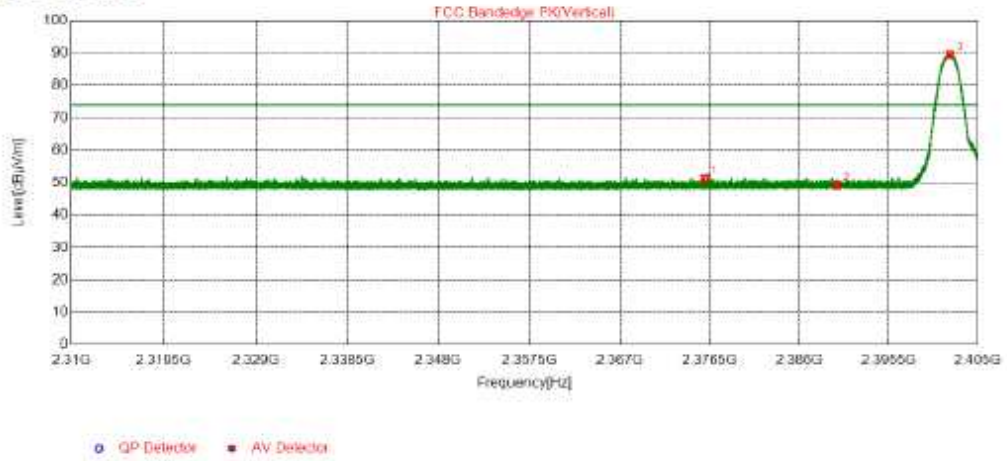


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2384.7603	46.13	51.04	54.00	2.96	155	108	Horizontal	AV
2	2390.0090	43.84	48.76	54.00	5.24	175	143	Horizontal	AV
3	2401.9838	79.64	84.59	54.00	-30.59	155	81	Horizontal	AV

Test Plot

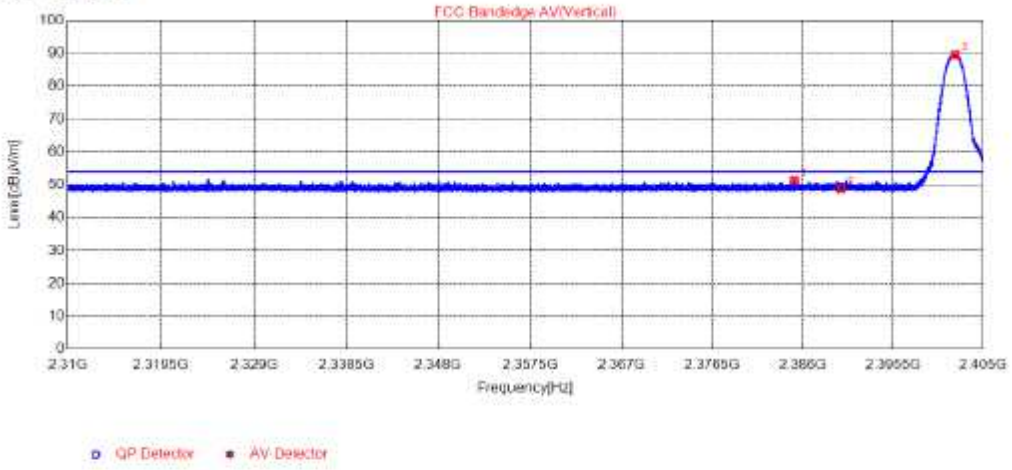
3DH5 2402MHz/ Vertical

Test Graph



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2375.9965	46.48	51.37	74.00	22.63	165	310	Vertical	PK
2	2390.0090	44.22	49.14	74.00	24.86	155	218	Vertical	PK
3	2402.0123	84.61	89.56	74.00	-15.56	175	166	Vertical	PK

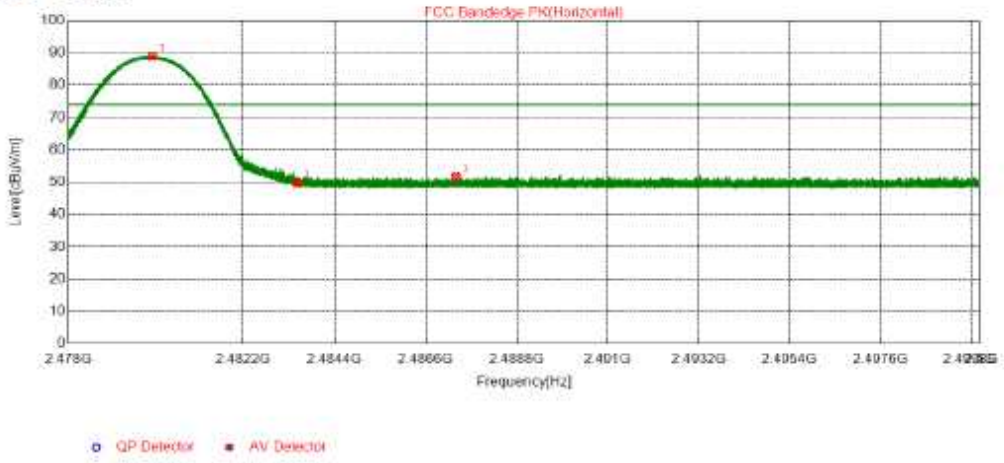
Test Graph



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2385.1403	46.42	51.33	54.00	2.67	165	198	Vertical	AV
2	2390.0043	43.78	48.70	54.00	5.30	155	145	Vertical	AV
3	2402.0503	84.66	89.61	54.00	-35.61	175	145	Vertical	AV

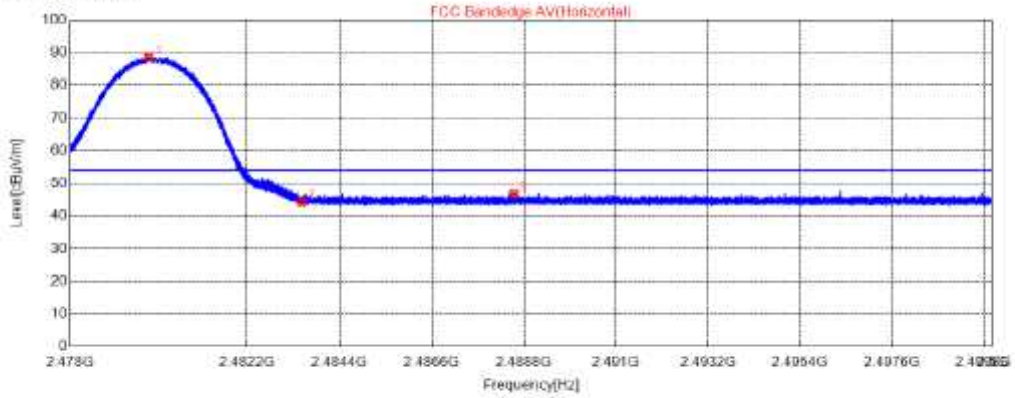
Test Plot
3DH5 2480MHz/ Horizontal

Test Graph



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2480.0086	83.88	88.96	74.00	-14.96	175	310	Horizontal	PK
2	2483.5000	44.64	49.73	74.00	24.27	155	145	Horizontal	PK
3	2487.3346	46.59	51.69	74.00	22.31	175	227	Horizontal	PK

Test Graph

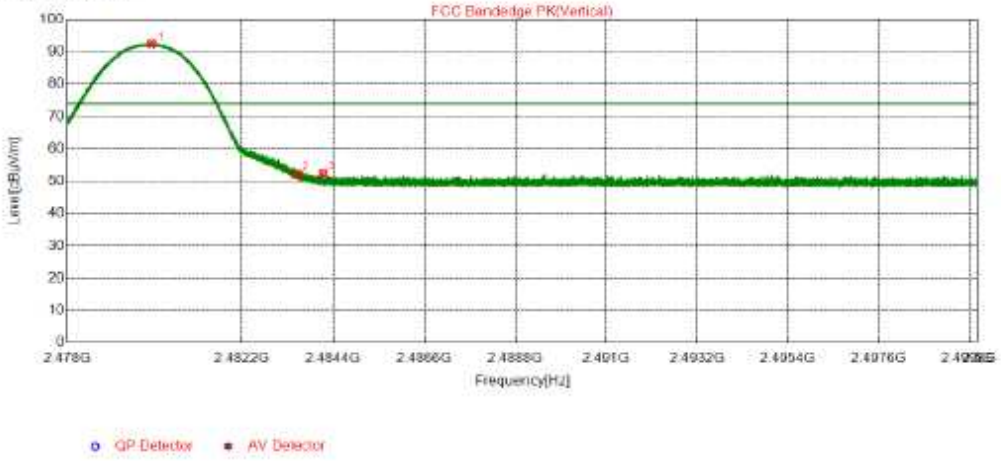


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.8645	83.53	88.61	54.00	-34.61	175	329	Horizontal	AV
2	2483.5000	39.23	44.32	54.00	9.68	175	285	Horizontal	AV
3	2488.5600	41.63	46.73	54.00	7.27	155	133	Horizontal	AV

Test Plot

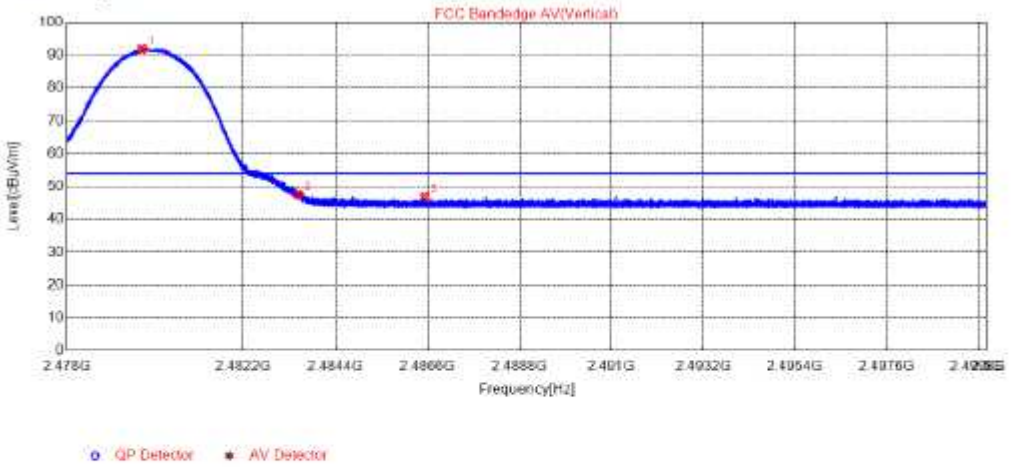
3DH5 2480MHz/ Vertical

Test Graph



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2480.0218	87.45	92.53	74.00	-18.53	175	211	Vertical	PK
2	2483.5000	46.96	52.05	74.00	21.95	165	116	Vertical	PK
3	2484.1556	47.26	52.35	74.00	21.65	175	46	Vertical	PK

Test Graph



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Detector
1	2479.7853	86.85	91.93	54.00	-37.93	175	230	Vertical	AV
2	2483.5000	42.49	47.58	54.00	6.42	165	351	Vertical	AV
3	2486.5316	41.81	46.91	54.00	7.09	175	124	Vertical	AV

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

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