MOTOROLA SOLUTIONS

CERTIFICATE 2518.08

MS ISO/IEC 17025 TESTING SAMM NO. 0825

MOTOROLA PENANG ADV. COMM. LABORATORY
Motorola Solutions Malaysia Sdn. Bhd.
Plot 2A Medan Bayan Lepas,
Mukim 12, S.W.D. 11900 Bayan Lepas,
Penang, Malaysia.

FCC / ISED TEST REPORT
Report Revision : Rev.A

Date/s Tested	:	11-Aug-2020 - 26-Aug-2020
Report Issue Date	:	11-Sep-2020
Manufacturer/Location	:	Motorola Solutions Malaysia Sdn Bhd Plot 2A, Medan Bayan Lepas, Mukim 12 SWD, 11900 Bayan Lepas, Penang, Malaysia
Requestor	:	SIEW KHENG TAN
Product Type	:	Hand-held
Product Version (PMN)	:	MSLB-MKZ900
Model Number (HVIN)	:	AAH90ZDU9RH1AN (PMUE5674A)
Frequency Band	:	2.402 - 2.480 GHz
Max RF Output Power	:	5.62 mWatts
Applicant Name	:	Motorola Solutions Inc
Applicant Address	:	8000 West Sunrise Boulevard, Fort Lauderdale, Florida 33322
FCC Registrations	:	461337
IC Registrations	:	MY0001
Firmware Version (FVIN)	:	I02.20.02.0032 (BP), D00.00.39 (AP)

The equipment was tested accordance to the requirement listed below:

(2.4GHz BT) **FCC 47CFR Part 15C** **ISED RSS 247 Issue 2**	**PASS**

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Prepared By:

GAN BOON TEONG
Test Personnel

Approved Signatory:

VINCENT FOONG CHUEN KIT
Deputy Technical Manager

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REVISION HISTORY

Revision History	Description	Date	Originator
Rev. A	Initial Report	**10-Sep-2020**	**Gan Boon Teong**

1.0. General Information

EUT Description:

Technologies	2.4GHz BT
TX Frequency range	2402MHz – 2480MHz
Modulation Type	GFSK, Pi/4 DQPSK,8DPSK
Connector type	PROGRAMMING, TEST & ALIGNMENT CABLE
Antenna type	BT/WIFI ANTENNA

The EUT contains following accessory devices and data cable:

Item	Brand	Model or P/N
BATTERY PACK,BATTERY PACK,IMPRES GEN2, LIION,IP68, 2900T, TIA4950	MOTOROLA	PMNN4804A
UHF STUBBY ANTENNA (400-527MHZ), 90MM, FERRULE	MOTOROLA	AN000348A01
CABLE,MACKENZIE PROG,TEST&ALIGN CABLE W/ TTR	MOTOROLA	PMKN4229A

Channel number and frequency information:

79 channels are provided to this EUT:

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		

General Description of Applied Standards
The EUT is a RF Product. According to the specifications of the manufacturer, the EUT is to comply with the requirements of the following standards:

Deviation from standard
Not applicable as no deviation from standard test method

Modifications to EUT
For RF conducted measurements a pigtail was soldered out of the board while for radiated measurements there were no modifications to the device

2.0. Summary of Test Results

FCC Clause	ISED Clause	Test Item	Result	Remark	Serial number tested	Tested by
15.247 (b)(1)	RSS-247 5.4(b)	Conducted RF Output Power (Peak)	Pass	Highest output power: 6.686 dBm (4.66 mW)	734TWP0317	Gan
15.247 (a)(1)	RSS-247 5.1(a) RSS-247 5.1(b)	(1) 20dB Channel Bandwidth (2) Channel Separation	Pass	GFSK – 848KF1D Pi/4 DQPSK – 1M17G1D 8DPSK - 1M17G1D	734TWP0317	Gan
15.247(a)(1)(iii)	RSS-247 5.1(d)	Number of hopping Frequency used	Pass	Meet the limit requirement.	734TWP0317	Gan
15.247(a)(1)(iii)	RSS-247 5.1(d)	Dwell time on each channel	Pass	Meet the limit requirement.	734TWP0317	Gan
15.247 (d)	RSS-247 5.5	Band Edge Conducted Spurious Emission	Pass	Worst case emission: -50.08 dBm	734TWP0317	Gan
15.247 (d)	RSS-247 5.5	Conducted Spurious Emission	Pass	Worst case emission: -48.684 dBm	734TWP0317	Gan
15.205, 15.209, 15.247 (d)	RSS-247 5.5	Radiated Emission within Restricted Bands	Pass	Worst case emission: No Spur detect (Noise Floor)	734TWP0311	Nazrin &Qawiman &Fendi
15.207	RSS-Gen 8.8	AC Powerline Conducted Emission	NA	Meet the limit requirement.	734TWP0311	Azil & Iskandar
15.203	-	Antenna Requirement	NA	Internal antenna is not accessible to the end-user	NA	

3.0. Measurement Uncertainty

Measurement	Frequency	Expended Uncertainty (k=1.96) (±dB)
AC Power Line Conducted Spurious Emission	150KHz ~ 30MHz	3.43
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	5.01
	200MHz ~ 1000MHz	5.01
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	5.01
	18GHz ~ 25GHz	5.01
Conducted Spurious Emissions	9kHz ~ 12.75GHz	2.82

4.0. Equipment List

Bluetooth ATE # 1 (SW Version: Ate Main_3.1.10_R2)

Description	Model	Serial Number	Calibration Date	Calibration Due Date
SPECTRUM ANALYZER	FSEK30	838495/014	19-Oct-19	19-Oct-20
CHAMBER	SH-641	92002639	9-Dec-19	9-Dec-20
POWER	6652A	3541A02565	26-Jun-20	26-Jun-21
SPECTRUM ANALYZER	E4440A	MY48250517	1-Nov-19	1-Nov-20
N to N RF Cable # 1	SF126/11N/11N	NA	NA	NA

Radiated Emission Station (SW Version: EMC FCC RE v1.6.2)

Description	Model	Serial Number	Calibration Date	Calibration Due Date
DRG HORN FREQ.	SAS-571	720	21-Mar-19	21-Mar-21
DRG HORN FREQ.	SAS-571	1143	14-Feb-19	14-Feb-21
POWER SUPPLY	6032A	2615A01178	21-MAY-20	21-MAY-21
SIGNAL GENERATOR	SMB 100A	181117	8-Nov-18	8-Nov-21
EMI TEST RECEIVER	ESW44	101750	24-Jul-19	24-Sep-20
EMI TEST RECEIVER	ESIB26	100017	19-Jul-19	19-Sep-20
5m Semi-anechoic Chamber	S800-HX	J2308	Not Required	Not Required
BILOG ANTENNA	CBL6112B	2964	23-Apr-19	23-Apr-21
BILOG ANTENNA	CBL6112B	2950	8-Jul-19	8-Jul-21
DATA LOGGER	SDL500	A.016776	4-Jun-20	4-Jun-21
SYSTEM CONTROLLER	SC104V	050806-1	Not Required	Not Required
TURNTABLE FLUSH MOUNT 2M	FM2011	NA	Not Required	Not Required
ANTENNA POSITIONING TOWER	TLT2	NA	Not Required	Not Required
BROAD-BAND HORN ANTENNA	BBHA9170	BBHA9170255	27-Jan-20	27-Jan-21
18 - 40GHz PREAMPLIFIER	Miteq Hi Gain Sucoflex	001	Not Required	Not Required
PREAMPLIFIER	PAM-0118	269	24-May-19	24-May-22
LOOP ANTENNA	6502	00208416	5-Sep-19	5-Sep-20

AC Power Line Conducted Spurious Emission(SW Version: EMC 32 Ver. 10.60.10)

Description	Model #	Serial Number	Calibration Date	Calibration Due Date
TEMPERATURE & HUMIDITY LOGGER	TM320	16344143	20-May-20	20-May-21
V-NETWORK 2-LINE	ENV216V	101039	20-Jul-19	20-Sep-20
EMI TEST RECEIVER	ESIB26	827769/009	25-Jul-19	25-Sep-20
PROGRAMMABLE AC SOURCE	61604	ABR000000926	10-July-2020	10-July-2021

5.0. Test Mode Applicability and Test Channel Detail

Radiated Emission Test (Above 1GHz)

☒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	Environmental Conditions
Test Mode	0 to 78	0,39,78	FHSS	GFSK, Pi/4 DQPSK,8DPSK	24.5°C, 70.3%RH

Radiated Emission Test (Below 1GHz)

☒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	Environmental Conditions
Test Mode	0 to 78	0,39,78	FHSS	GFSK, Pi/4 DQPSK,8DPSK	24.5°C, 70.3%RH

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.

NAEUT Configure Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Environmental Conditions
Application Mode	0 to 78	AUTO	FHSS	AUTO	22.2°C, 61%RH

Antenna Port Conducted Measurement:

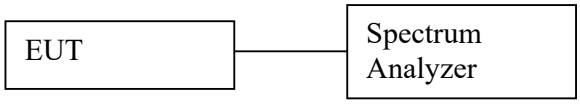
☒This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
☒Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Environmental Conditions
Test Mode	0 to 78	0,39,78	FHSS	GFSK, Pi/4 DQPSK,8DPSK	25°C, 50.0%RH

6.0. Transmitter Test Parameters

6.1. Conducted RF Output Power (Peak)

6.1.1. Test Setup



a) Check and ensure the spectrum analyzer well calibrate.
b) Turn on the EUT and set EUT to transmit maximum data rate with hopping disable.
c) Connect EUT's antenna terminal to spectrum analyzer with a low loss cable.
d) Setting of Spectrum analyzer :
   a. RBW = > 20 dB bandwidth
   b. VBW = RBW
   c. Detector mode = Peak
   d. AMPLITUDE → Scale/Div = 10 dB
   e. Trace = Max hold
   f. Sweep = auto
e) Measure the captured power within the band and recording the plot.
f) Repeat above procedure with other different mode of operation.

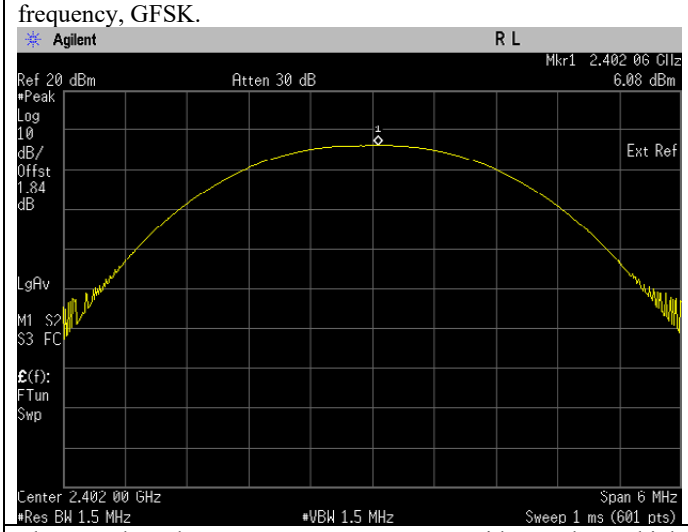
6.1.2. Test Limits:

Normal Condition (25 ° C)
≤ 125mW (or 20.9dBm)

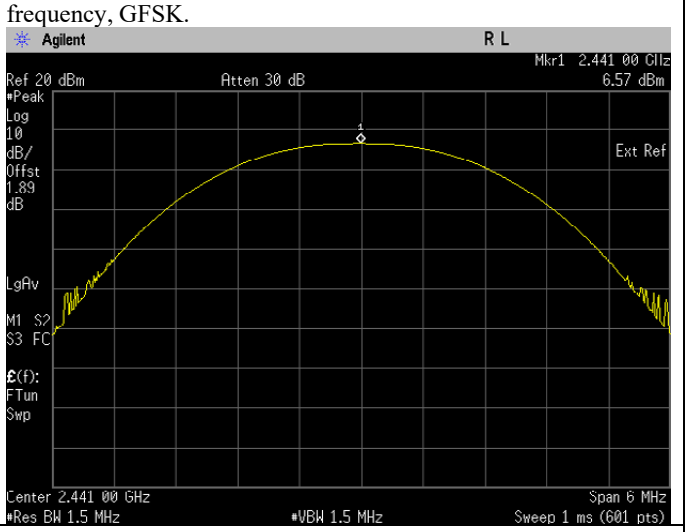
6.1.3. Test Data:

Test Conditions		Test Frequency (GHz)	Results	
Modulation	Voltage(V)		dBm	Status
GFSK	7.50	2.4020	6.081	Pass
		2.4410	6.568	Pass
		2.4800	5.267	Pass
Pi/4DQPSK	7.50	2.4020	6.043	Pass
		2.4410	6.444	Pass
		2.4800	5.127	Pass
8DPSK	7.50	2.4020	6.183	Pass
		2.4410	6.686	Pass
		2.4800	5.348	Pass

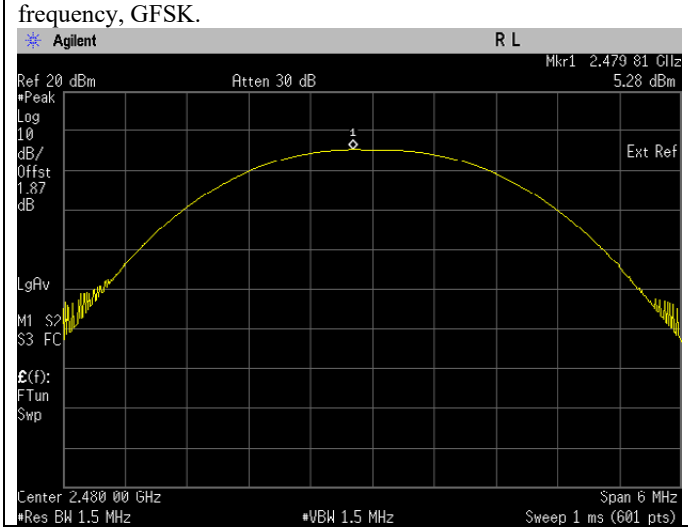
The Conducted RF Output Power test with result at low frequency, GFSK.



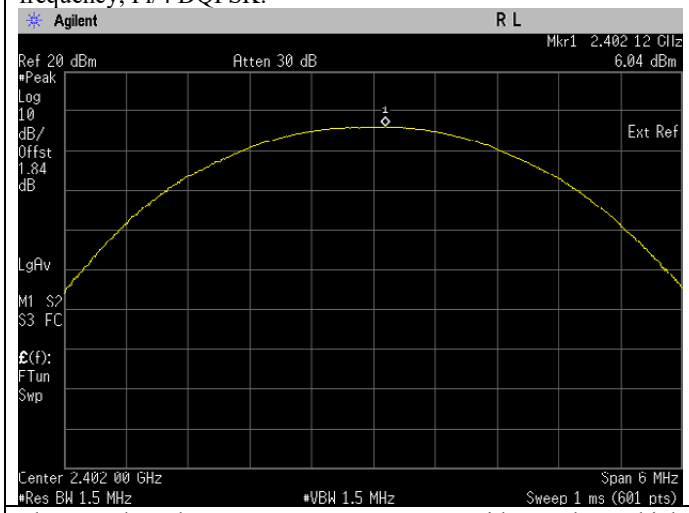
The Conducted RF Output Power test with result at mid frequency, GFSK.



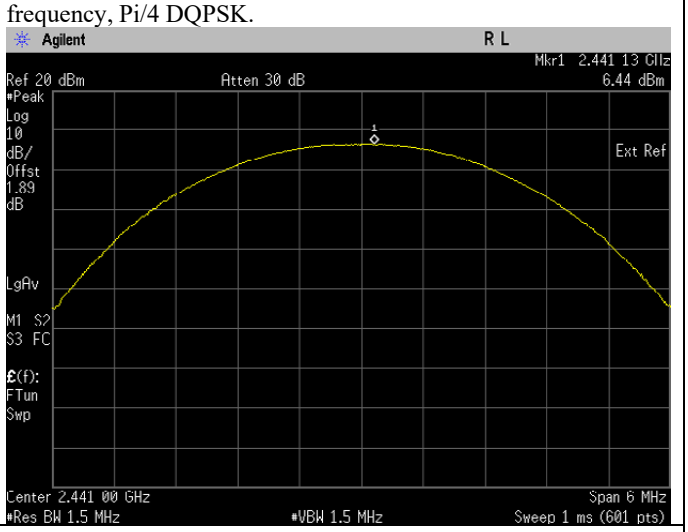
The Conducted RF Output Power test with result at high frequency, GFSK.



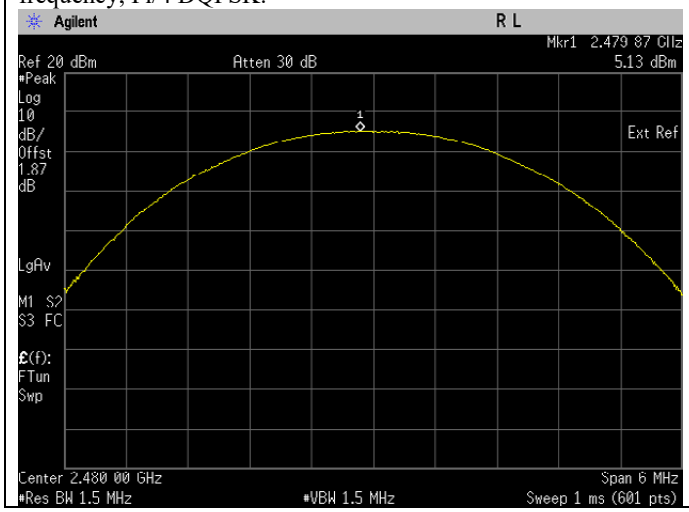
The Conducted RF Output Power test with result at low frequency, Pi/4 DQPSK.



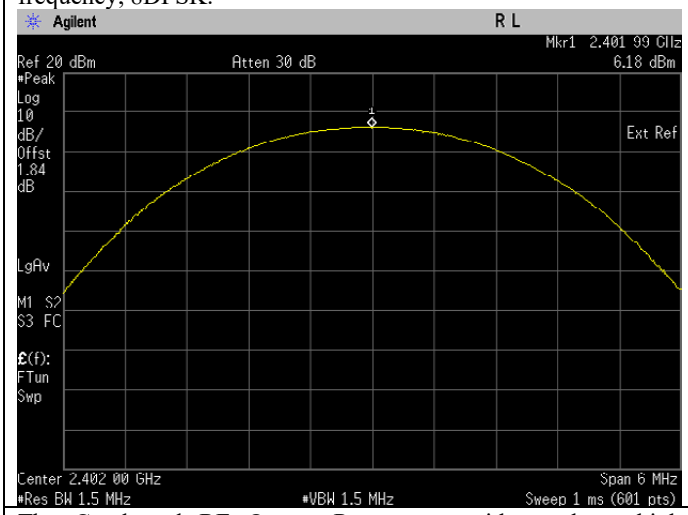
The Conducted RF Output Power test with result at mid frequency, Pi/4 DQPSK.



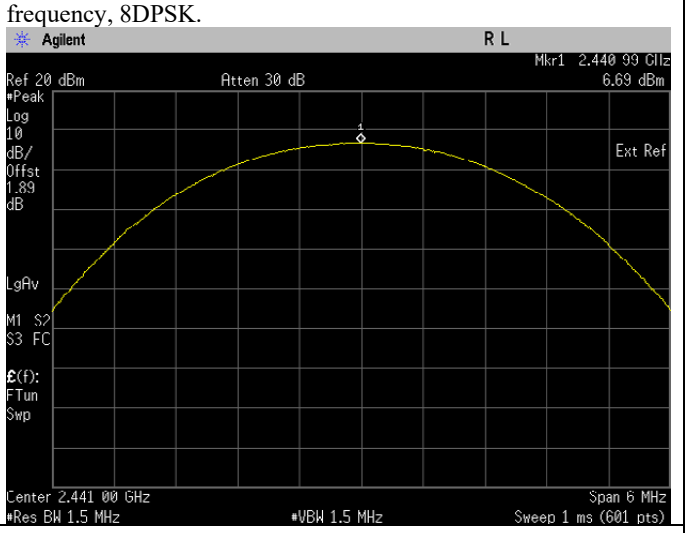
The Conducted RF Output Power test with result at high frequency, Pi/4 DQPSK.



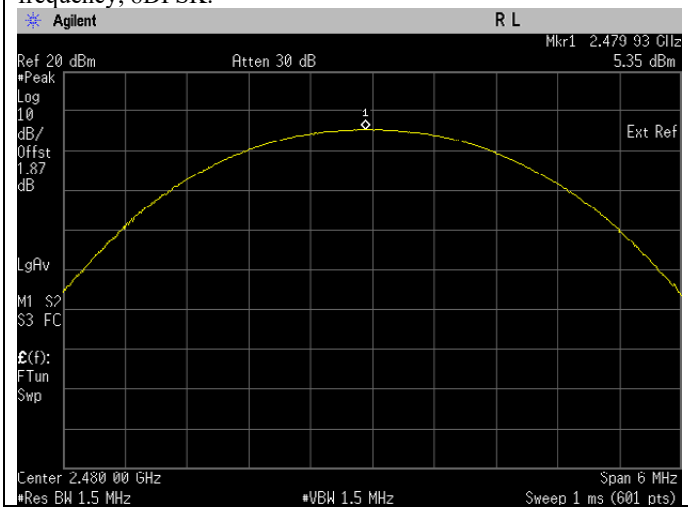
The Conducted RF Output Power test with result at low frequency, 8DPSK.



The Conducted RF Output Power test with result at mid frequency, 8DPSK.

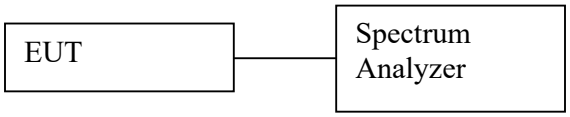


The Conducted RF Output Power test with result at high frequency, 8DPSK.



6.2. 20dB Channel Bandwidth

6.2.1. Test Setup



a) Check and ensure the spectrum analyzer well calibrate.
b) Turn on the EUT and set EUT to transmit maximum data rate with hopping disable.
c) Connect EUT's antenna terminal to spectrum analyzer with a low loss cable.
d) Setting of Spectrum analyzer :
   a. RBW = 30 kHz
   b. VBW = 100 kHz
   c. SPAN = 3 MHz, center on test frequency
   d. AMPLITUDE → Scale/Div = 10 dB
   e. Detector mode = Peak
   f. Trace = Max hold
   g. Sweep = auto
e) Measure the freq different of two frequencies that were attenuated 20dB from peak of the emission & record the frequency difference as the emission bandwidth.
f) Save the plot result from spectrum analyzer screen.
g) Repeat above procedure with other different mode of operation.

6.2.2. Test Limits:

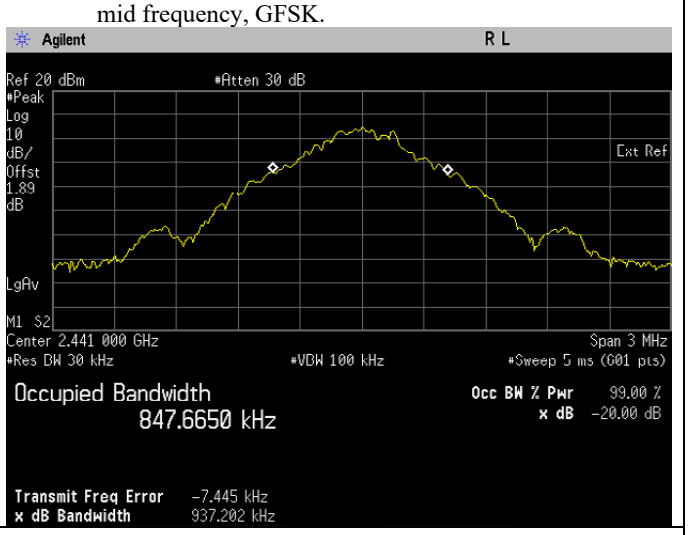
Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

6.2.3. est Data:

Test Conditions		Test Frequency TX (GHz)	Results (MHz)		
Modulation Type	Voltage(V)		20dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Status
GFSK	7.50	2.4020	0.938	0.846	Pass
		2.4410	0.937	0.848	Pass
		2.4800	0.938	0.844	Pass
Pi/4 DQPSK	7.50	2.4020	1.281	1.172	Pass
		2.4410	1.280	1.171	Pass
		2.4800	1.278	1.172	Pass
8DPSK	7.50	2.4020	1.298	1.179	Pass
		2.4410	1.292	1.175	Pass
		2.4800	1.289	1.179	Pass

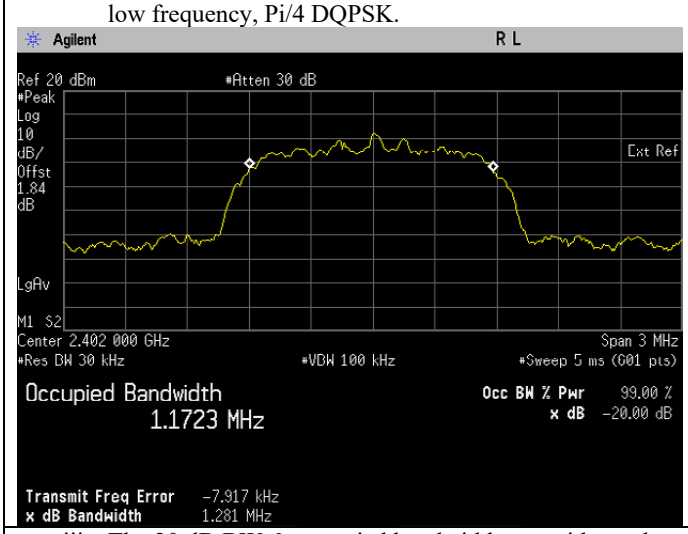
i. The 20 dB BW & occupied bandwidth test with result at low frequency, GFSK.

ii. The 20 dB BW & occupied bandwidth test with result at mid frequency, GFSK.

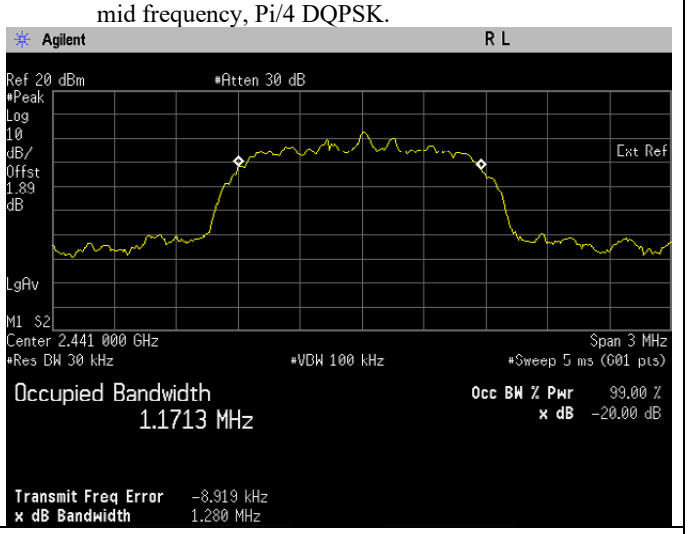


iii. The 20 dB BW & occupied bandwidth test with result at high frequency, GFSK.

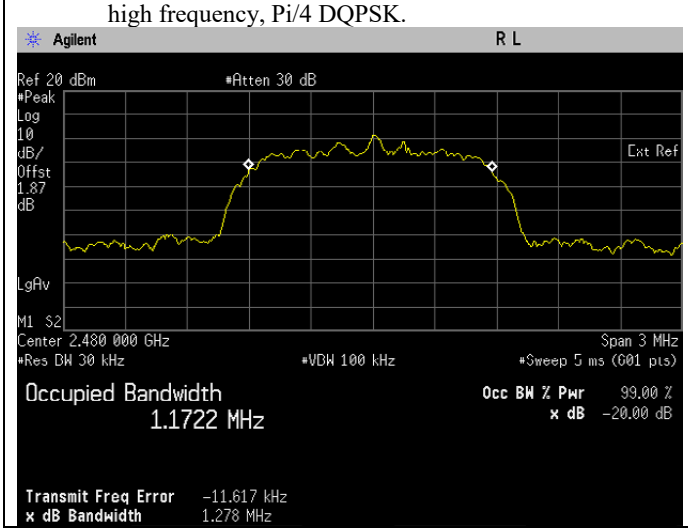
i. The 20 dB BW & occupied bandwidth test with result at low frequency, Pi/4 DQPSK.



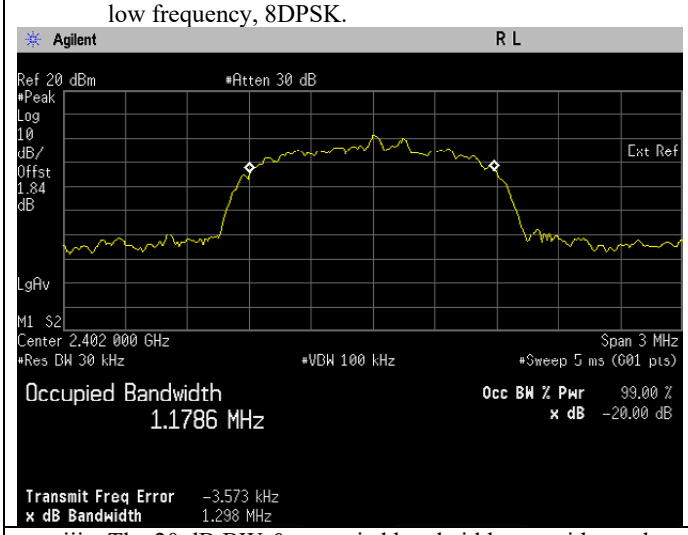
ii. The 20 dB BW & occupied bandwidth test with result at mid frequency, Pi/4 DQPSK.



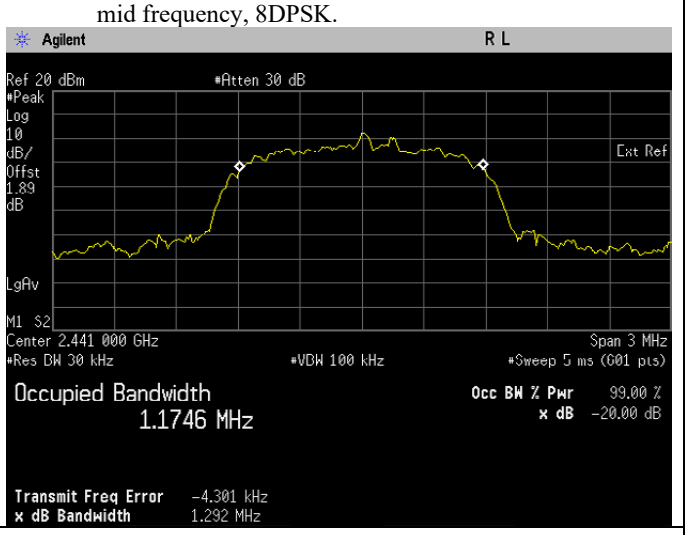
iii. The 20 dB BW & occupied bandwidth test with result at high frequency, Pi/4 DQPSK.



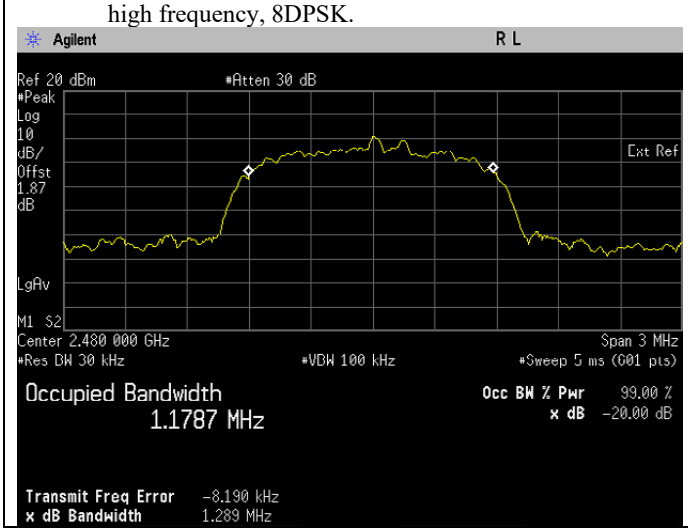
i. The 20 dB BW & occupied bandwidth test with result at low frequency, 8DPSK.



ii. The 20 dB BW & occupied bandwidth test with result at mid frequency, 8DPSK.

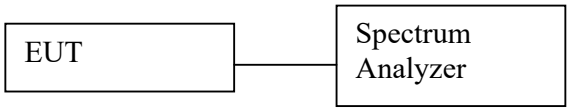


iii. The 20 dB BW & occupied bandwidth test with result at high frequency, 8DPSK.



6.3. Band-edge Conducted Spurious Emission

6.3.1. Test Setup



a) Check and ensure the spectrum analyzer well calibrate.
b) Turn on the EUT and keep the EUT in hopping mode.
c) Connect EUT's antenna terminal to spectrum analyzer with a low loss cable.
d) Setting of Spectrum analyzer :
   a. RBW = 100 kHz
   b. VBW = 300 kHz
   c. SPAN = 4 MHz (Low channel) or 6MHz(High Channel)
   d. Detector mode = Peak
   e. AMPLITUDE → Scale/Div = 10 dB
   f. Trace = Max hold
   g. Sweep = auto
e) Measure the captured band edge emission result and recording the plot.
f) Repeat above on EUT with hopping disable.
g) Repeat above procedure with other different test frequency.

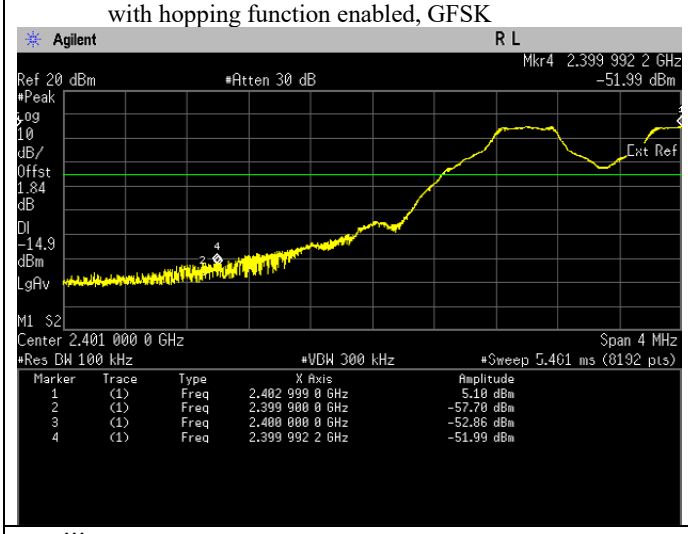
6.3.2. Test Limits

Normal Condition (25 º C)
Shall be at least 20 dB below the peak power.

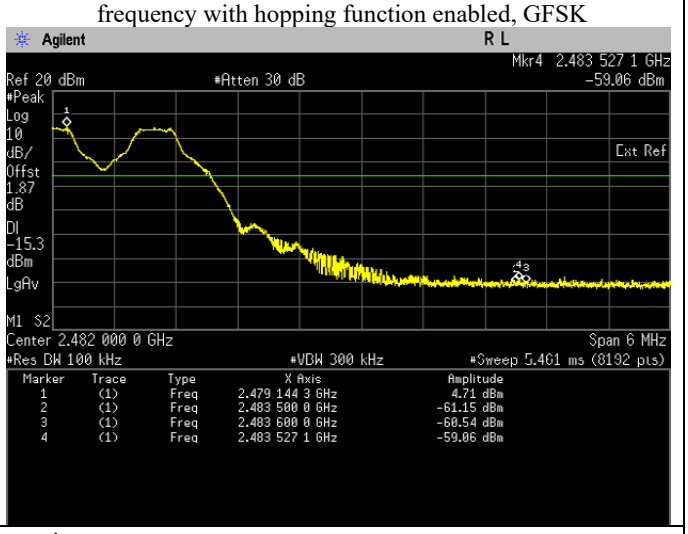
6.3.3. Test Result

Test Conditions		Hopping Method	Test Frequency(GHz)	Results	
Modulation	Voltage(V)			dB	Status
GFSK	7.50	Enabled (continuously)	2.4020	-51.99	Pass
			2.4800	-59.06	Pass
		Disabled (constantly)	2.4020	-50.08	Pass
			2.4800	-57.87	Pass
Pi/4 DQPSK	7.50	Enabled (continuously)	2.4020	-54.33	Pass
			2.4800	-60.33	Pass
		Disabled (constantly)	2.4020	-52.15	Pass
			2.4800	-57.02	Pass
8DPSK	7.50	Enabled (continuously)	2.4020	-54.55	Pass
			2.4800	-59.75	Pass
		Disabled (constantly)	2.4020	-53.13	Pass
			2.4800	-58.76	Pass

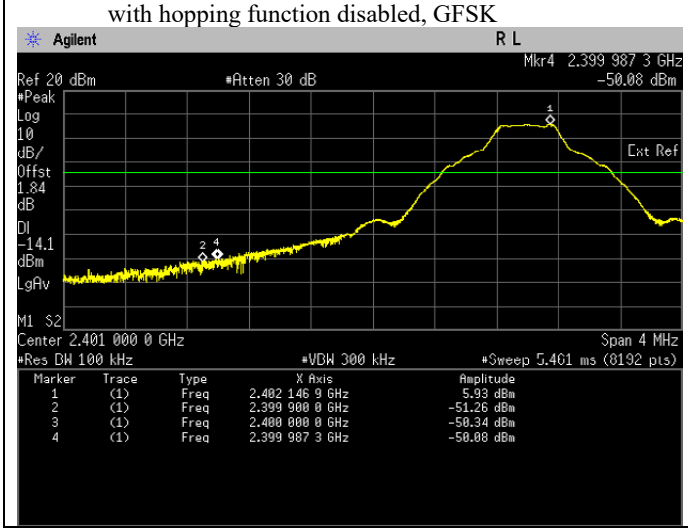
i. The highest band edge emission at low carrier frequency with hopping function enabled, GFSK



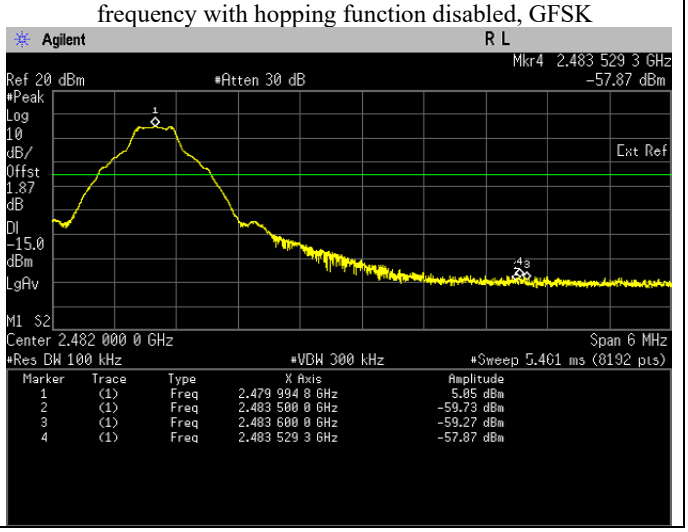
ii. The highest band edge emission at high carrier frequency with hopping function enabled, GFSK



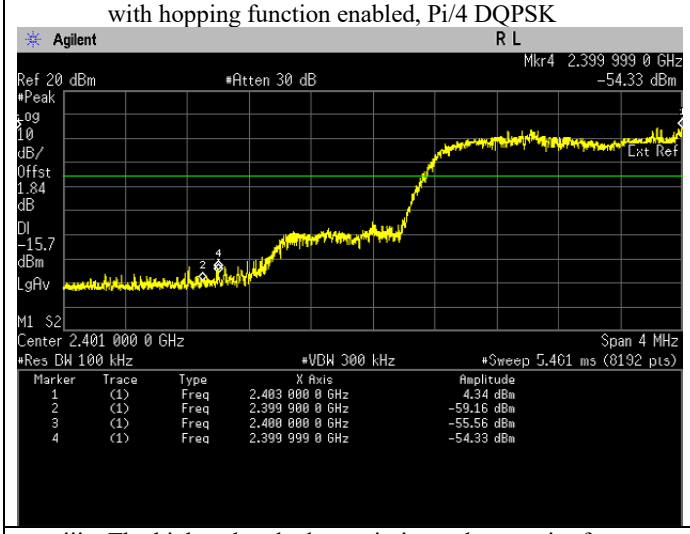
iii. The highest band edge emission at low carrier frequency with hopping function disabled, GFSK



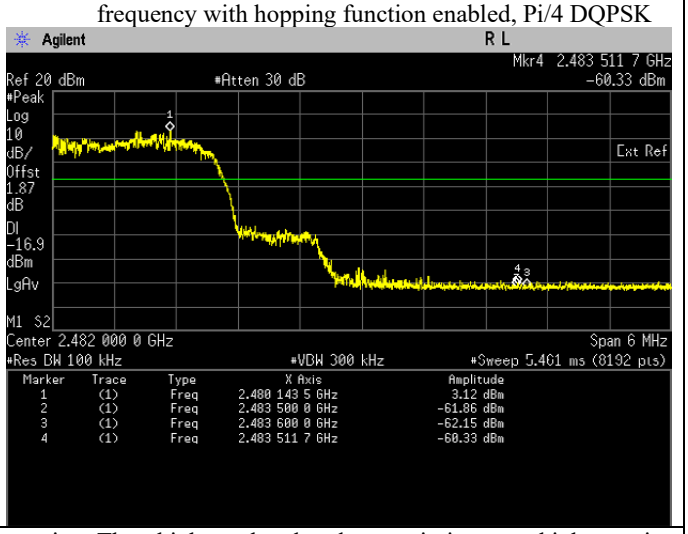
iv. The highest band edge emission at high carrier frequency with hopping function disabled, GFSK



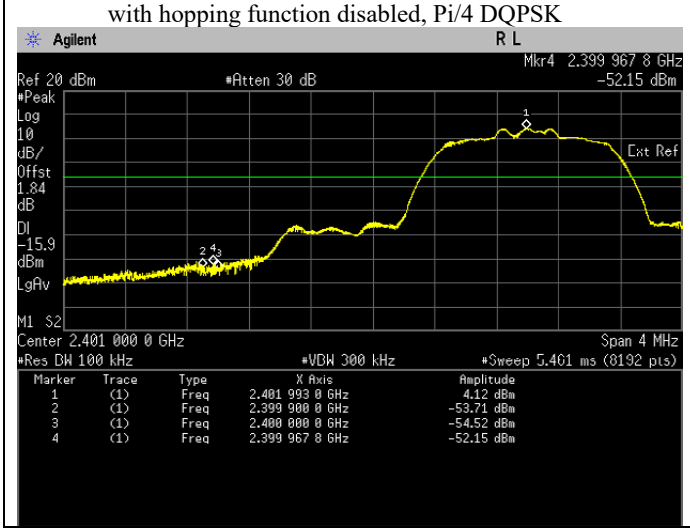
i. The highest band edge emission at low carrier frequency with hopping function enabled, Pi/4 DQPSK



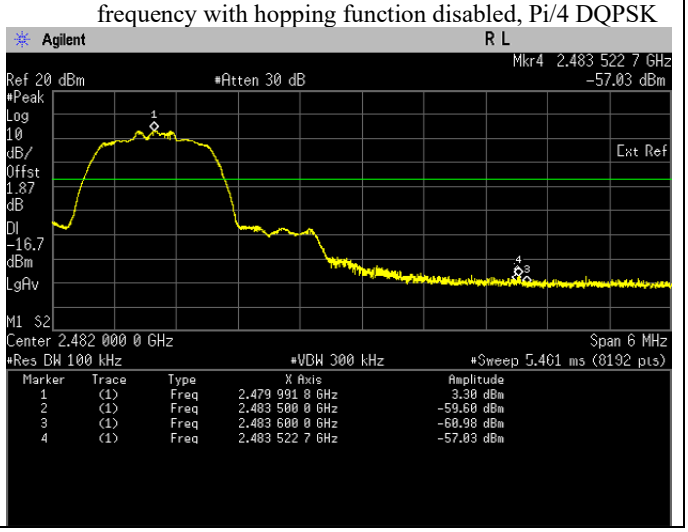
ii. The highest band edge emission at high carrier frequency with hopping function enabled, Pi/4 DQPSK



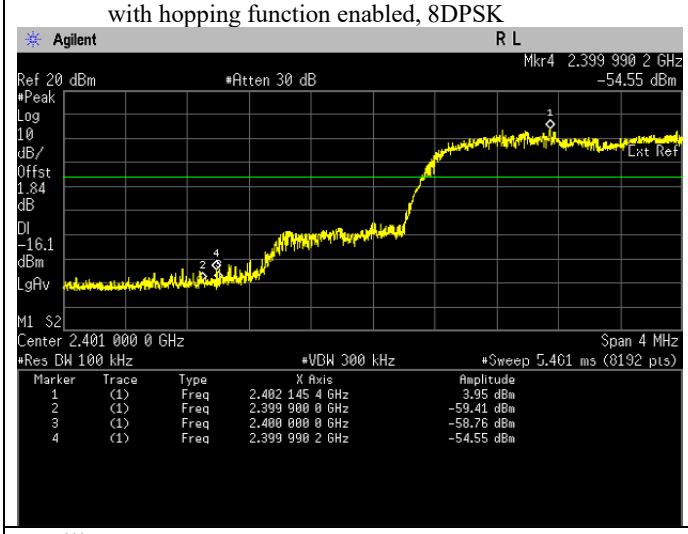
iii. The highest band edge emission at low carrier frequency with hopping function disabled, Pi/4 DQPSK



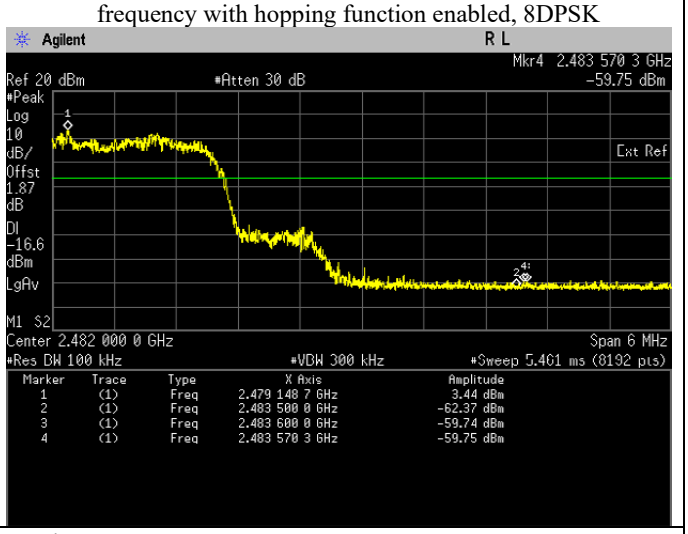
iv. The highest band edge emission at high carrier frequency with hopping function disabled, Pi/4 DQPSK



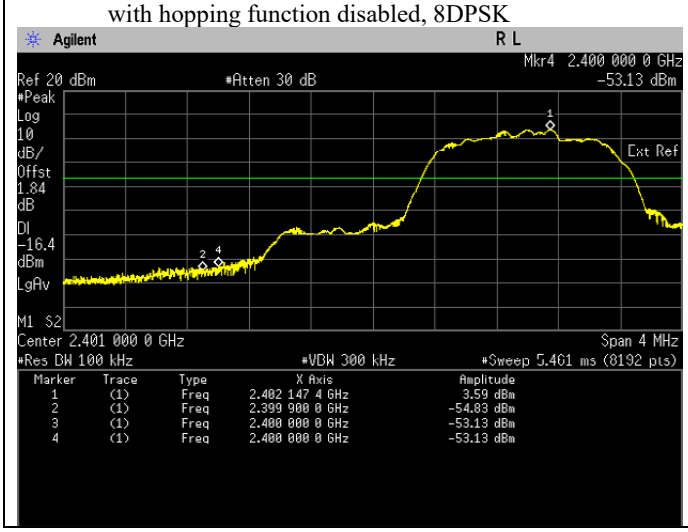
i. The highest band edge emission at low carrier frequency with hopping function enabled, 8DPSK



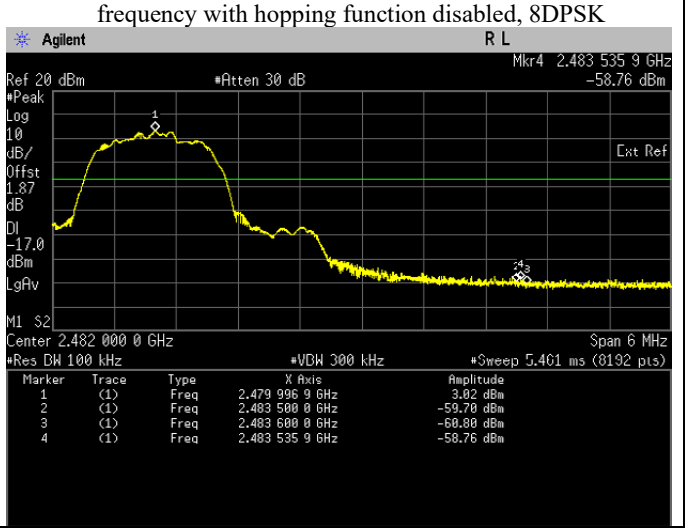
ii. The highest band edge emission at high carrier frequency with hopping function enabled, 8DPSK



iii. The highest band edge emission at low carrier frequency with hopping function disabled, 8DPSK

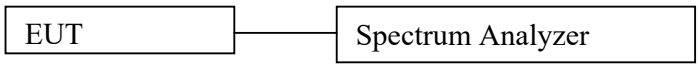


iv. The highest band edge emission at high carrier frequency with hopping function disabled, 8DPSK



6.4. Dwell time on each channel

6.4.1. Test Setup



a) Check and ensure the spectrum analyzer well calibrate.
b) Turn on the EUT and keep the EUT in hopping mode.
c) Connect EUT's antenna terminal to spectrum analyzer with a low loss cable.
d) Setting of Spectrum analyzer :
    a. RBW = 100 kHz
    b. VBW = 300 kHz
    c. SPAN = Zero SPAN, center on hopping frequency
    d. Detector mode = Peak
    e. Trace = Max hold
    f. Sweep time = 5second
    g. Sweep = Single
e) Measure total numbers of transmissions occur in 5 second and save the plot.
f) Change the setting of spectrum analyzer :
    a. RBW = 100 kHz
    b. VBW = 300 kHz
    c. Sweep time = sufficient to capture dwell time for 1 transmission
    d. Sweep = Single
g) Measure dwell time for 1 transmission and save the plot.
h) Calculate accumulate dwell time in a given period equal to number of hopping frequencies x 0.4
i) Repeat above procedure with other different mode of operation.

6.4.2. Test Limits:

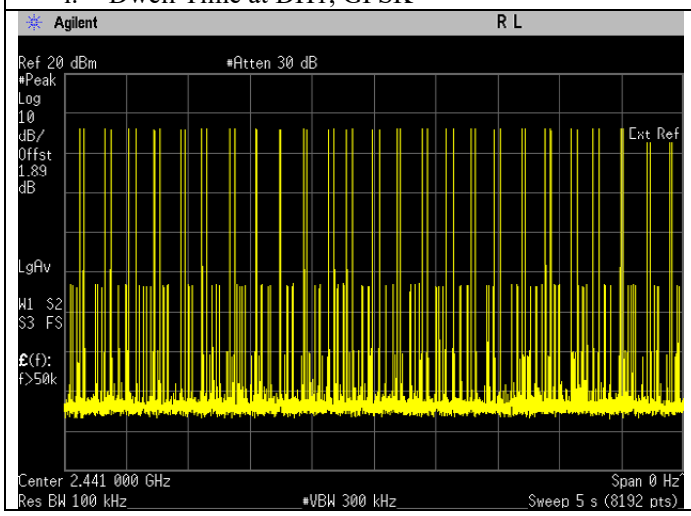
Normal Condition (25 º C)
≤ 400ms

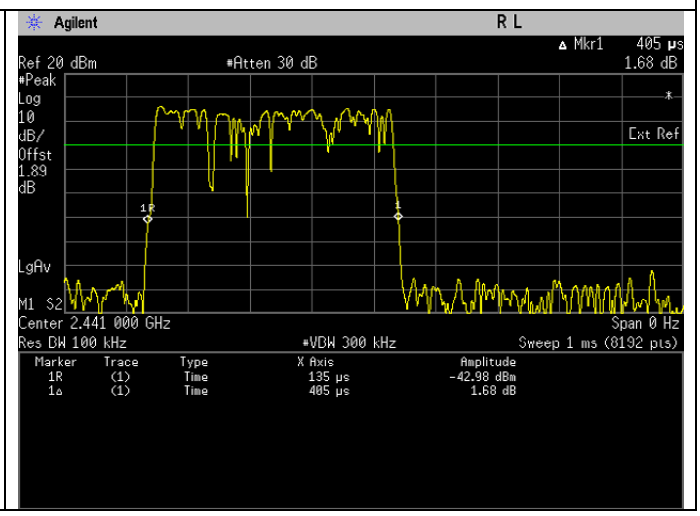
6.4.3. Test Result

Test Conditions			Data Package	Results			
Modulation	Voltage (V)	Test Frequency (GHz)		No. of transmission in 5s **(a)**	Dwell time in one transmission **(b) (msec)**	Total accumulate dwell time in 31.6s. **(c) (msec)**	Status
GFSK	7.50	2.4410	DH1	51	0.405	130.539600	Pass
			DH3	30	1.661	314.925600	Pass
			DH5	15	2.910	275.868000	Pass
Pi/4 DQPSK	7.50		DH1	51	0.413	133.118160	Pass
			DH3	9	2.9	164.952000	Pass
			DH5	20	2.401	303.486400	Pass
8 DPSK	7.50		DH1	49	1.157	358.299760	Pass
			DH3	23	0.412	59.888320	Pass
			DH5	15	2.914	276.247200	Pass

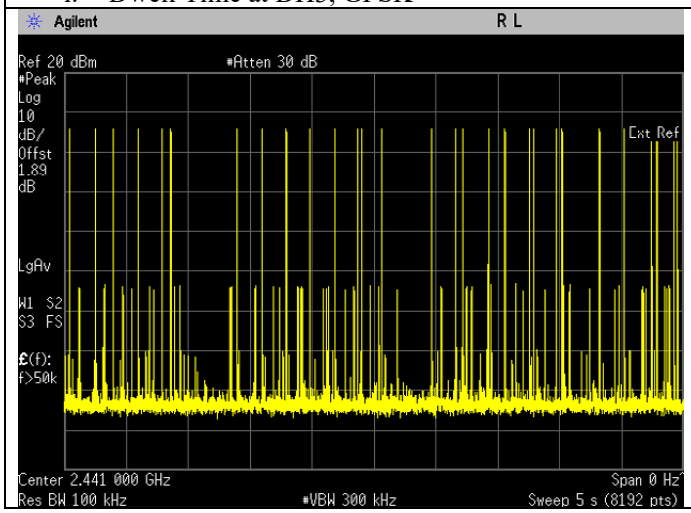
****Note:** Total dwell time 31.6s (79Hopping*0.4), (c) = (a) x 6.32 x (b)

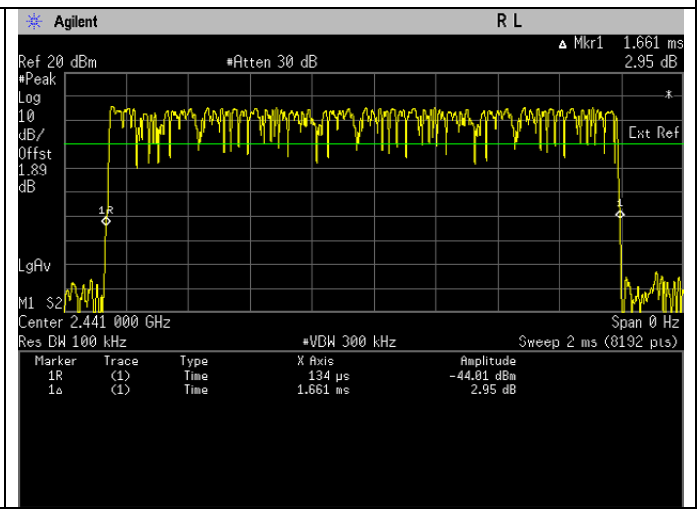
i. Dwell Time at DH1, GFSK



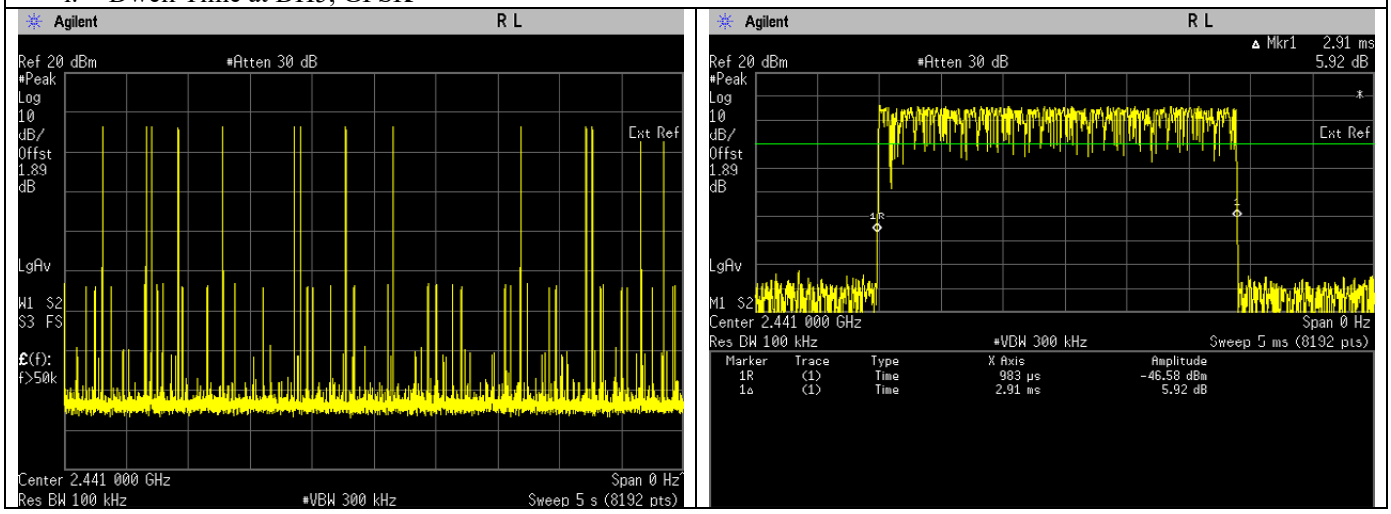


i. Dwell Time at DH3, GFSK

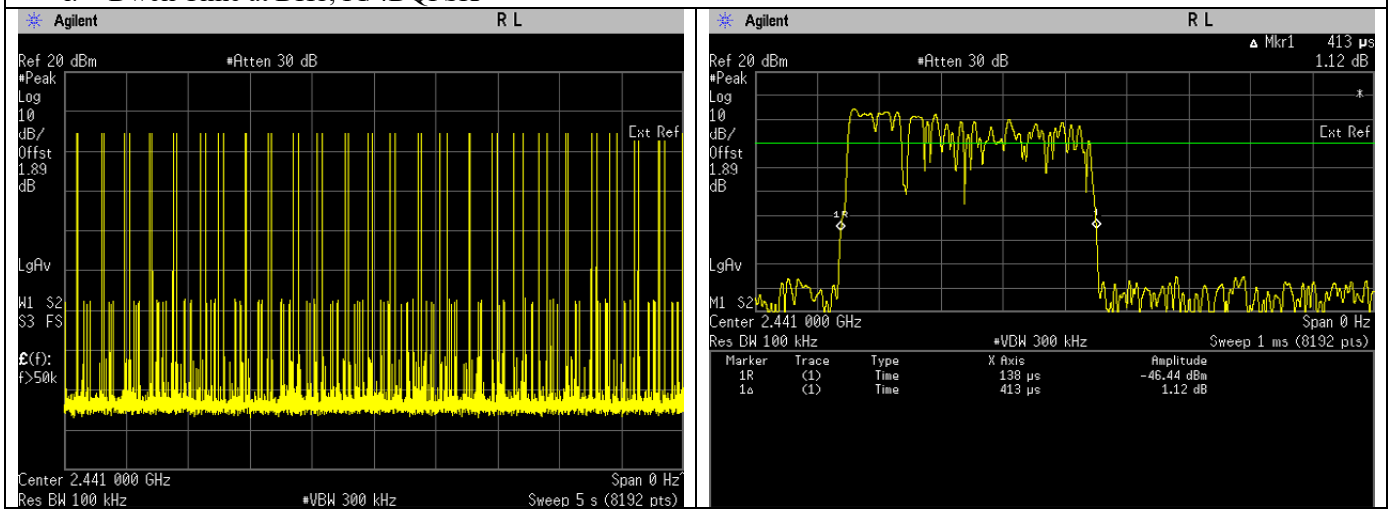




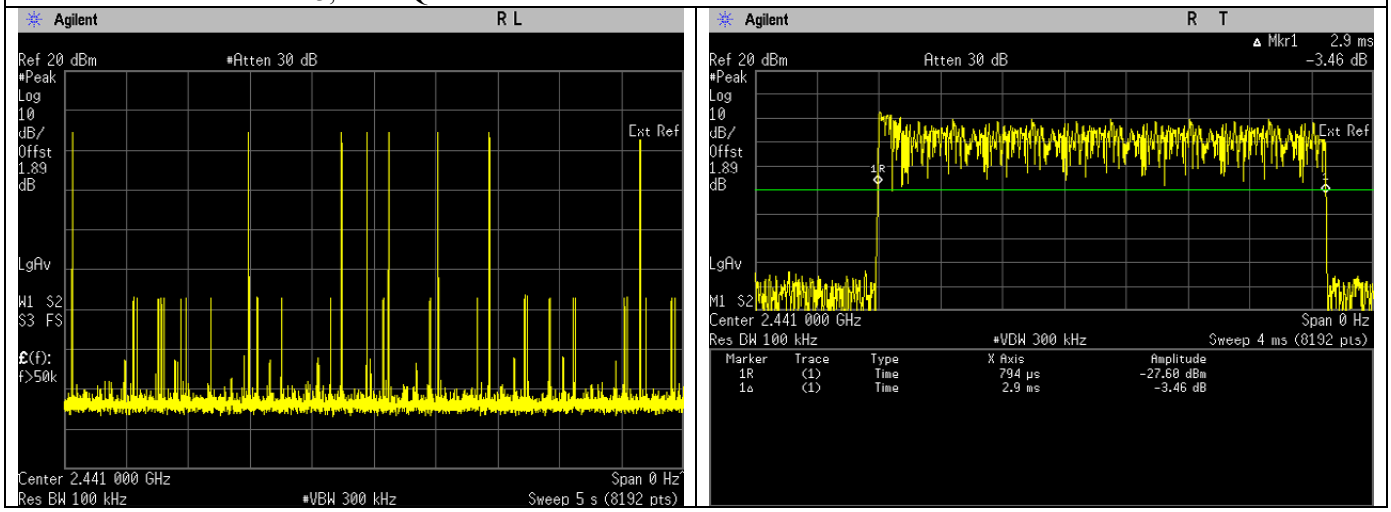
i. Dwell Time at DH5, GFSK



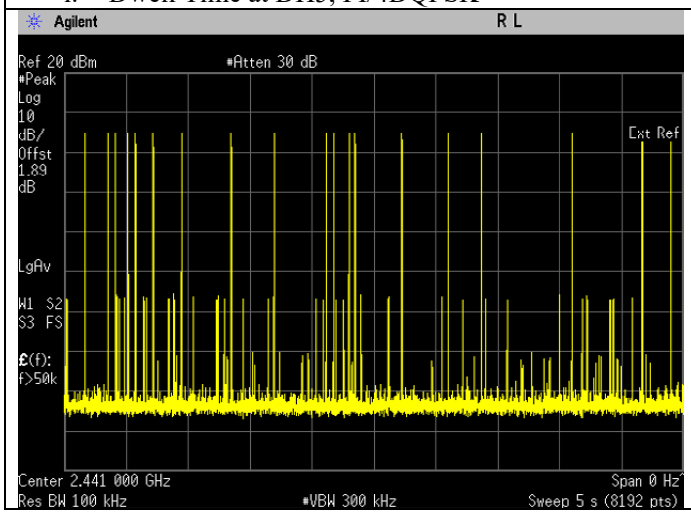
i. Dwell Time at DH1, PI/4DQPSK

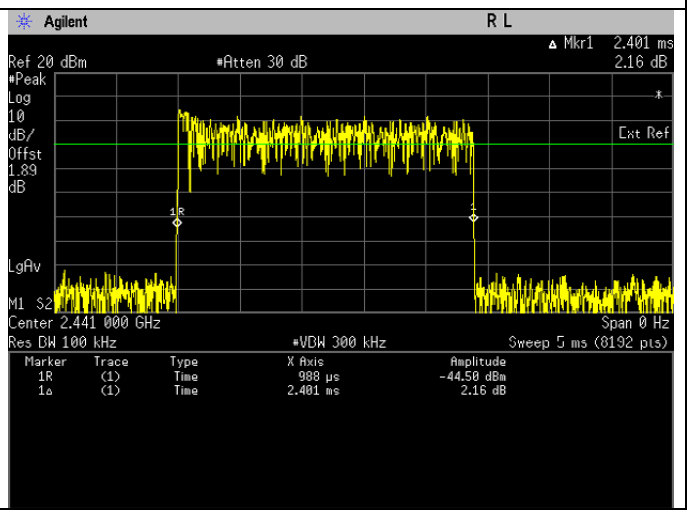


i. Dwell Time at DH3, PI/4DQPSK

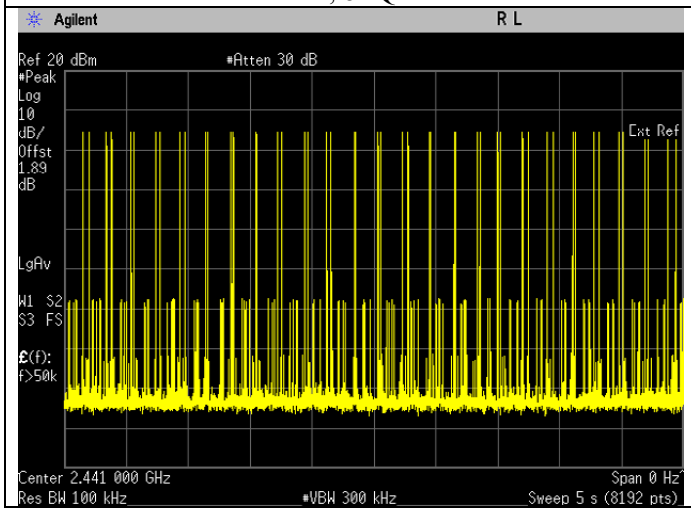


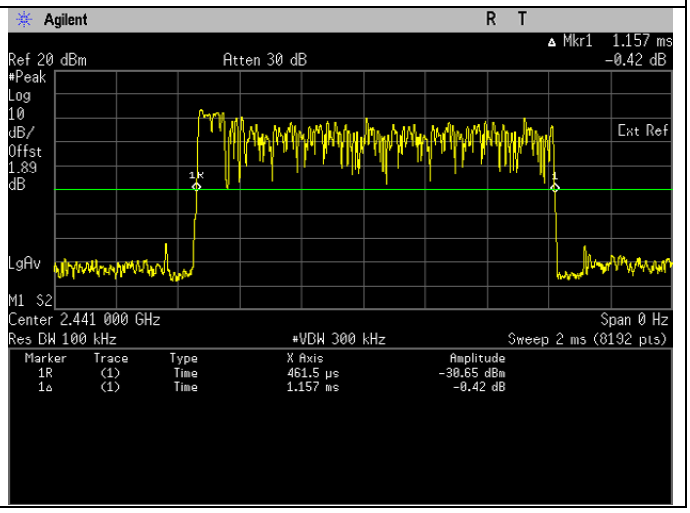
i. Dwell Time at DH5, PI/4DQPSK



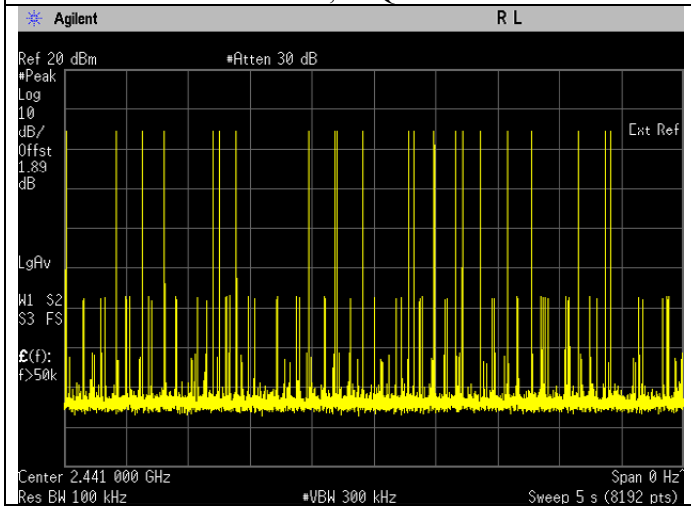


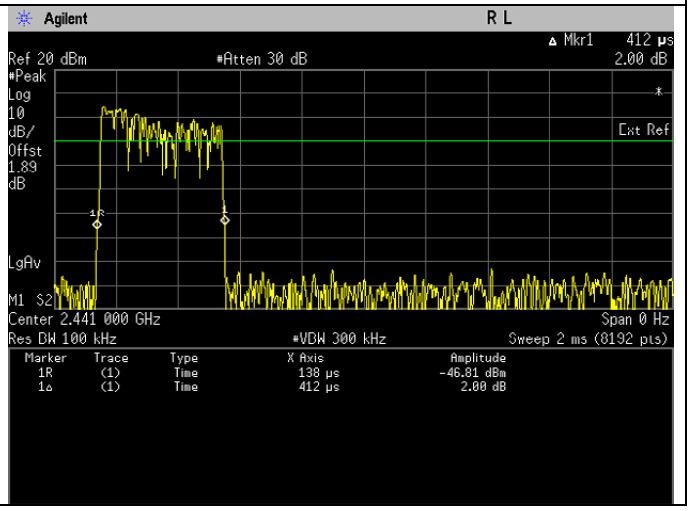
i. Dwell Time at DH1, 8DQPSK



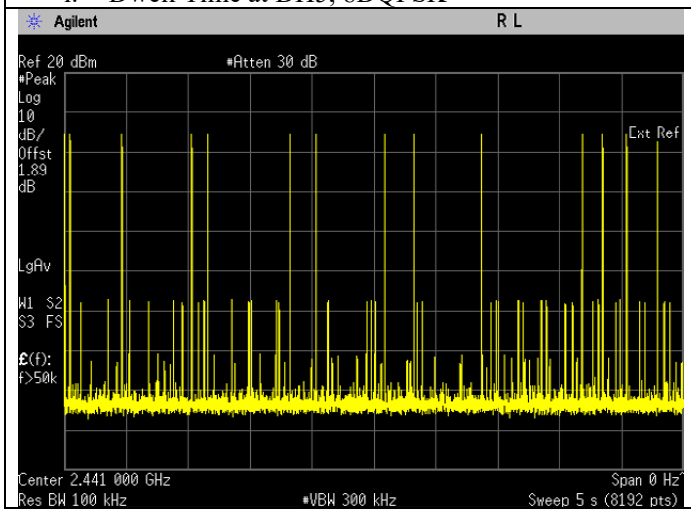


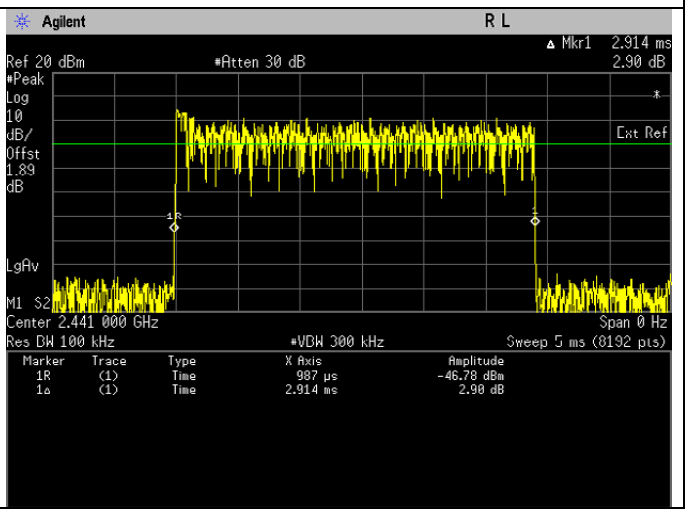
i. Dwell Time at DH3, 8DQPSK





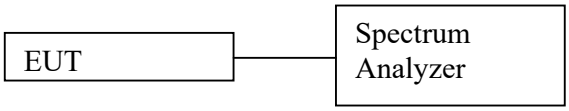
i. Dwell Time at DH5, 8DQPSK





6.5. Number of hopping Frequency

6.5.1. Test Setup



a) Check and ensure the spectrum analyzer well calibrate.
b) Turn on the EUT and keep the EUT in hopping mode.
c) Connect EUT's antenna terminal to spectrum analyzer with a low loss cable.
d) Setting of Spectrum analyzer :
   a. RBW = 300 kHz
   b. VBW = 300 kHz
   c. Detector mode = Peak
   d. Trace = Max hold
e) Allow the trace to stabilized & save the plot result from spectrum analyzer screen.
f) Count number of channel frequency in the operating.
g) Repeat above procedure for other test frequency.

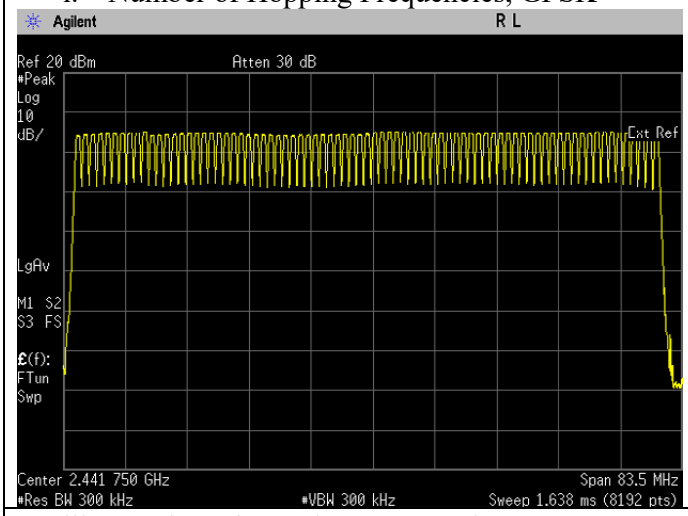
6.5.2. Test Limits:

Normal Condition (25 º C)
≥ 15

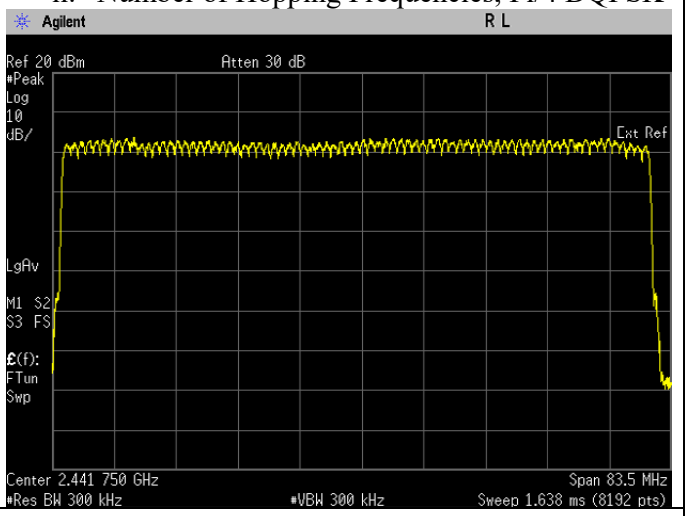
6.5.3. Test Result

Test Conditions		Sweep Range (GHz)	Results	
Modulation	Voltage(V)		No. of Hopping Frequencies	Status
GFSK	7.50	2.4000-2.4835	79	Pass
Pi/4DQPSK	7.50	2.4000-2.4835	79	Pass
8DPSK	7.50	2.4000-2.4835	79	Pass

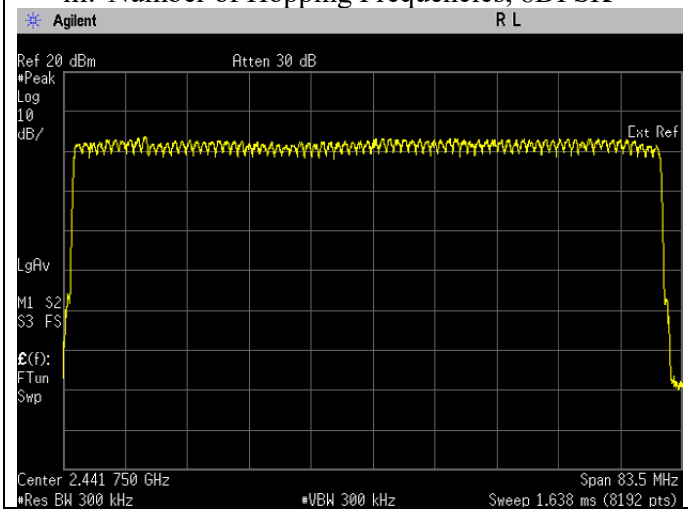
i. Number of Hopping Frequencies, GFSK



ii. Number of Hopping Frequencies, Pi/4 DQPSK

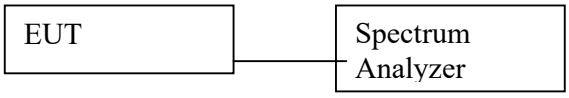


iii. Number of Hopping Frequencies, 8DPSK



6.6. Channel Separation

6.6.1. Test Setup



a) Check and ensure the spectrum analyzer well calibrate.
b) Turn on the EUT and keep the EUT in hopping mode.
c) Connect EUT's antenna terminal to spectrum analyzer with a low loss cable.
d) Setting of Spectrum analyzer :
   a. RBW = 300 kHz
   b. VBW = 300 kHz
   c. SPAN = 3 MHz, center on test frequency
   d. AMPLITUDE → Scale/Div = 5 dB
   e. Detector mode = Peak
   f. Trace = Max hold
   g. Sweep = auto
e) Measure the frequency different of these two adjacent channels with marker delta function & record the measurement results.
f) Repeat above procedure with other different mode of operation.

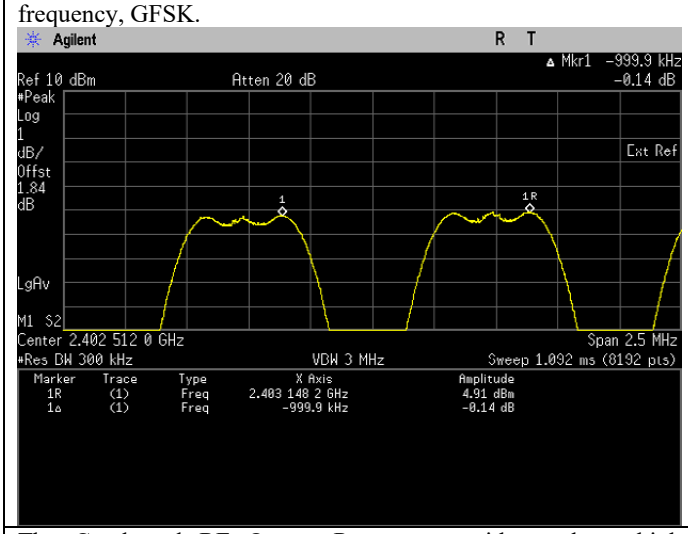
6.6.2. Test Limits:

Normal Condition (25 º C)
≥ 2/3 of 20dB Bandwidth

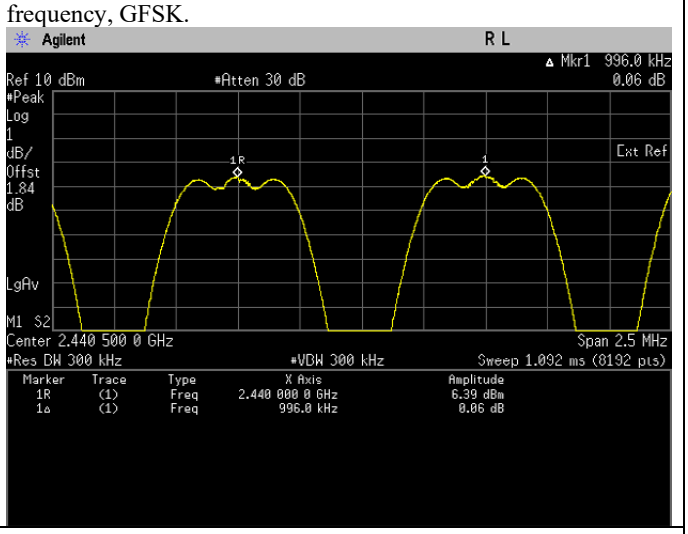
6.6.3. Test Result

Test Conditions			Results			
Modulation	Voltage(V)	Test Frequency (GHz)	Adjacent Channel Separation (MHz)	20dB Bandwidth (MHz)	2/3 of 20dB Bandwidth (kHz)	Status
GFSK	7.50	2.4020	0.999	0.938	625.107	Pass
		2.4410	0.996	0.937	624.801	Pass
		2.4800	0.984	0.938	625.222	Pass
Pi/4DQPSK	7.50	2.4020	1.023	1.281	853.960	Pass
		2.4410	0.999	1.280	853.192	Pass
		2.4800	0.993	1.278	852.227	Pass
8DPSK	7.50	2.4020	0.992	1.298	865.315	Pass
		2.4410	0.990	1.292	861.441	Pass
		2.4800	0.993	1.289	859.354	Pass

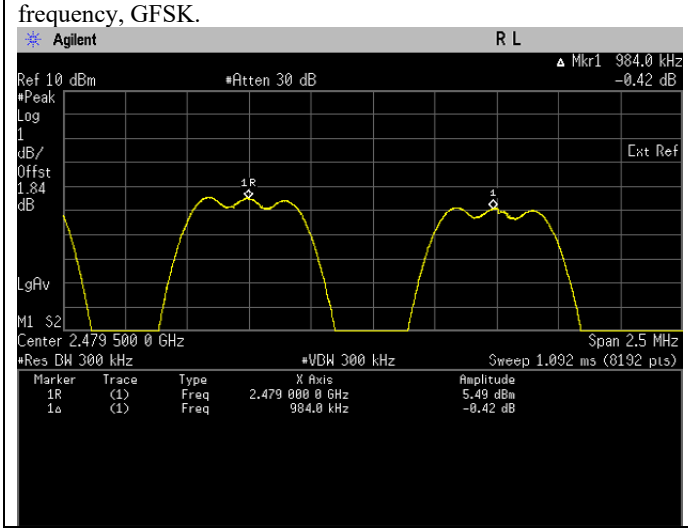
The Conducted RF Output Power test with result at low frequency, GFSK.



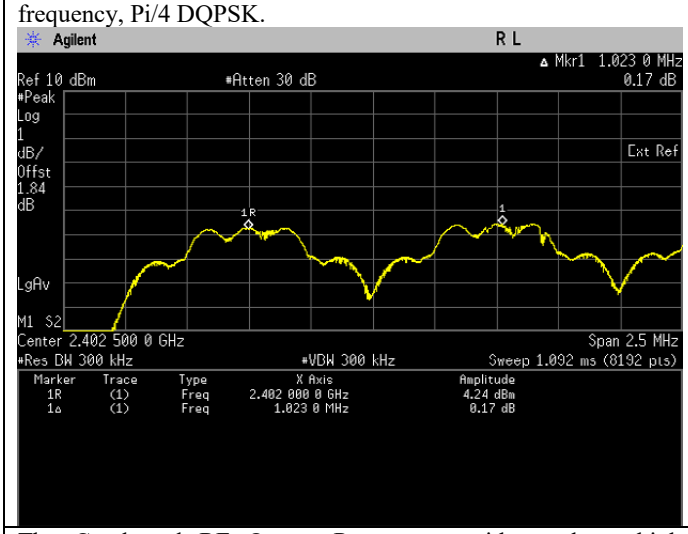
The Conducted RF Output Power test with result at mid frequency, GFSK.



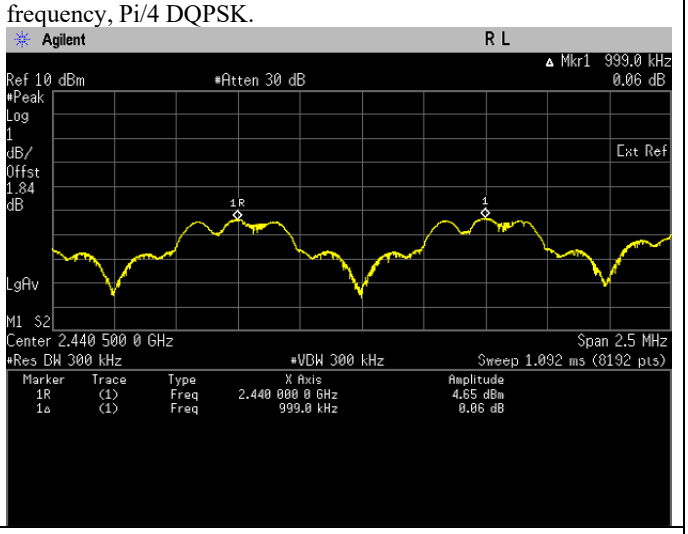
The Conducted RF Output Power test with result at high frequency, GFSK.



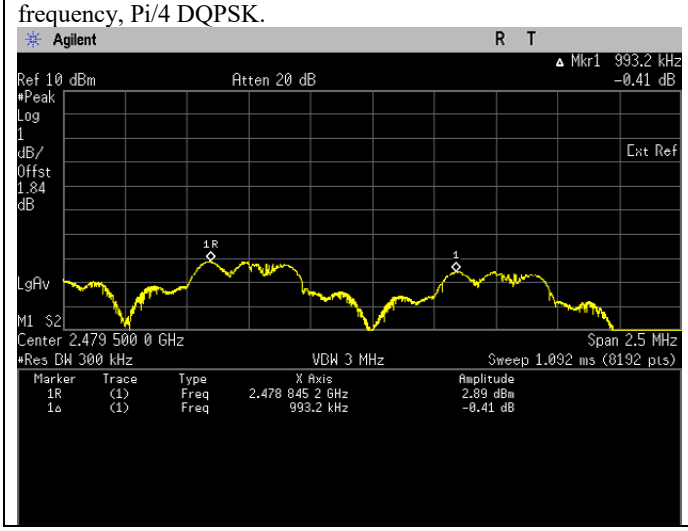
The Conducted RF Output Power test with result at low frequency, Pi/4 DQPSK.



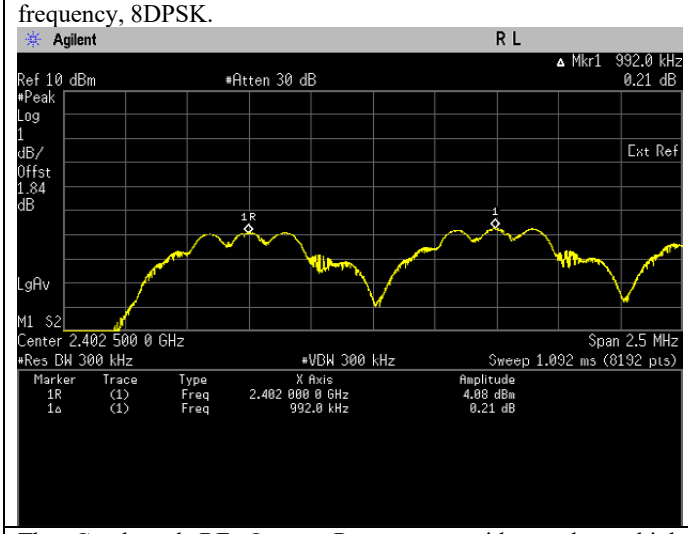
The Conducted RF Output Power test with result at mid frequency, Pi/4 DQPSK.



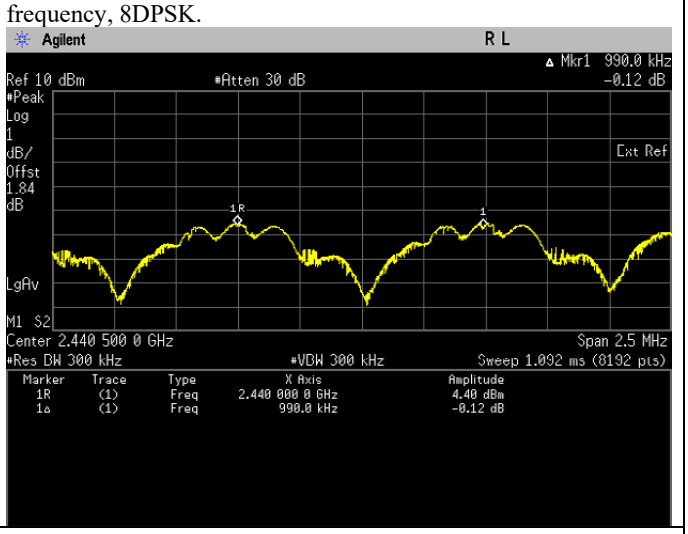
The Conducted RF Output Power test with result at high frequency, Pi/4 DQPSK.



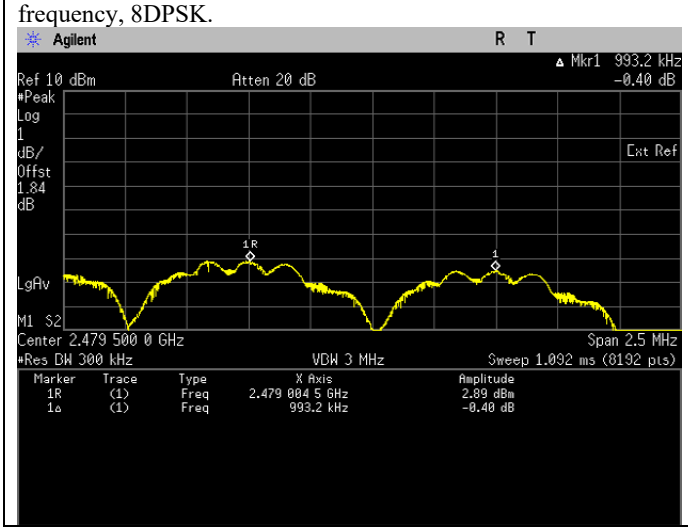
The Conducted RF Output Power test with result at low frequency, 8DPSK.



The Conducted RF Output Power test with result at mid frequency, 8DPSK.

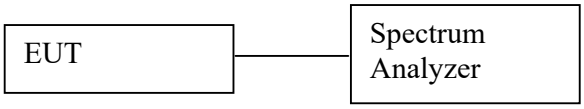


The Conducted RF Output Power test with result at high frequency, 8DPSK.



6.7. Conducted Spurious Emission

6.7.1. Test Setup



a) Check and ensure the spectrum analyzer well calibrate.
b) Turn on the EUT and set EUT to transmit maximum data rate with hopping disable.
c) Connect EUT's antenna terminal to spectrum analyzer with a low loss cable.
d) Setting of Spectrum analyzer :
   a. RBW = 100 kHz
   b. VBW = 300 kHz
   c. SPAN = Cover until 10th harmonic
   d. Detector mode = Peak
   e. AMPLITUDE → Scale/Div = 10 dB
   f. Trace = Max hold
   g. Sweep = auto
e) Measure the captured spurious emission result and recording the plot.
f) Repeat above procedure with other different mode of operation.

6.7.2. Test Limits:

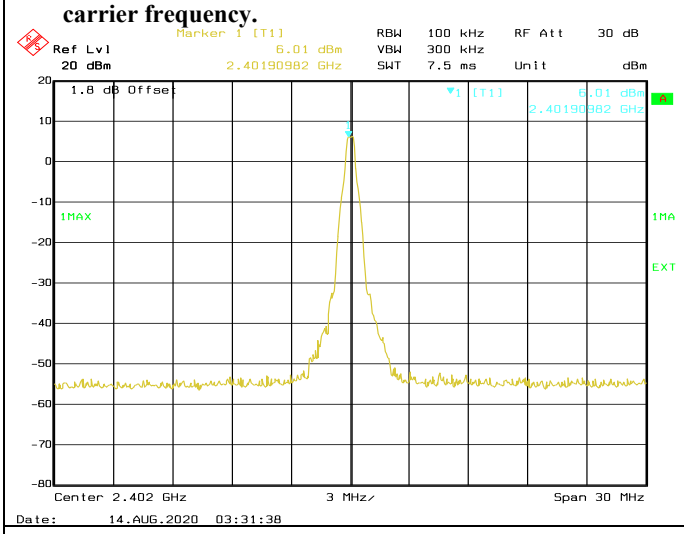
Normal Condition (25 º C)
Shall be at least 20 dB below for peak power.

6.7.3. Test Data:

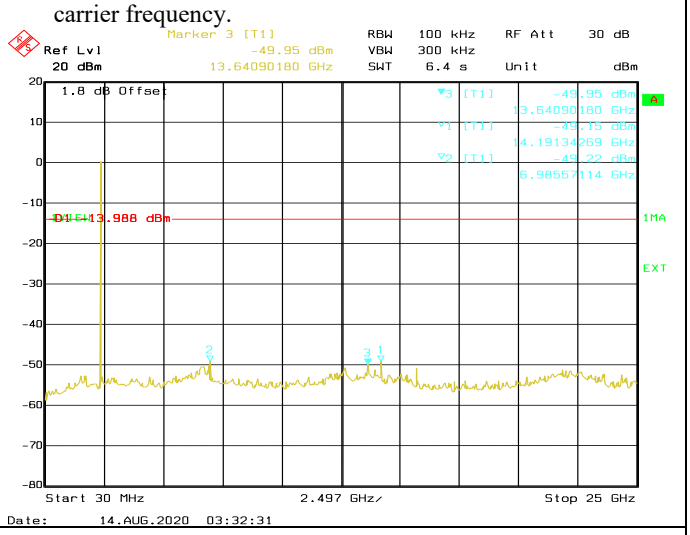
Test Conditions			Results		
Modulation	Voltage(V)	Test Frequency (GHz)	Spurs (MHz)	Level (dBm)	Status
GFSK	7.50	2.4020	14191.343	-49.151	Pass
		2.4410	14191.343	-48.960	Pass
		2.4800	14191.343	-48.802	Pass
Pi/4 DQPSK	7.50	2.4020	14191.343	-49.070	Pass
		2.4410	14191.343	-48.863	Pass
		2.4800	14191.343	-48.684	Pass
8DPSK	7.50	2.4020	14191.343	-49.627	Pass
		2.4410	14191.343	-49.251	Pass
		2.4800	14191.343	-48.871	Pass

GFSK Modulation:

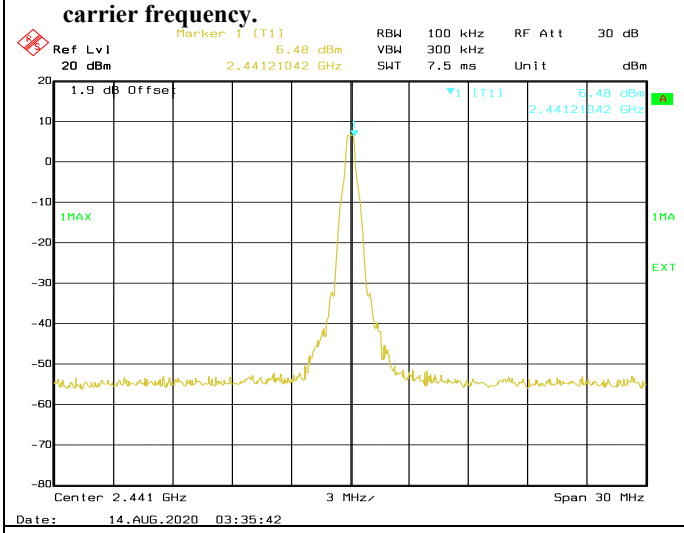
- **The high emission level within the assigned band at low carrier frequency.**



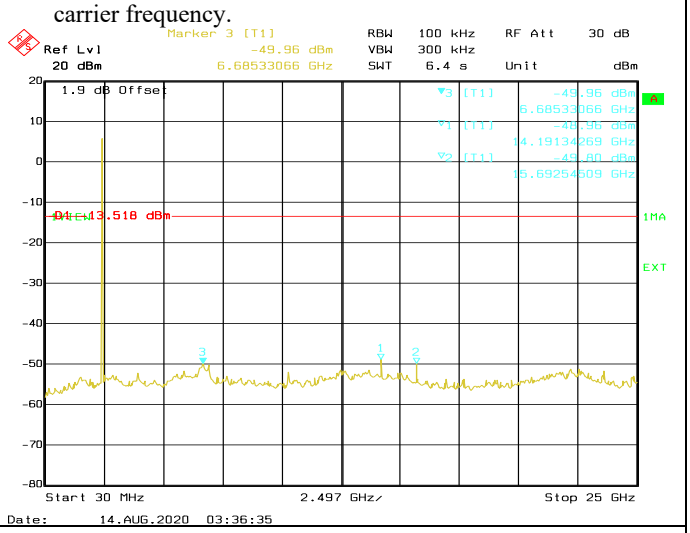
- Spurious emission measurement in **30MHz – 25GHz** at low carrier frequency.



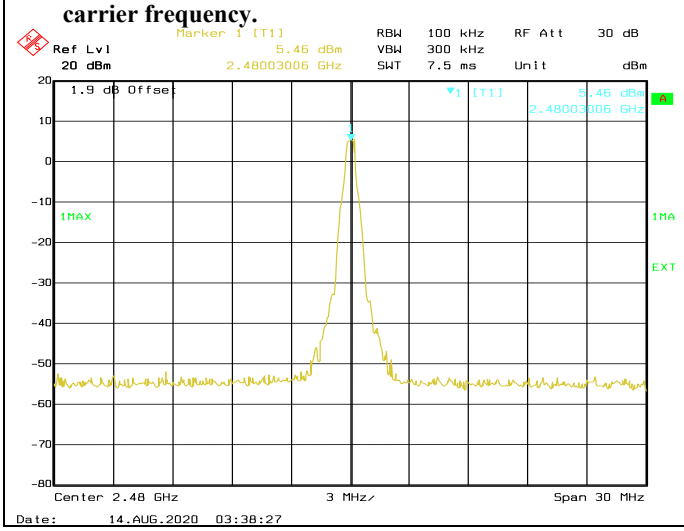
- **The high emission level within the assigned band at mid carrier frequency.**



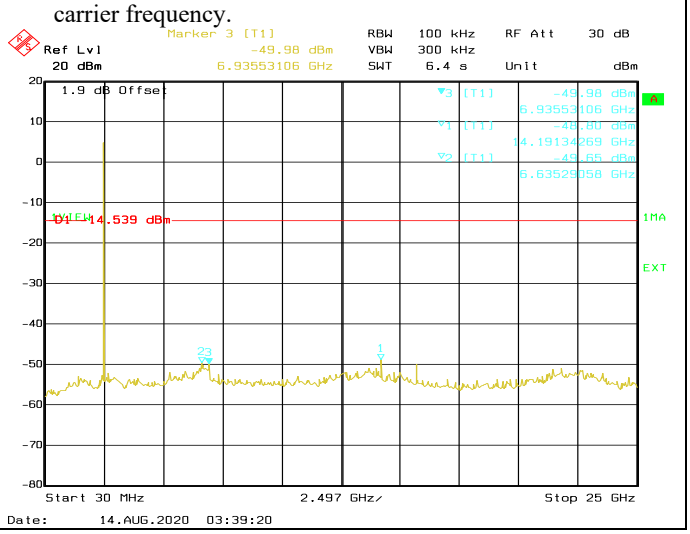
- Spurious emission measurement in **30MHz – 25GHz** at mid carrier frequency.



- **The high emission level within the assigned band at high carrier frequency.**

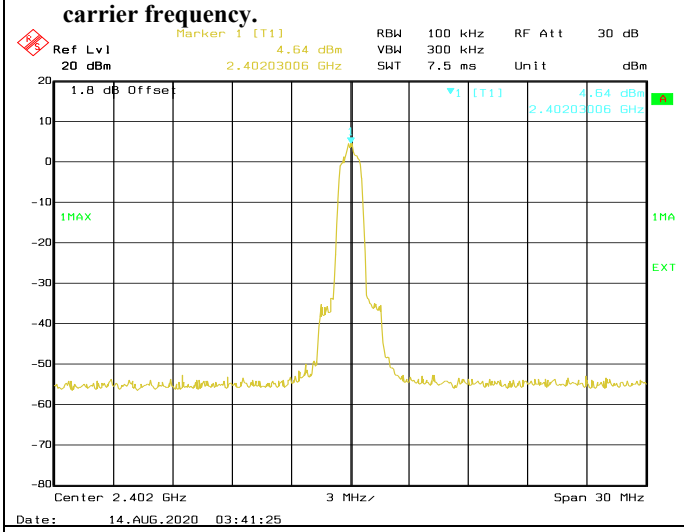


- Spurious emission measurement in **30MHz – 25GHz** at high carrier frequency.

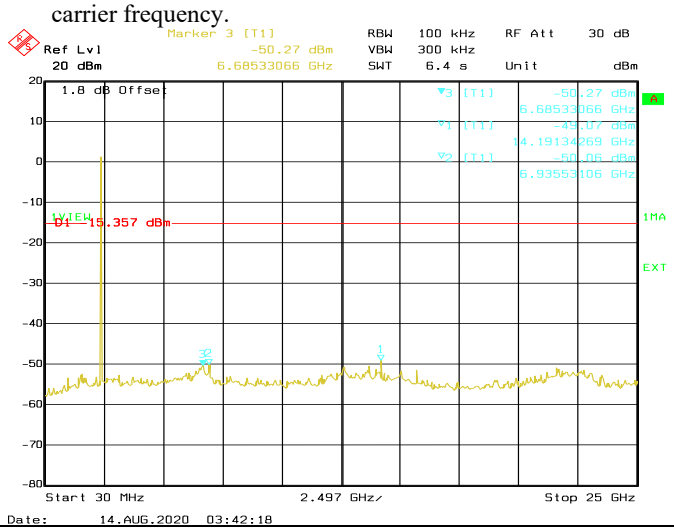


Pi/4 DQPSK Modulation:

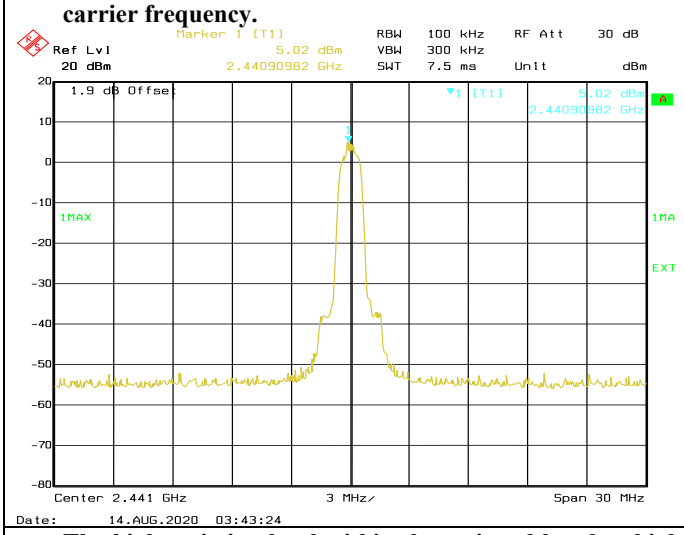
i. The high emission level within the assigned band at low carrier frequency.



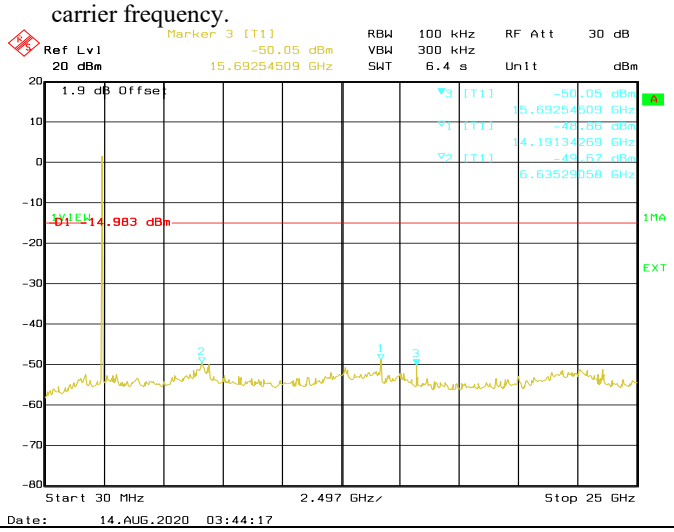
ii. Spurious emission measurement in **30MHz – 25GHz** at low carrier frequency.



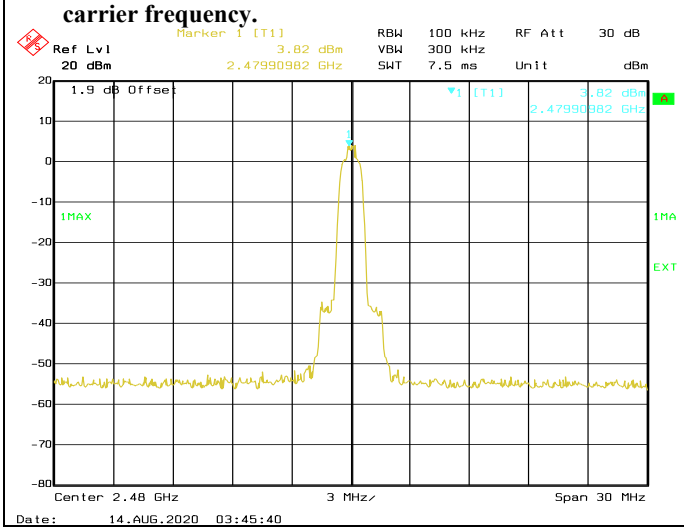
iii. The high emission level within the assigned band at mid carrier frequency.



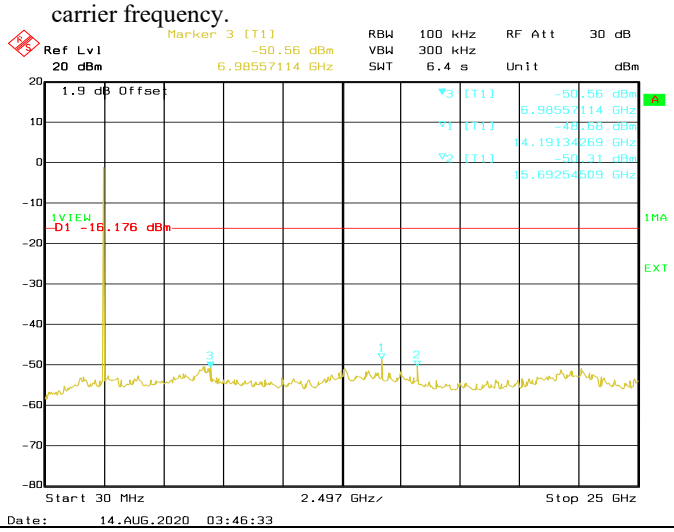
iv. Spurious emission measurement in **30MHz – 25GHz** at mid carrier frequency.



v. The high emission level within the assigned band at high carrier frequency.

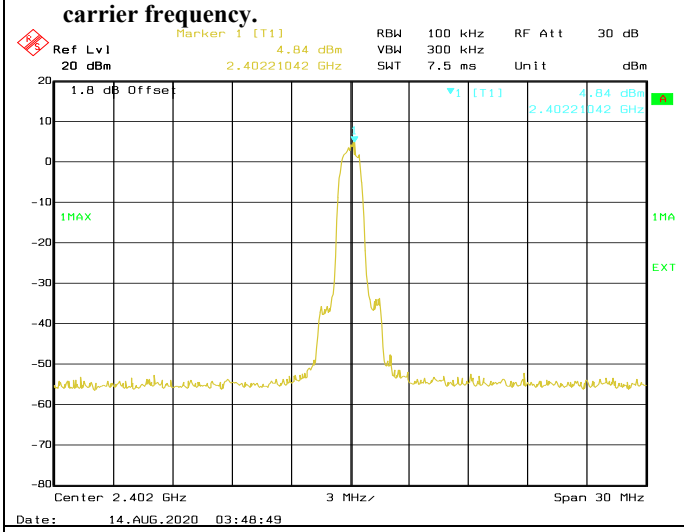


vi. Spurious emission measurement in **30MHz – 25GHz** at high carrier frequency.

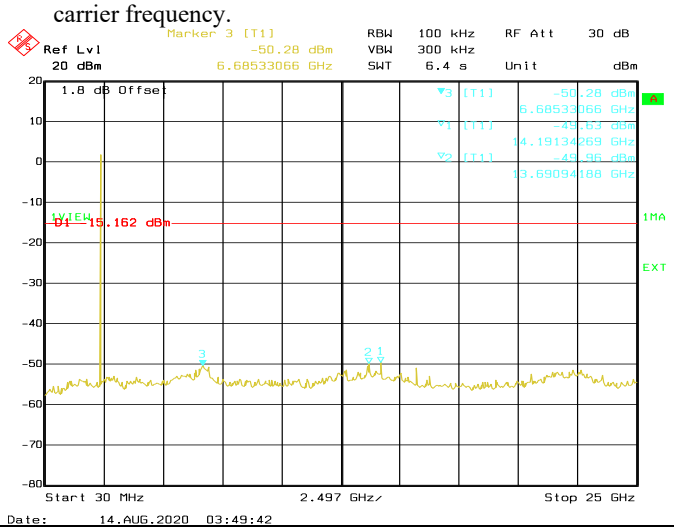


8DPSK Modulation:

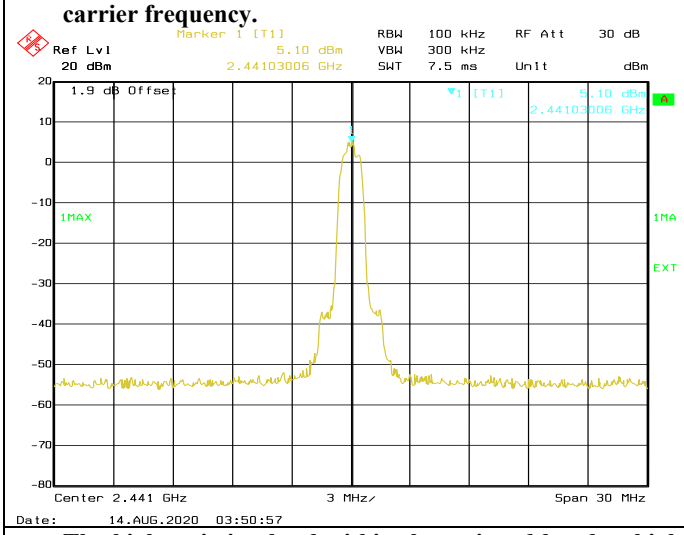
i. The high emission level within the assigned band at low carrier frequency.



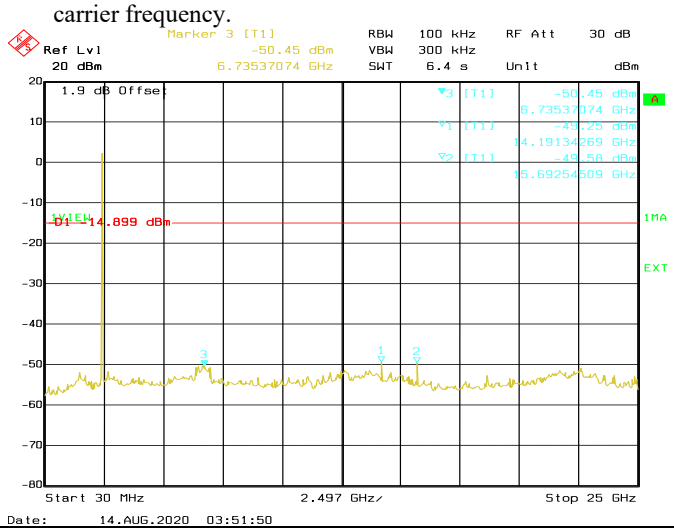
ii. Spurious emission measurement in **30MHz – 25GHz** at low carrier frequency.



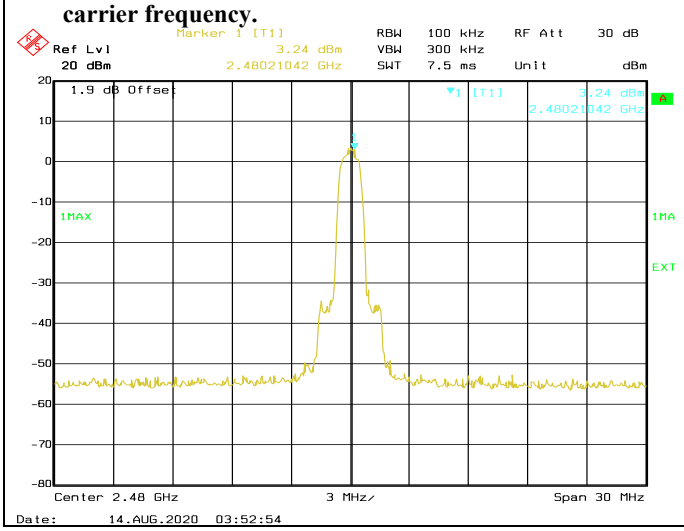
iii. The high emission level within the assigned band at mid carrier frequency.



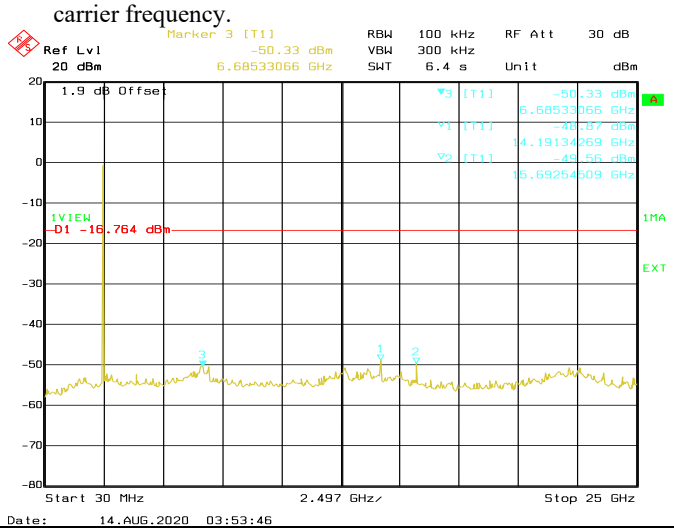
iv. Spurious emission measurement in **30MHz – 25GHz** at mid carrier frequency.



v. The high emission level within the assigned band at high carrier frequency.

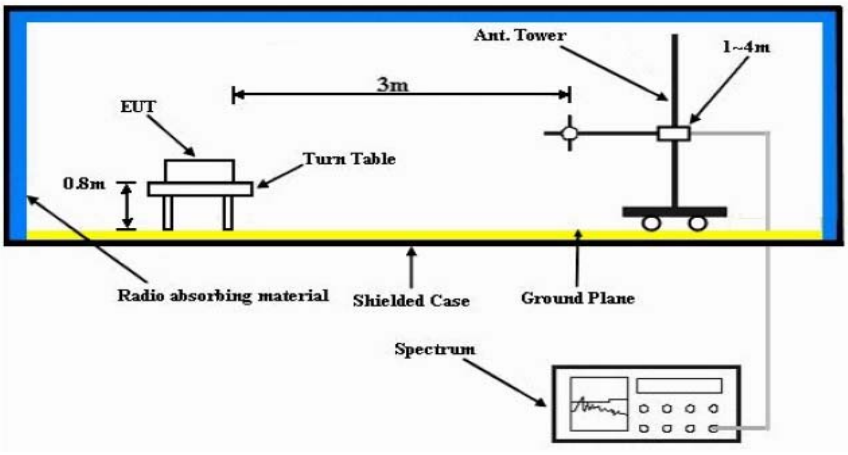


vi. Spurious emission measurement in **30MHz – 25GHz** at high carrier frequency.



6.8. Radiated Emission within restricted Bands

6.8.1. Test Setup



a. The EUT is placed on the top of a rotating table 0.8m (<1GHz) or 1.5m (>1GHz) above the ground at a 3m semi-anechoic chamber. The table is rotated 360 degrees to determine the position of the highest radiation.
b. The EUT is set 3m away from the interference-receiving antenna, which is mounted on the top of a variable-height antenna tower.
c. The antenna is Bilog/Horn antenna depend on which frequency range uses, and its height 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 is arranged to its worst case and then the antenna is tuned to heights from 1m to 4m and the rotatable table is turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system is set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. If the emission level of the EUT in peak mode is fall within the range of 10dB from the limit specified, the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. Otherwise, the testing could be stopped and the peak values of the EUT would be reported.

NOTE:

a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1GHz.
b. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3 MHz for Peak detection at frequency above 1 GHz.
c. All modes of operation were investigated and the worst-case emissions are reported.

6.8.2. Test Limits:

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power.

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
Above 960	500	3

NOTE:

a. The lower limit shall apply at the transition frequencies.
b. Emission level (dBuV/m) = 20 log Emission level (uV/m).
c. 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 20dB under any condition of modulation.

6.8.3. Test Data:

Test: Bluetooth SAC Transmitter Radiated Emission
Model#: AAH90ZDU9RH1AN S/N: 734TWP0311 EMC SR ID#: 18058-EMC-00037
Battery: PMNN4804A Accessory: AN000348A01
Test Channel: Low Test Frequency: 2402.0000 MHz Test Standard: ANSI C63.10-2013
Worst Case Plane: Z-Plane (GFSK)

Radiated Emission (Low Channel) tabular data

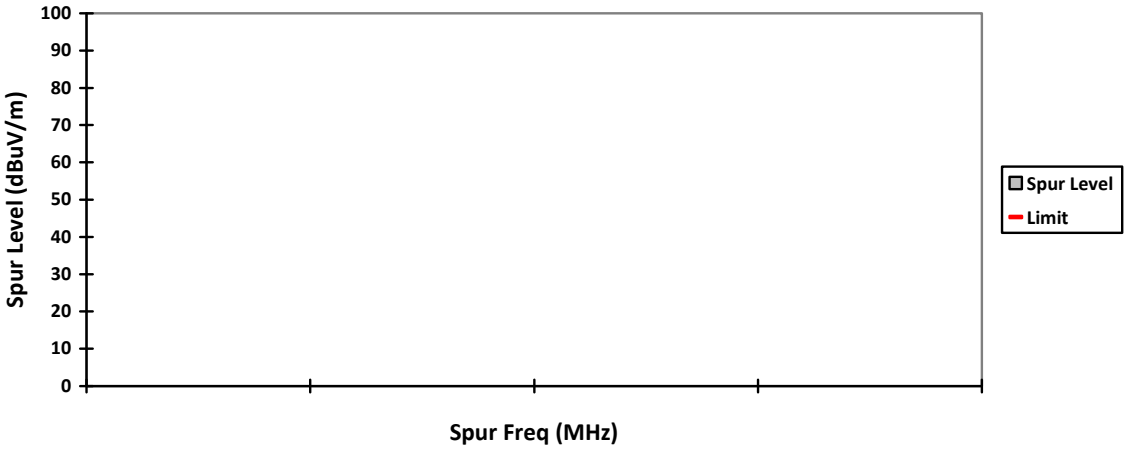
Vertical Radiated Emission Result										
Spur Freq (MHz)	Spur level QPK (dBµV/m)	Spur level PK (dBµV/m)	Spur level AV (dBµV/m)	Limit QPK (dBµV/m)	Limit PK (dBµV/m)	Limit AV (dBµV/m)	Margin QPK (dBµV/m)	Margin PK (dBµV/m)	Margin AV (dBµV/m)	Carrier PK Power (dBµV/m)
4804	-	40.9935**	**	-	74	54	-	33.01**	-	-
7206	-	46.2970**	**	-	74	54	-	27.70**	-	-
9608	-	49.2079**	**	-	74	54	-	24.79**	-	-
12010	-	50.9923**	**	-	74	54	-	23.01**	-	-
14412	-	53.8455**	**	-	74	54	-	20.15**	-	-
16814	-	56.3156**	**	-	74	54	-	17.68**	-	-
19216	-	34.8163**	**	-	74	54	-	39.18**	-	-
21618	-	35.1450**	**	-	74	54	-	38.85**	-	-
24020	-	35.2085**	**	-	74	54	-	38.79**	-	-
Horizontal Radiated Emission Result										
4804	-	41.3809**	**	-	74	54	-	32.62**	-	-
7206	-	46.6185**	**	-	74	54	-	27.38**	-	-
9608	-	49.6149**	**	-	74	54	-	24.39**	-	-
12010	-	50.3251**	**	-	74	54	-	23.67**	-	-
14412	-	53.9227**	**	-	74	54	-	20.08**	-	-
16814	-	56.6830**	**	-	74	54	-	17.32**	-	-
19216	-	34.2489**	**	-	74	54	-	39.75**	-	-
21618	-	33.7529**	**	-	74	54	-	40.25**	-	-
24020	-	35.6149**	**	-	74	54	-	38.39**	-	-

Remarks: Pass Result	Marginal Result	Fail Result

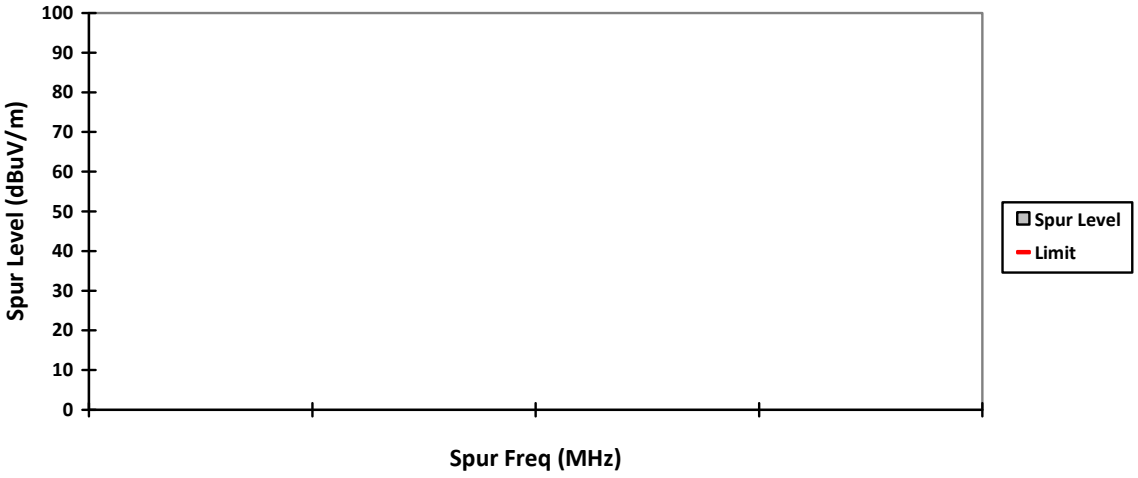
Temperature (degC): 24.5 **Humidity (%): 70.3**
Test Performed by: Nazrin&Fendi **Test Date: Fri, Aug 14, 2020**
System MU: 4.03dB

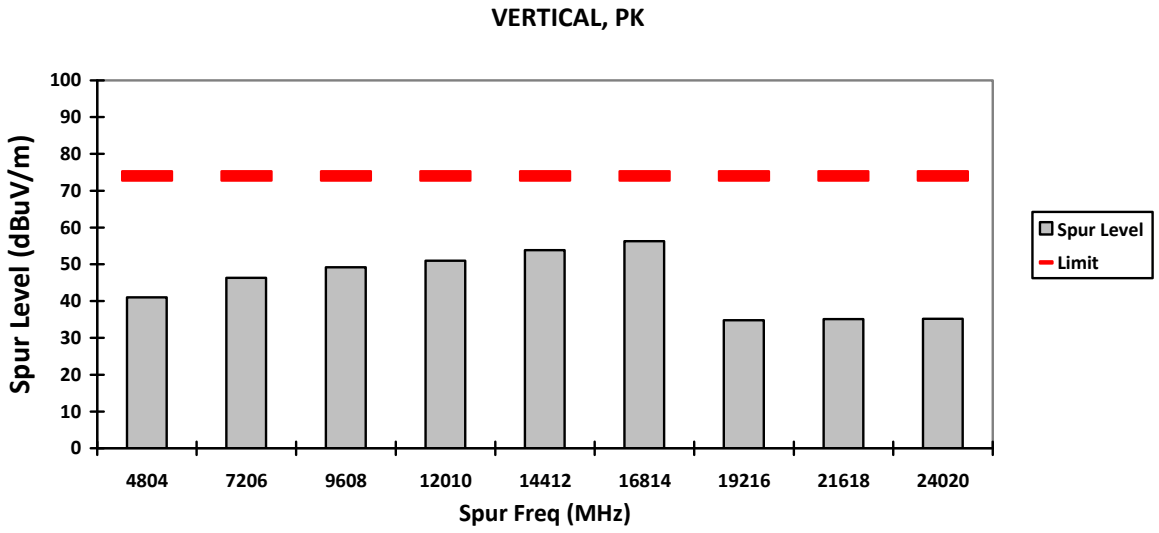
Remarks: ** Indicates the spurious emission could not be detected due to noise limitations or ambient.
***Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported.**

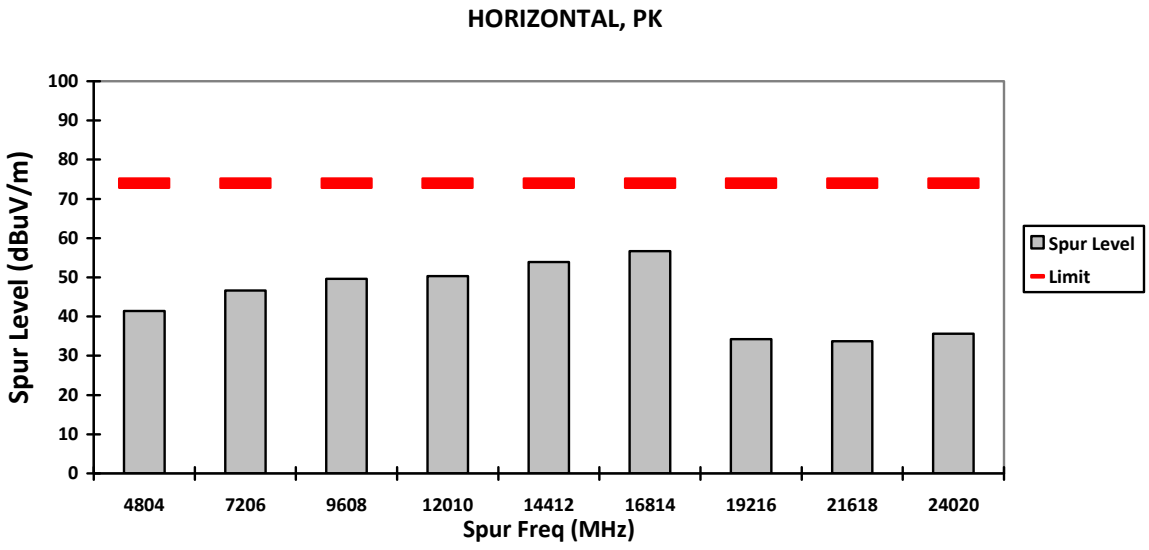
VERTICAL, QPK



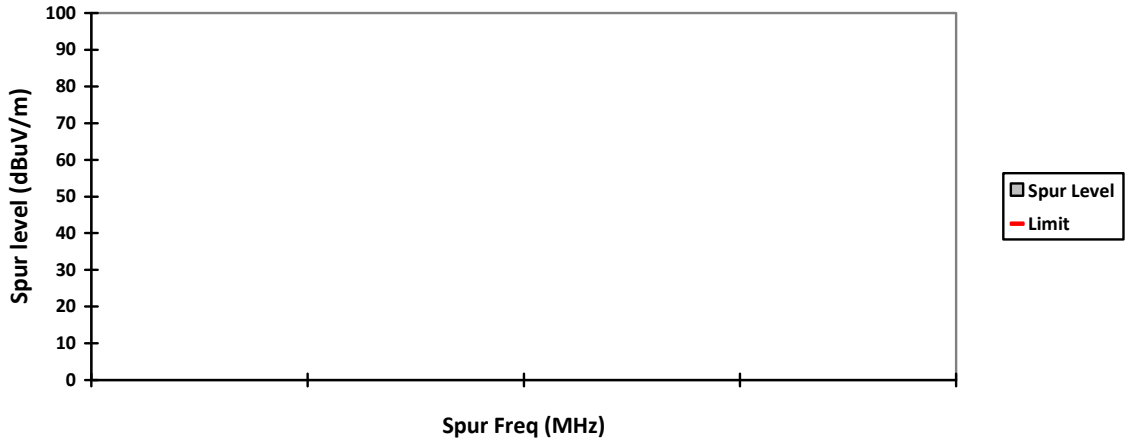
HORIZONTAL, QPK



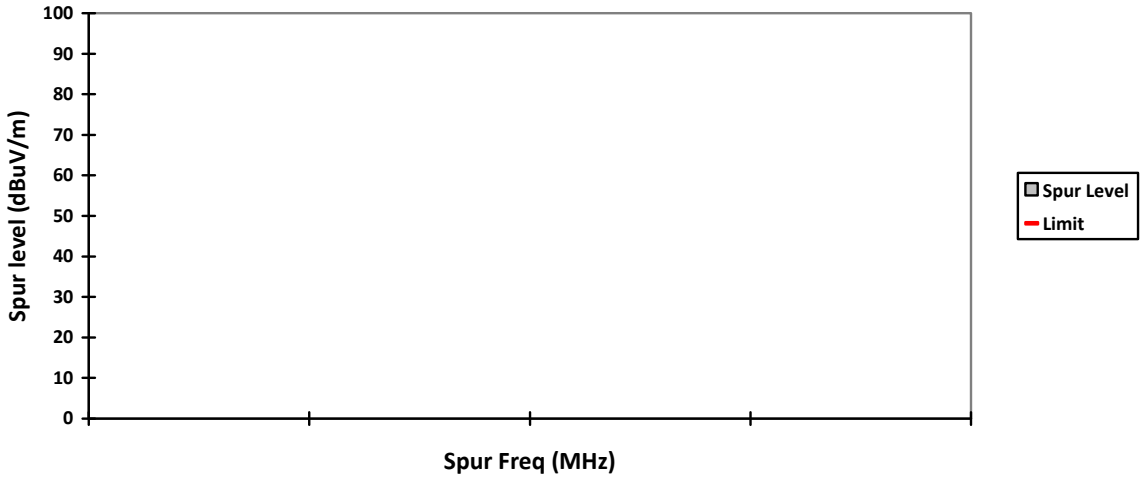

VERTICAL, PK
Spur Level (dBuV/m)
100
90
80
70
60
50
40
30
20
10
0
4804
7206
9608
12010
14412
16814
19216
21618
24020
Spur Freq (MHz)
Spur Level
Limit


HORIZONTAL, PK
Spur Level (dBuV/m)
100
90
80
70
60
50
40
30
20
10
0
4804
7206
9608
12010
14412
16814
19216
21618
24020
Spur Freq (MHz)
Spur Level
Limit

VERTICAL, AV



HORIZONTAL, AV



Test: Bluetooth SAC Transmitter Radiated Emission
Model#: AAH90ZDU9RH1AN S/N: 734TWP0311 EMC SR ID#: 18058-EMC-00037
Battery: PMNN4804A Accessory: AN000348A01
Test Channel: Mid Test Frequency: 2441.0000 MHz Test Standard: ANSI C63.10-2013
Worst Case Plane: Z-Plane (GFSK)

Radiated Emission (Mid Channel) tabular data

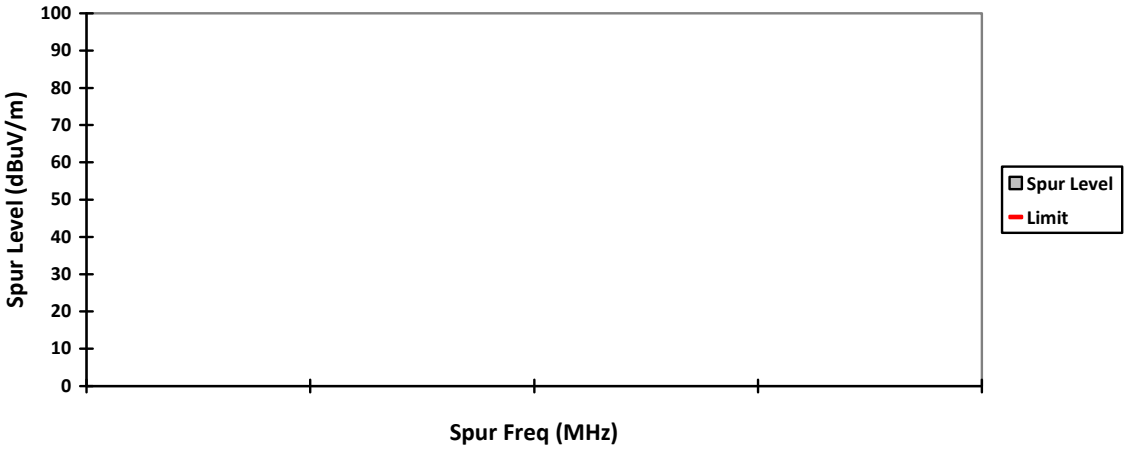
Vertical Radiated Emission Result										
Spur Freq (MHz)	Spur level QPK (dBµV/m)	Spur level PK (dBµV/m)	Spur level AV (dBµV/m)	Limit QPK (dBµV/m)	Limit PK (dBµV/m)	Limit AV (dBµV/m)	Margin QPK (dBµV/m)	Margin PK (dBµV/m)	Margin AV (dBµV/m)	Carrier PK Power (dBµV/m)
4882	-	40.9979**	**	-	74	54	-	33.00**	-	-
7323	-	45.5405**	**	-	74	54	-	28.46**	-	-
9764	-	49.2184**	**	-	74	54	-	24.78**	-	-
12205	-	52.9528**	**	-	74	54	-	21.05**	-	-
14646	-	55.1650**	**	-	74	54	-	18.84**	-	-
17087	-	56.0296**	**	-	74	54	-	17.97**	-	-
19528	-	33.5357**	**	-	74	54	-	40.46**	-	-
21969	-	34.9914**	**	-	74	54	-	39.01**	-	-
24410	-	35.4895**	**	-	74	54	-	38.51**	-	-
Horizontal Radiated Emission Result										
4882	-	40.7511**	**	-	74	54	-	33.25**	-	-
7323	-	46.1918**	**	-	74	54	-	27.81**	-	-
9764	-	49.9184**	**	-	74	54	-	24.08**	-	-
12205	-	52.5672**	**	-	74	54	-	21.43**	-	-
14646	-	55.1149**	**	-	74	54	-	18.89**	-	-
17087	-	55.1681**	**	-	74	54	-	18.83**	-	-
19528	-	33.6938**	**	-	74	54	-	40.31**	-	-
21969	-	35.3501**	**	-	74	54	-	38.65**	-	-
24410	-	35.2901**	**	-	74	54	-	38.71**	-	-

Remarks: Pass Result	Marginal Result	Fail Result

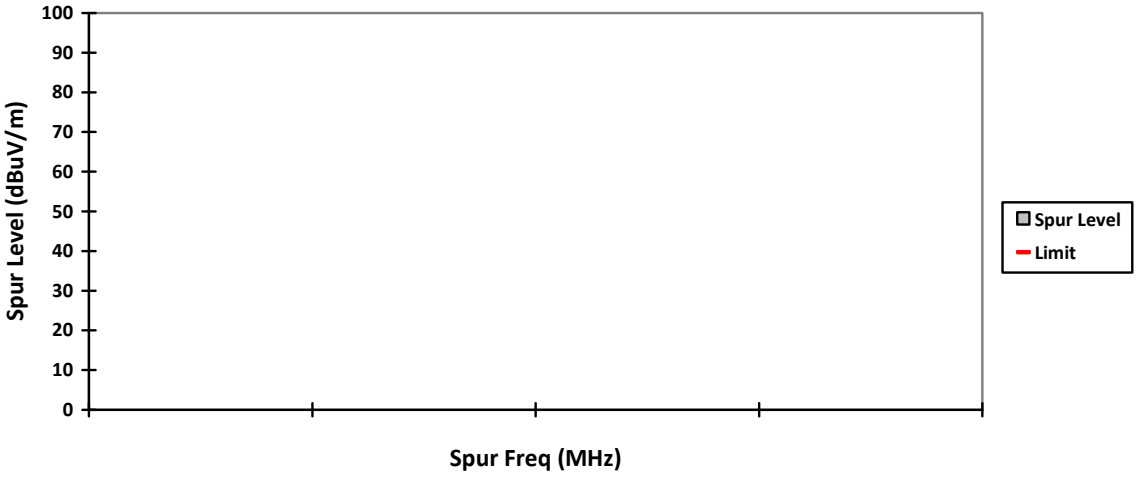
Temperature (degC): 24.5 **Humidity (%): 70.3**
Test Performed by: Nazrin&Fendi **Test Date: Fri, Aug 14, 2020**
System MU: 4.03dB

Remarks: ** Indicates the spurious emission could not be detected due to noise limitations or ambient.
***Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported.**

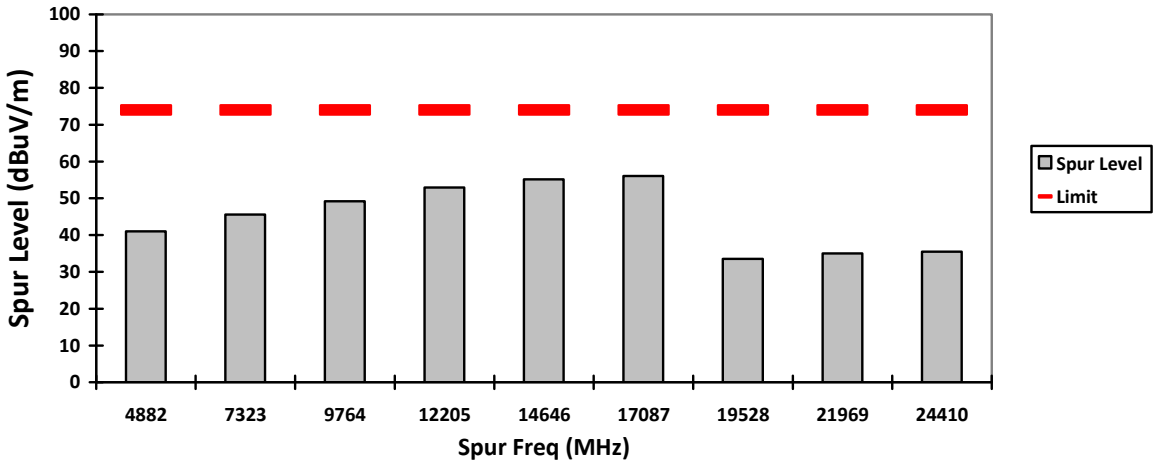
VERTICAL, QPK



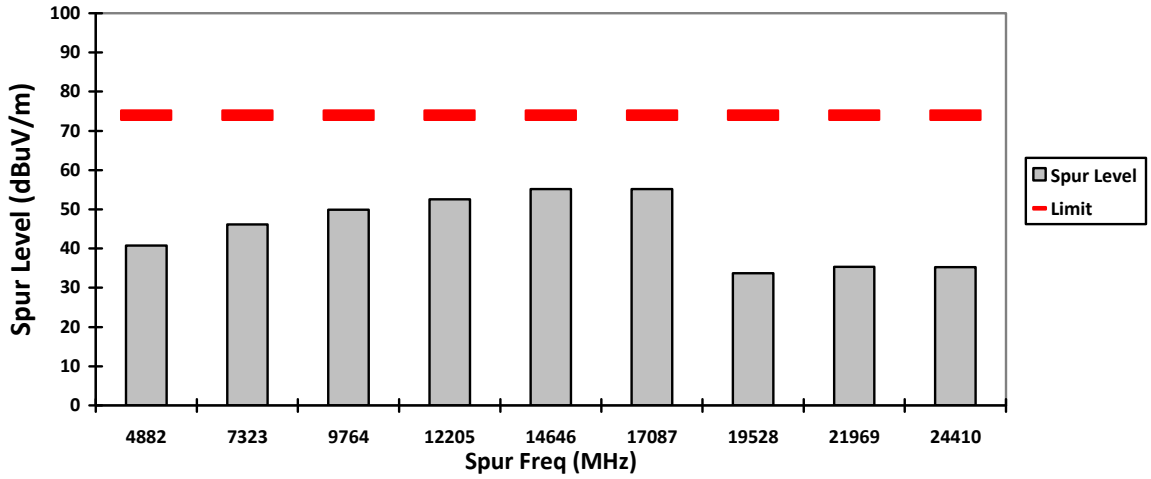
HORIZONTAL, QPK



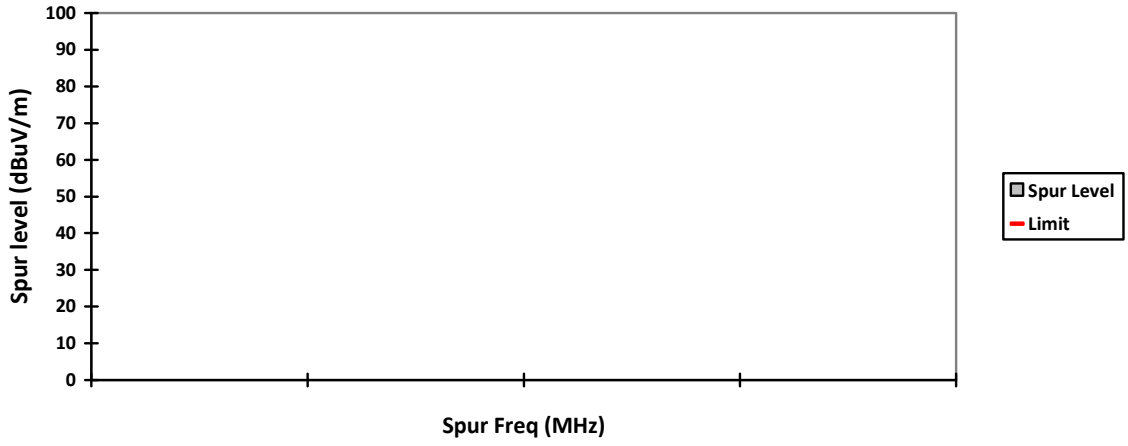
VERTICAL, PK



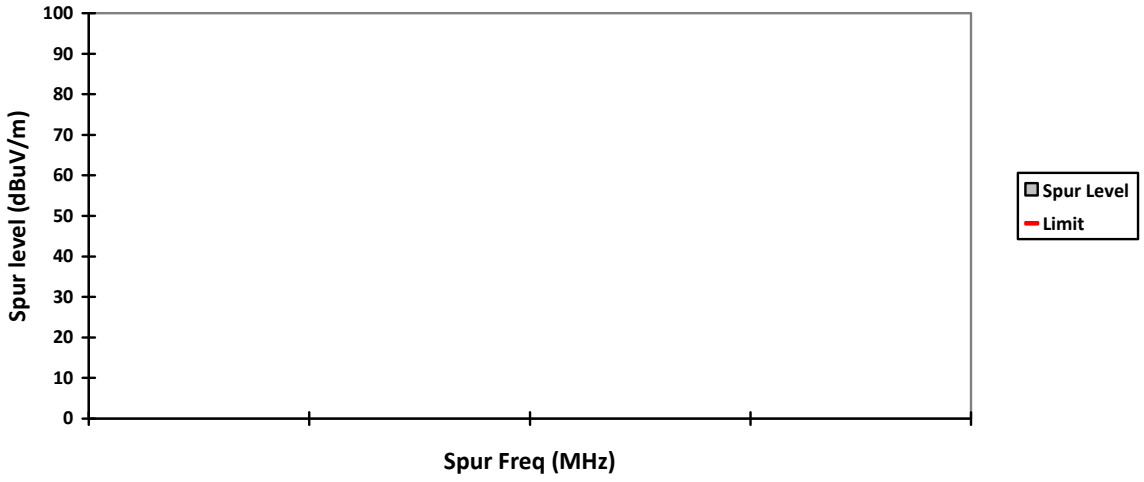
HORIZONTAL, PK



VERTICAL, AV



HORIZONTAL, AV



Test: Bluetooth SAC Transmitter Radiated Emission
Model#: AAH90ZDU9RH1AN S/N: 734TWP0311 EMC SR ID#: 18058-EMC-00037
Battery: PMNN4804A Accessory: AN000348A01
Test Channel: High Test Frequency: 2480.0000 MHz Test Standard: ANSI C63.10-2013
Worst Case Plane: Z-Plane (GFSK)

Radiated Emission (High Channel) tabular data

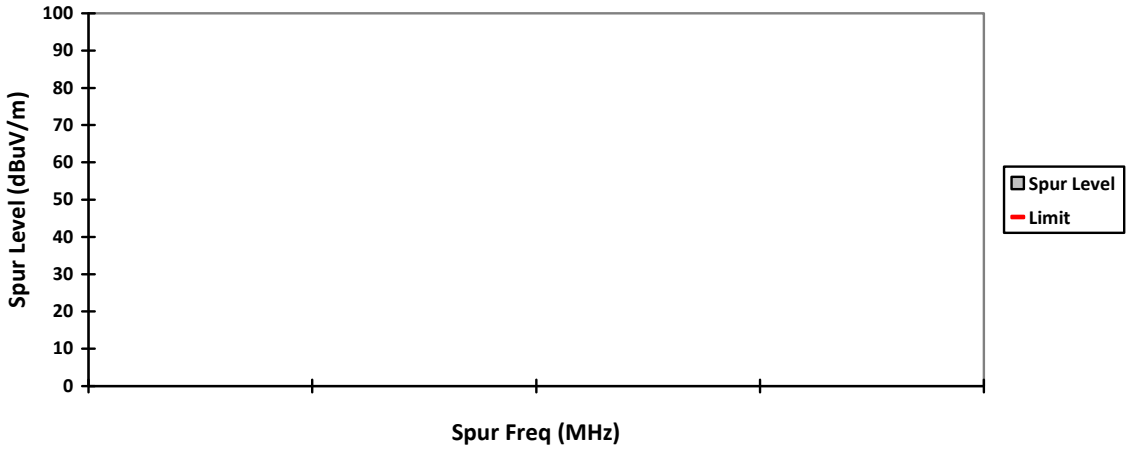
Vertical Radiated Emission Result										
Spur Freq (MHz)	Spur level QPK (dBµV/m)	Spur level PK (dBµV/m)	Spur level AV (dBµV/m)	Limit QPK (dBµV/m)	Limit PK (dBµV/m)	Limit AV (dBµV/m)	Margin QPK (dBµV/m)	Margin PK (dBµV/m)	Margin AV (dBµV/m)	Carrier PK Power (dBµV/m)
4960	-	41.0172**	**	-	74	54	-	32.98**	-	-
7440	-	46.5201**	**	-	74	54	-	27.48**	-	-
9920	-	50.1000**	**	-	74	54	-	23.90**	-	-
12400	-	51.7550**	**	-	74	54	-	22.24**	-	-
14880	-	54.1108**	**	-	74	54	-	19.89**	-	-
17360	-	55.3192**	**	-	74	54	-	18.68**	-	-
19840	-	33.9659**	**	-	74	54	-	40.03**	-	-
22320	-	34.4227**	**	-	74	54	-	39.58**	-	-
24800	-	35.8123**	**	-	74	54	-	38.19**	-	-
Horizontal Radiated Emission Result										
4960	-	40.4283**	**	-	74	54	-	33.57**	-	-
7440	-	47.1532**	**	-	74	54	-	26.85**	-	-
9920	-	49.4721**	**	-	74	54	-	24.53**	-	-
12400	-	51.6346**	**	-	74	54	-	22.37**	-	-
14880	-	54.0351**	**	-	74	54	-	19.96**	-	-
17360	-	55.7802**	**	-	74	54	-	18.22**	-	-
19840	-	33.8881**	**	-	74	54	-	40.11**	-	-
22320	-	34.4763**	**	-	74	54	-	39.52**	-	-
24800	-	36.1640**	**	-	74	54	-	37.84**	-	-

Remarks: Pass Result	Marginal Result	Fail Result

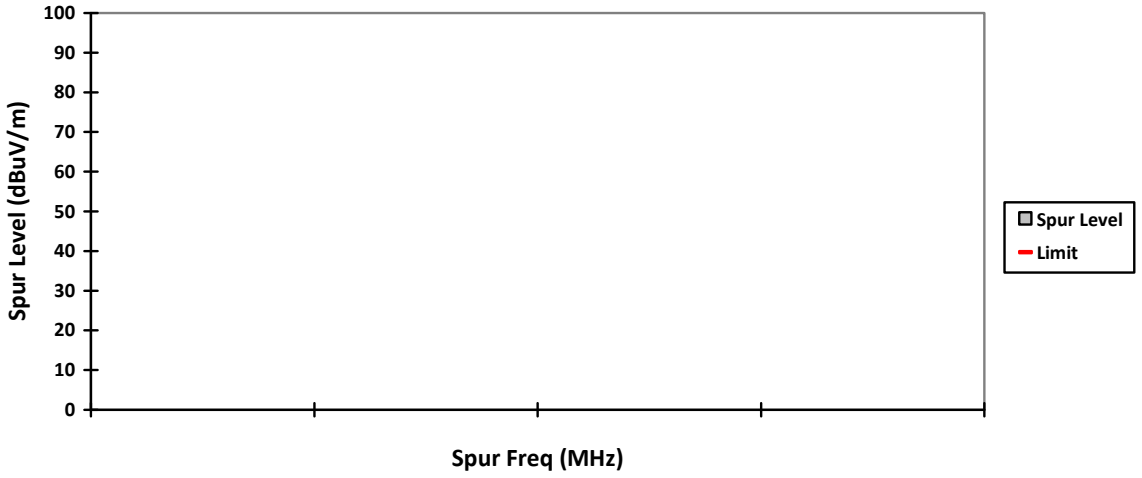
Temperature (degC): 24.5 **Humidity (%): 70.3**
Test Performed by: Nazrin&Fendi **Test Date: Fri, Aug 14, 2020**
System MU: 4.03dB

Remarks: ** Indicates the spurious emission could not be detected due to noise limitations or ambient.
***Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported.**

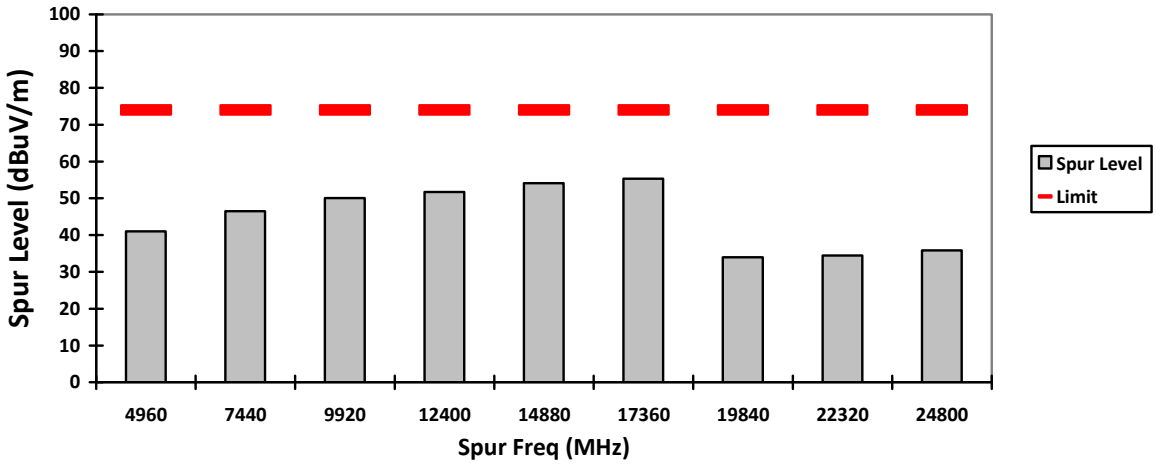
VERTICAL, QPK



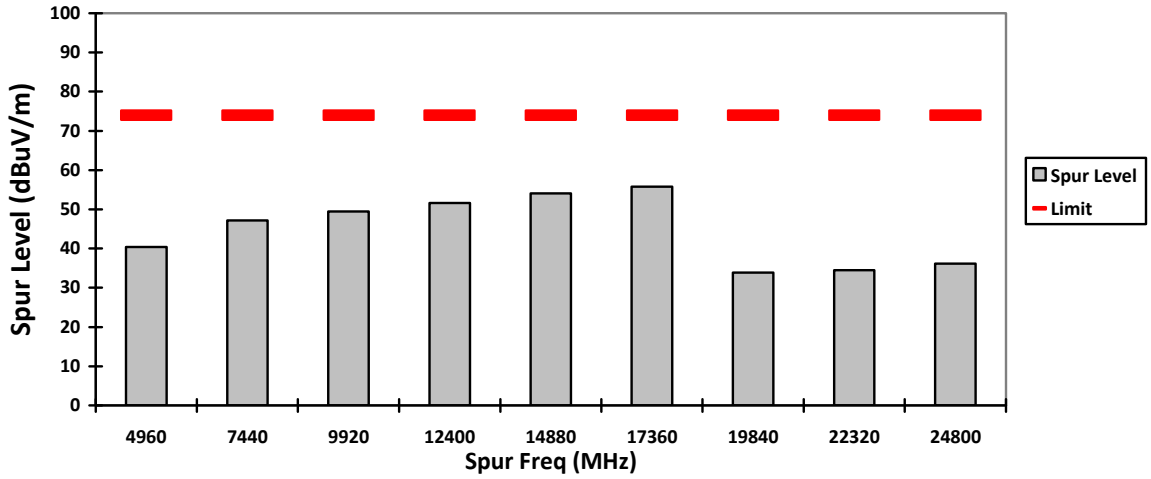
HORIZONTAL, QPK



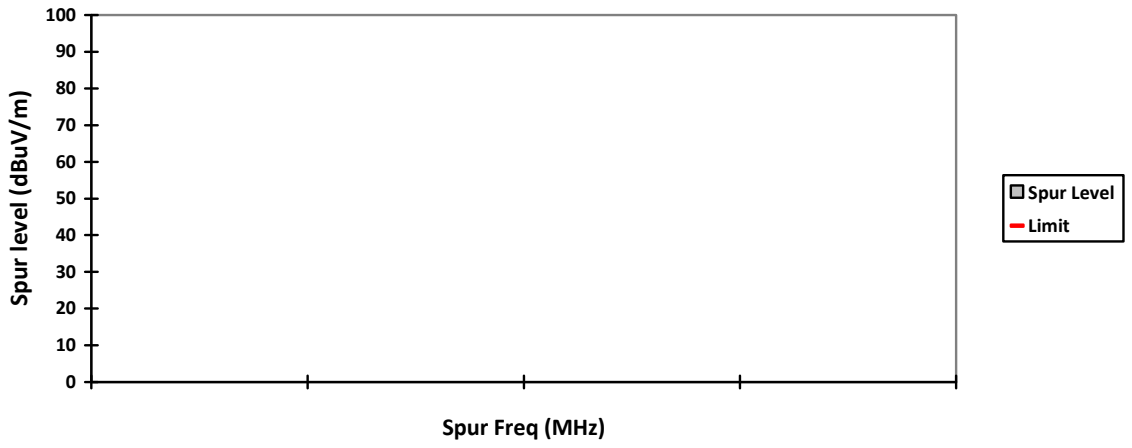
VERTICAL, PK



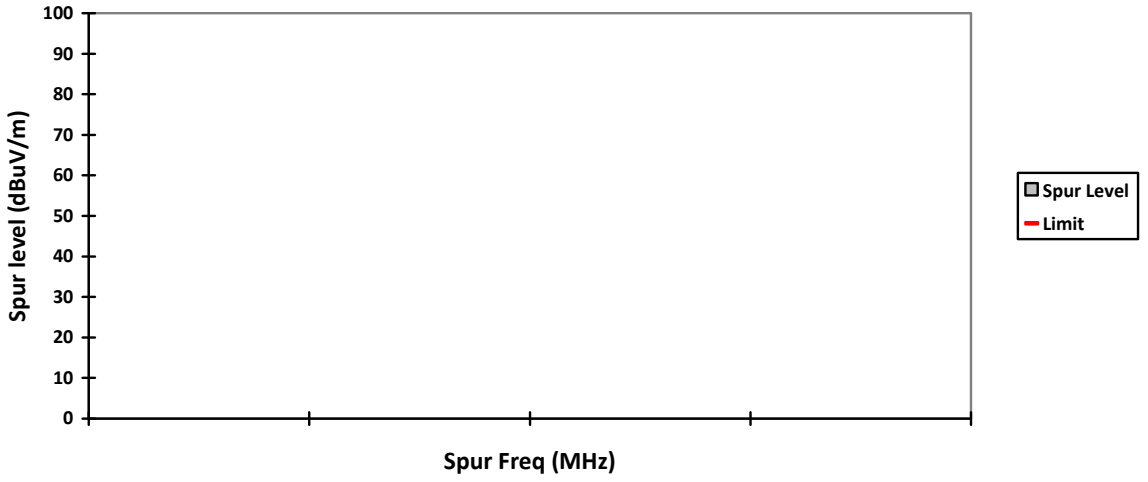
HORIZONTAL, PK



VERTICAL, AV



HORIZONTAL, AV



NOTE:
Transmitter Duty Cycle Calculation, FCC Rule 15.35 (b,c)

Based on the Bluetooth Specification Version 2.1+EDR, and worst case AFH mode, transmitter ON time is independent of packet type (DH1, DH3 and DH5) and packet length, the AFH mode Duty cycle connection factor as below:

Channel hop rate = 800 hops/second (AFH Mode)
Adjusted channel hop rate for DH5 mode = 133.33 hops/second
Time per channel hop = 1 / 133.33 hops/second = 7.5 ms
Time to cycle through all channels = 7.5 x 20 channels = 150 ms
Number of times transmitter hits on one channel = 100 ms / 150 ms = 1 time(s)
Worst case dwell time = 7.5 ms
Duty cycle connection factor = $20\log_{10}$ (7.5ms / 100ms) = **-22.5 dB**

Test: Bluetooth SAC Transmitter Radiated Emission
Model#: AAH90ZDU9RH1AN S/N: 734TWP0311 EMC SR ID#: 18058-EMC-00037
Battery: PMNN4804A Accessory: AN000348A01
Test Channel: Low Test Frequency: 2402.0000 MHz Test Standard: ANSI C63.10-2013
Worst Case Plane: Z-Plane (DQPSK)

Radiated Emission (Low Channel) tabular data

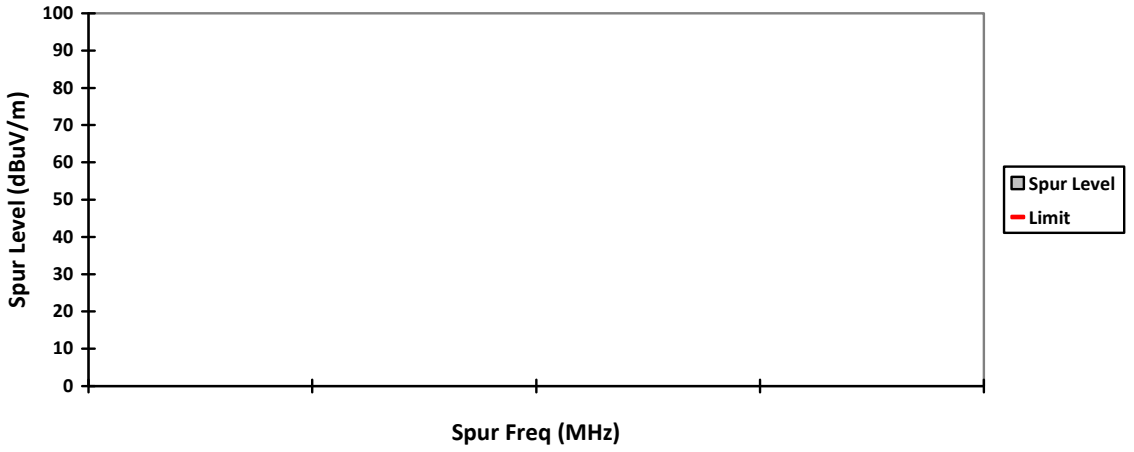
Vertical Radiated Emission Result										
Spur Freq (MHz)	Spur level QPK (dBµV/m)	Spur level PK (dBµV/m)	Spur level AV (dBµV/m)	Limit QPK (dBµV/m)	Limit PK (dBµV/m)	Limit AV (dBµV/m)	Margin QPK (dBµV/m)	Margin PK (dBµV/m)	Margin AV (dBµV/m)	Carrier PK Power (dBµV/m)
4804	-	41.2529**	**	-	74	54	-	32.75**	-	-
7206	-	45.7558**	**	-	74	54	-	28.24**	-	-
9608	-	50.0148**	**	-	74	54	-	23.99**	-	-
12010	-	51.4373**	**	-	74	54	-	22.56**	-	-
14412	-	53.3590**	**	-	74	54	-	20.64**	-	-
16814	-	56.0039**	**	-	74	54	-	18.00**	-	-
19216	-	34.0350**	**	-	74	54	-	39.97**	-	-
21618	-	34.3717**	**	-	74	54	-	39.63**	-	-
24020	-	35.6887**	**	-	74	54	-	38.31**	-	-
Horizontal Radiated Emission Result										
4804	-	41.7348**	**	-	74	54	-	32.27**	-	-
7206	-	47.1539**	**	-	74	54	-	26.85**	-	-
9608	-	49.0679**	**	-	74	54	-	24.93**	-	-
12010	-	51.6460**	**	-	74	54	-	22.35**	-	-
14412	-	54.0660**	**	-	74	54	-	19.93**	-	-
16814	-	55.6951**	**	-	74	54	-	18.30**	-	-
19216	-	33.9747**	**	-	74	54	-	40.03**	-	-
21618	-	34.2641**	**	-	74	54	-	39.74**	-	-
24020	-	34.9894**	**	-	74	54	-	39.01**	-	-

Remarks: Pass Result	Marginal Result	Fail Result

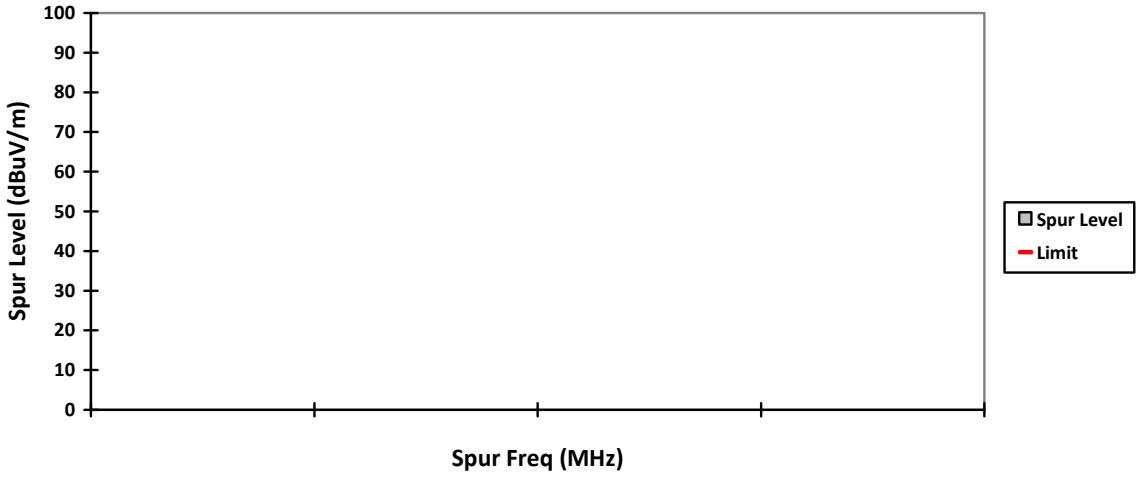
Temperature (degC): 24.5 **Humidity (%): 70.3**
Test Performed by: Nazrin&Fendi **Test Date: Fri, Aug 14, 2020**
System MU: 4.03dB

Remarks: ** Indicates the spurious emission could not be detected due to noise limitations or ambient.
***Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported.**

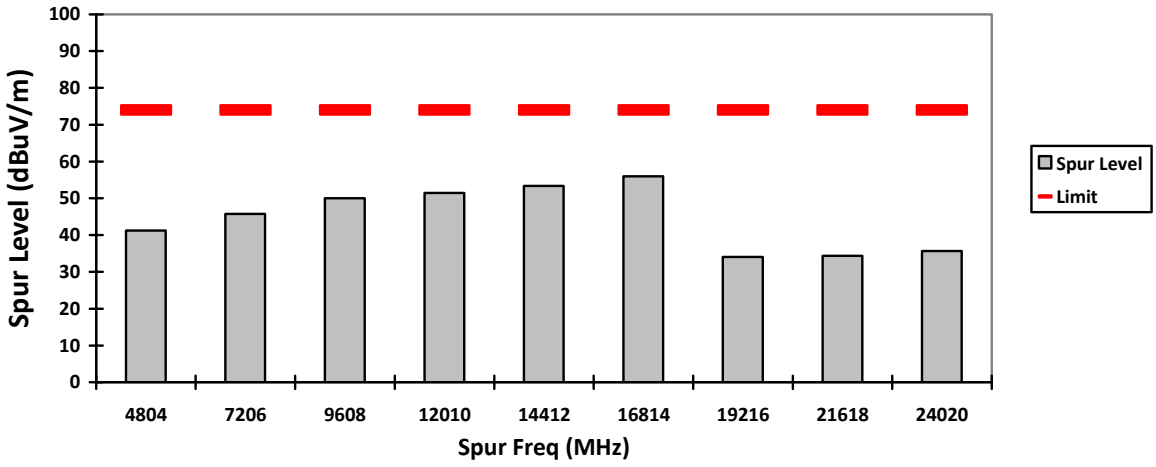
VERTICAL, QPK



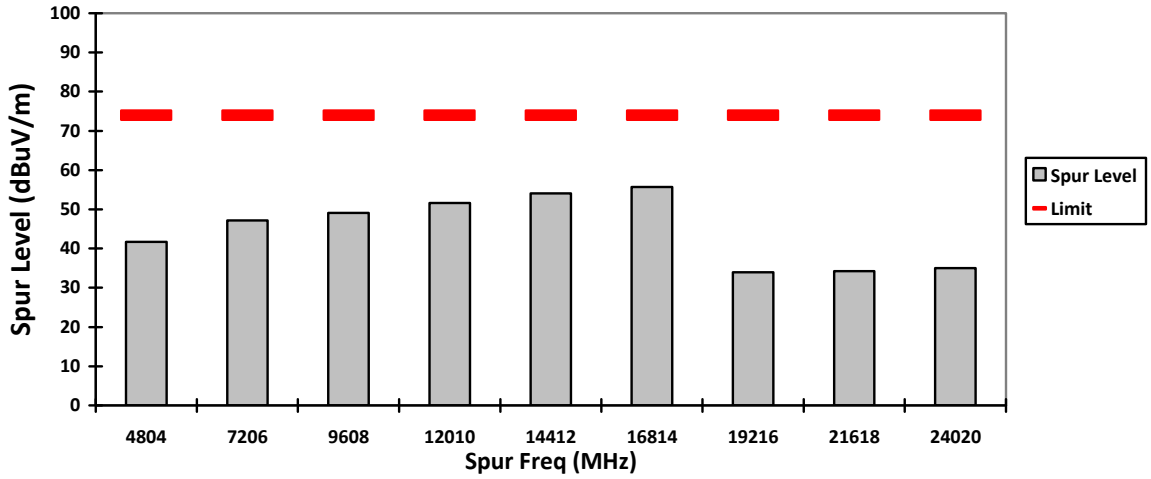
HORIZONTAL, QPK



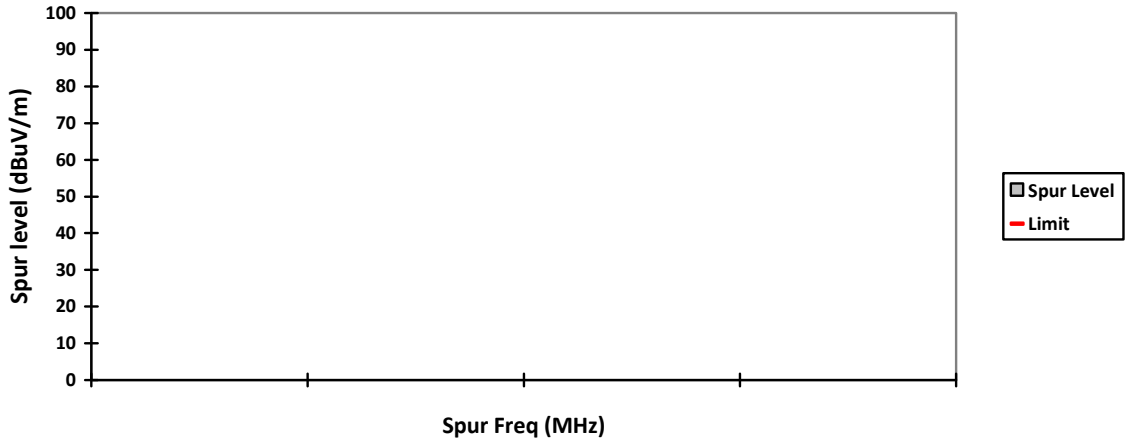
VERTICAL, PK



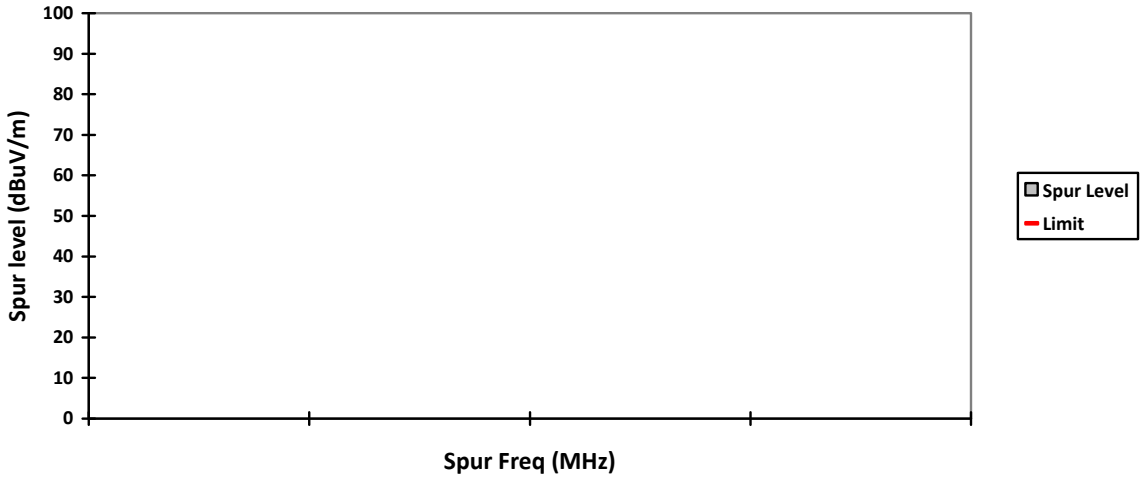
HORIZONTAL, PK



VERTICAL, AV



HORIZONTAL, AV



Test: Bluetooth SAC Transmitter Radiated Emission
Model#: AAH90ZDU9RH1AN S/N: 734TWP0311 EMC SR ID#: 18058-EMC-00037
Battery: PMNN4804A Accessory: AN000348A01
Test Channel: Mid Test Frequency: 2441.0000 MHz Test Standard: ANSI C63.10-2013
Worst Case Plane: Z-Plane (DQPSK)

Radiated Emission (Mid Channel) tabular data

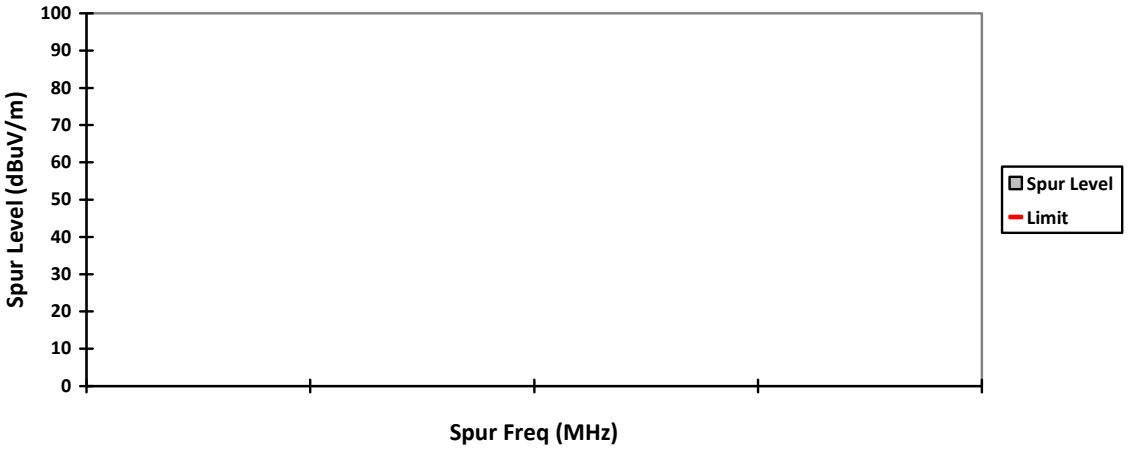
Vertical Radiated Emission Result										
Spur Freq (MHz)	Spur level QPK (dBµV/m)	Spur level PK (dBµV/m)	Spur level AV (dBµV/m)	Limit QPK (dBµV/m)	Limit PK (dBµV/m)	Limit AV (dBµV/m)	Margin QPK (dBµV/m)	Margin PK (dBµV/m)	Margin AV (dBµV/m)	Carrier PK Power (dBµV/m)
4882	-	41.8156**	**	-	74	54	-	32.18**	-	-
7323	-	45.7944**	**	-	74	54	-	28.21**	-	-
9764	-	49.9243**	**	-	74	54	-	24.08**	-	-
12205	-	51.7038**	**	-	74	54	-	22.30**	-	-
14646	-	54.4169**	**	-	74	54	-	19.58**	-	-
17087	-	55.6030**	**	-	74	54	-	18.40**	-	-
19528	-	33.6594**	**	-	74	54	-	40.34**	-	-
21969	-	35.4951**	**	-	74	54	-	38.50**	-	-
24410	-	35.4967**	**	-	74	54	-	38.50**	-	-
Horizontal Radiated Emission Result										
4882	-	40.6778**	**	-	74	54	-	33.32**	-	-
7323	-	45.8025**	**	-	74	54	-	28.20**	-	-
9764	-	49.9923**	**	-	74	54	-	24.01**	-	-
12205	-	52.7552**	**	-	74	54	-	21.24**	-	-
14646	-	53.9033**	**	-	74	54	-	20.10**	-	-
17087	-	55.9375**	**	-	74	54	-	18.06**	-	-
19528	-	33.1939**	**	-	74	54	-	40.81**	-	-
21969	-	35.0420**	**	-	74	54	-	38.96**	-	-
24410	-	35.3619**	**	-	74	54	-	38.64**	-	-

Remarks: Pass Result	Marginal Result	Fail Result

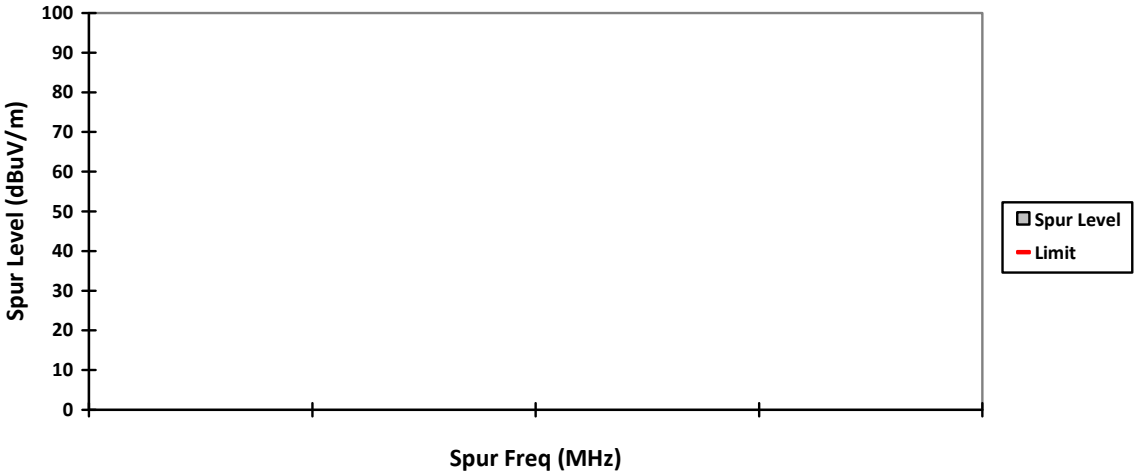
Temperature (degC): 24.5 **Humidity (%): 70.3**
Test Performed by: Nazrin&Fendi **Test Date: Fri, Aug 14, 2020**
System MU: 4.03dB

Remarks: ** Indicates the spurious emission could not be detected due to noise limitations or ambient.
***Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported.**

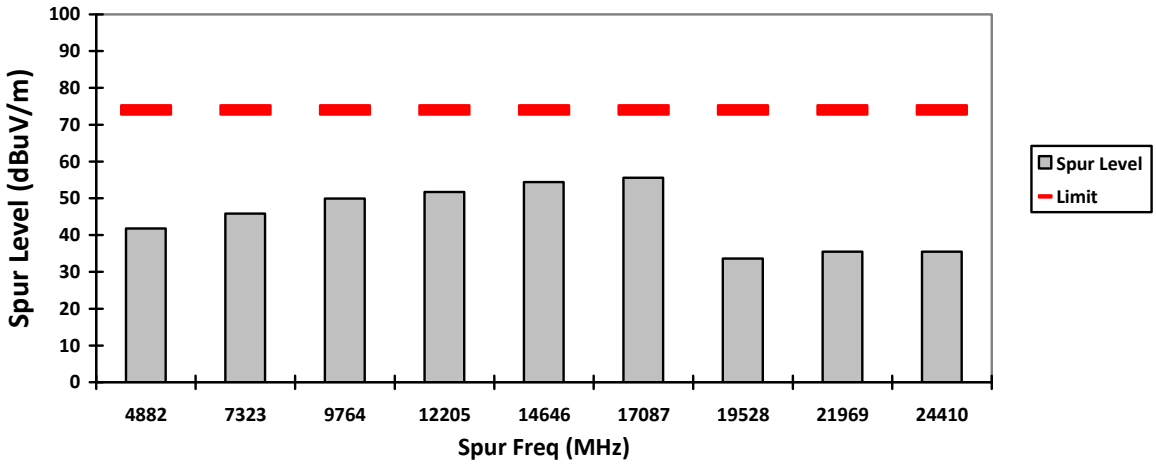
VERTICAL, QPK



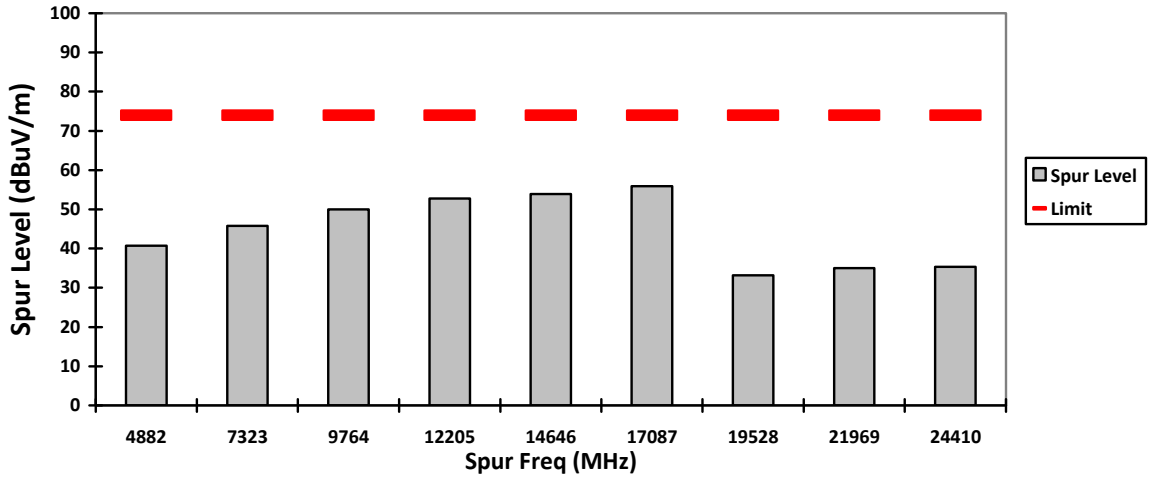
HORIZONTAL, QPK



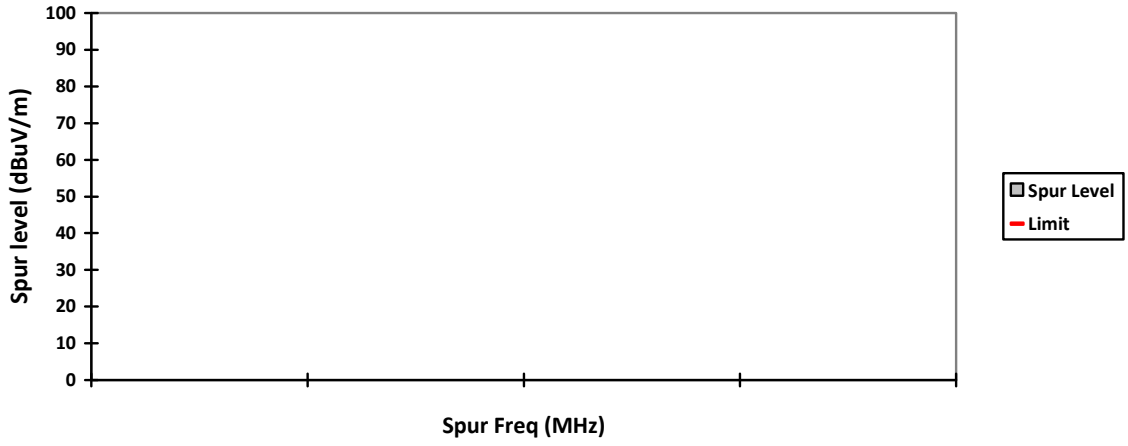
VERTICAL, PK



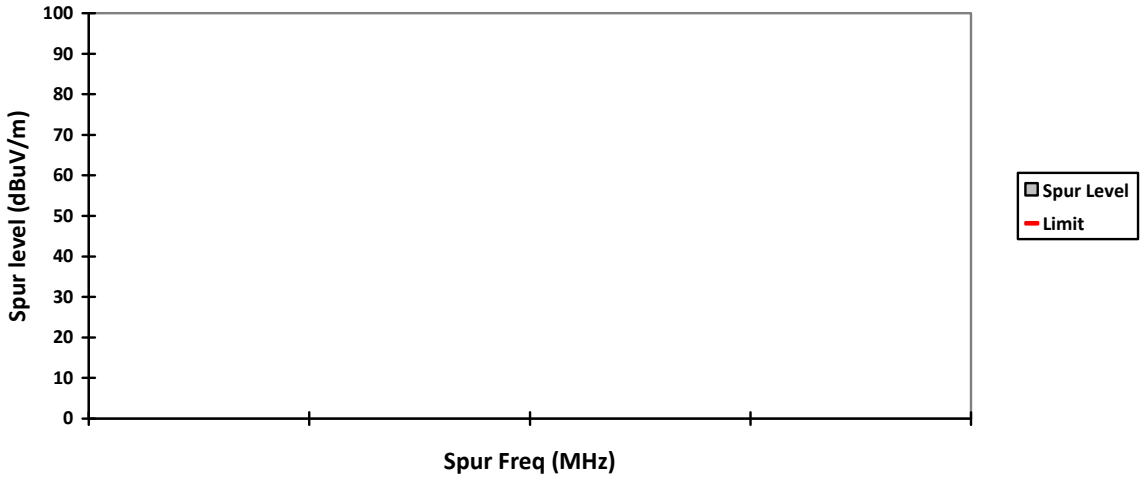
HORIZONTAL, PK



VERTICAL, AV



HORIZONTAL, AV



Test: Bluetooth SAC Transmitter Radiated Emission
Model#: AAH90ZDU9RH1AN S/N: 734TWP0311 EMC SR ID#: 18058-EMC-00037
Battery: PMNN4804A Accessory: AN000348A01
Test Channel: High Test Frequency: 2480.0000 MHz Test Standard: ANSI C63.10-2013
Worst Case Plane: Z-Plane (DQPSK)

Radiated Emission (High Channel) tabular data

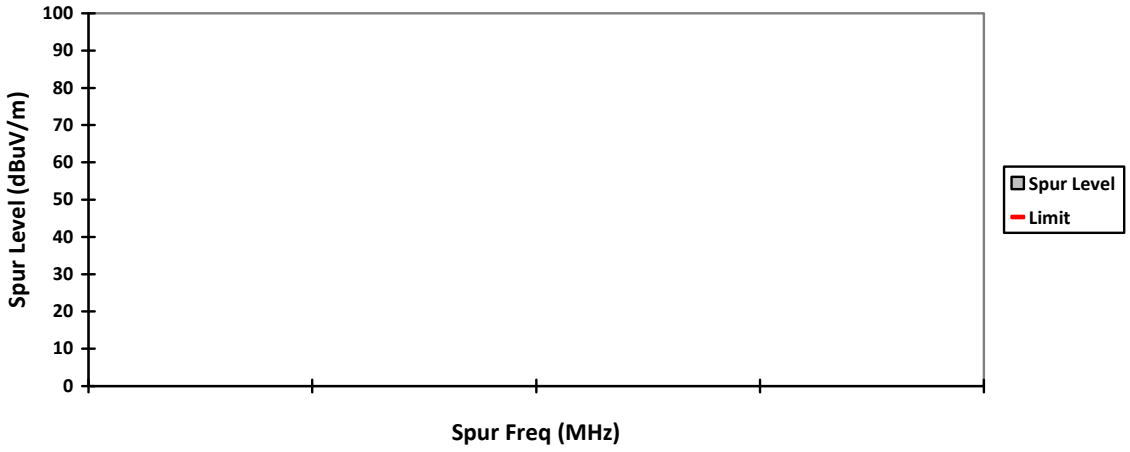
Vertical Radiated Emission Result										
Spur Freq (MHz)	Spur level QPK (dBµV/m)	Spur level PK (dBµV/m)	Spur level AV (dBµV/m)	Limit QPK (dBµV/m)	Limit PK (dBµV/m)	Limit AV (dBµV/m)	Margin QPK (dBµV/m)	Margin PK (dBµV/m)	Margin AV (dBµV/m)	Carrier PK Power (dBµV/m)
4960	-	41.4397**	**	-	74	54	-	32.56**	-	-
7440	-	46.5777**	**	-	74	54	-	27.42**	-	-
9920	-	50.0184**	**	-	74	54	-	23.98**	-	-
12400	-	52.3157**	**	-	74	54	-	21.68**	-	-
14880	-	54.5754**	**	-	74	54	-	19.42**	-	-
17360	-	56.3173**	**	-	74	54	-	17.68**	-	-
19840	-	34.2768**	**	-	74	54	-	39.72**	-	-
22320	-	33.7900**	**	-	74	54	-	40.21**	-	-
24800	-	35.8831**	**	-	74	54	-	38.12**	-	-
Horizontal Radiated Emission Result										
4960	-	41.0264**	**	-	74	54	-	32.97**	-	-
7440	-	46.2509**	**	-	74	54	-	27.75**	-	-
9920	-	49.2878**	**	-	74	54	-	24.71**	-	-
12400	-	51.3106**	**	-	74	54	-	22.69**	-	-
14880	-	54.2238**	**	-	74	54	-	19.78**	-	-
17360	-	56.1408**	**	-	74	54	-	17.86**	-	-
19840	-	33.9364**	**	-	74	54	-	40.06**	-	-
22320	-	33.8441**	**	-	74	54	-	40.16**	-	-
24800	-	36.2295**	**	-	74	54	-	37.77**	-	-

Remarks: Pass Result	Marginal Result	Fail Result

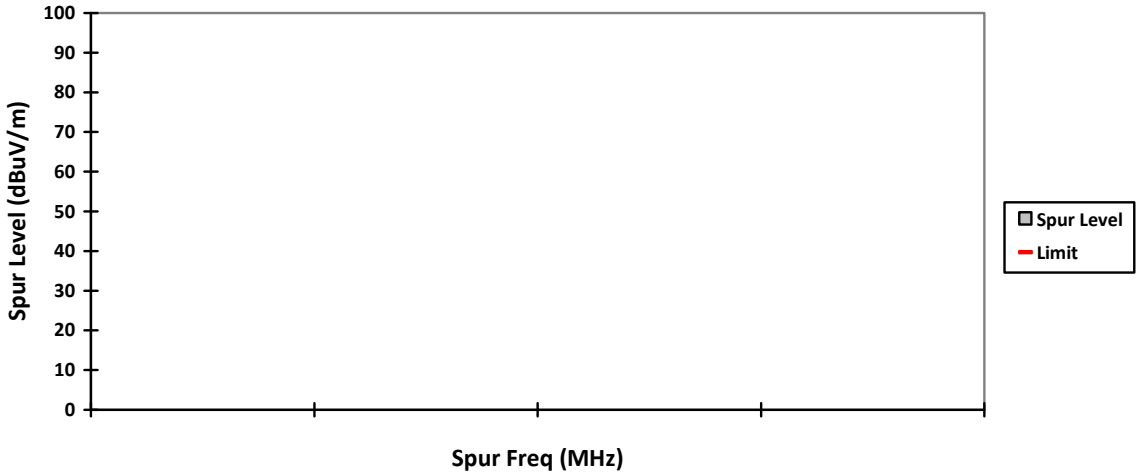
Temperature (degC): 24.5 **Humidity (%): 70.3**
Test Performed by: Nazrin&Fendi **Test Date: Fri, Aug 14, 2020**
System MU: 4.03dB

Remarks: ** Indicates the spurious emission could not be detected due to noise limitations or ambient.
***Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported.**

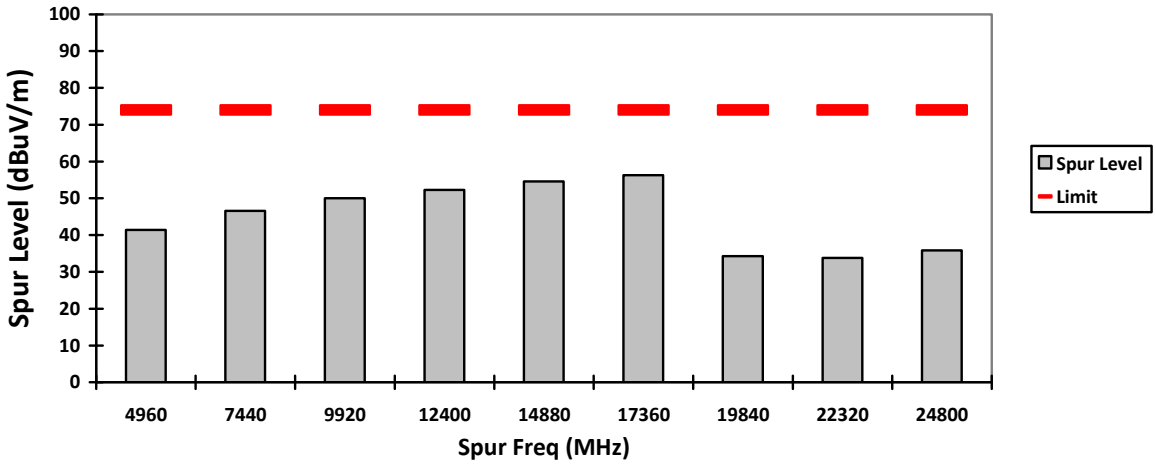
VERTICAL, QPK



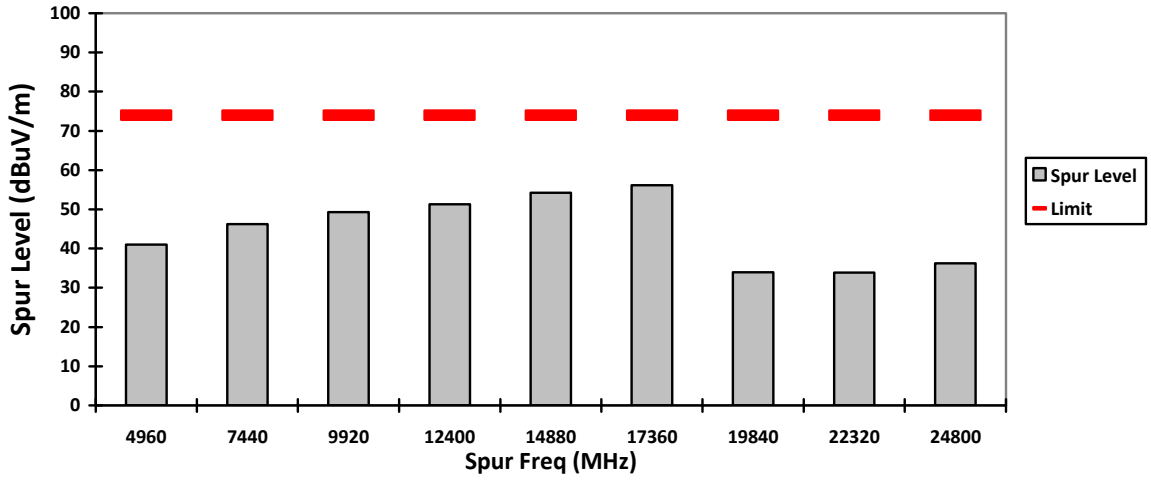
HORIZONTAL, QPK

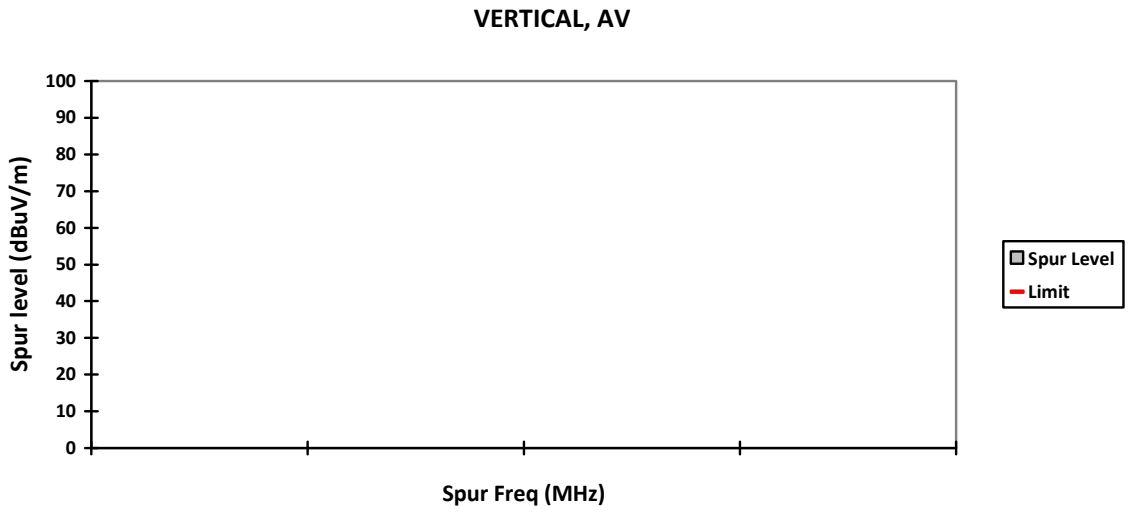


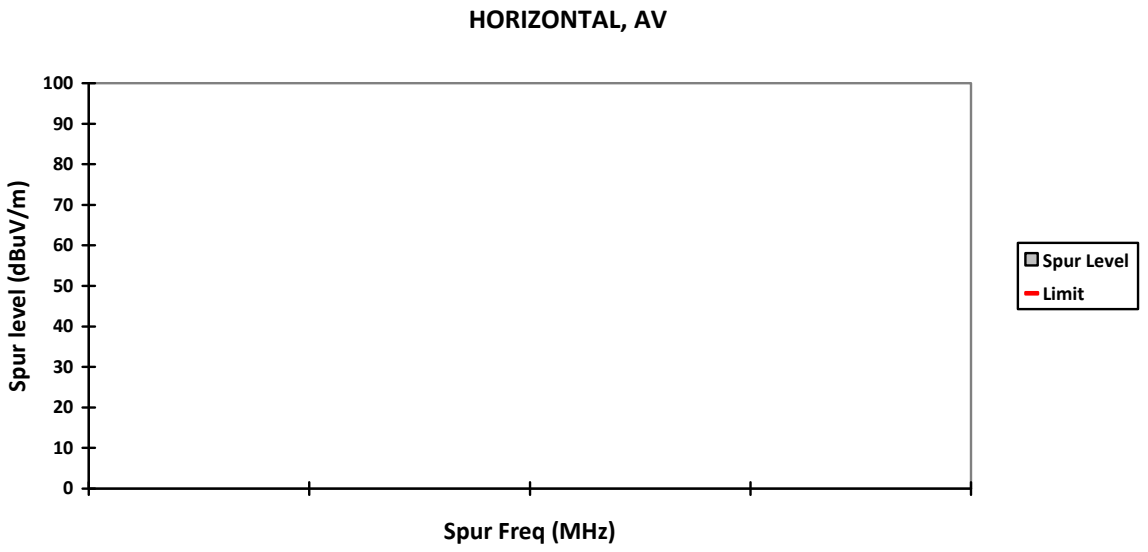
VERTICAL, PK



HORIZONTAL, PK







NOTE:
Transmitter Duty Cycle Calculation, FCC Rule 15.35 (b,c)

Based on the Bluetooth Specification Version 2.1+EDR, and worst case AFH mode, transmitter ON time is independent of packet type (DH1, DH3 and DH5) and packet length, the AFH mode Duty cycle connection factor as below:

Channel hop rate = 800 hops/second (AFH Mode)
Adjusted channel hop rate for DH5 mode = 133.33 hops/second
Time per channel hop = 1 / 133.33 hops/second = 7.5 ms
Time to cycle through all channels = 7.5 x 20 channels = 150 ms
Number of times transmitter hits on one channel = 100 ms / 150 ms = 1 time(s)
Worst case dwell time = 7.5 ms
Duty cycle connection factor = $20\log_{10}$ (7.5ms / 100ms) = **-22.5 dB**

Test: Bluetooth SAC Transmitter Radiated Emission
Model#: AAH90ZDU9RH1AN S/N: 734TWP0311 EMC SR ID#: 18058-EMC-00037
Battery: PMNN4804A Accessory: AN000348A01
Test Channel: Low Test Frequency: 2402.0000 MHz Test Standard: ANSI C63.10-2013
Worst Case Plane: Z-Plane (8DPSK)

Radiated Emission (Low Channel) tabular data

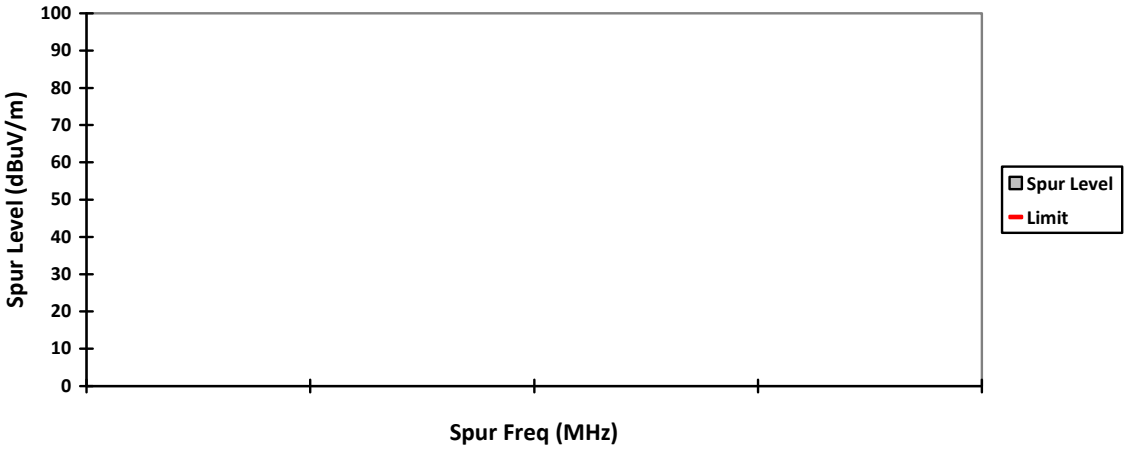
Vertical Radiated Emission Result										
Spur Freq (MHz)	Spur level QPK (dBµV/m)	Spur level PK (dBµV/m)	Spur level AV (dBµV/m)	Limit QPK (dBµV/m)	Limit PK (dBµV/m)	Limit AV (dBµV/m)	Margin QPK (dBµV/m)	Margin PK (dBµV/m)	Margin AV (dBµV/m)	Carrier PK Power (dBµV/m)
4804	-	41.9751**	**	-	74	54	-	32.02**	-	-
7206	-	46.9777**	**	-	74	54	-	27.02**	-	-
9608	-	49.4446**	**	-	74	54	-	24.56**	-	-
12010	-	51.4830**	**	-	74	54	-	22.52**	-	-
14412	-	53.8394**	**	-	74	54	-	20.16**	-	-
16814	-	55.4288**	**	-	74	54	-	18.57**	-	-
19216	-	34.8959**	**	-	74	54	-	39.10**	-	-
21618	-	34.4744**	**	-	74	54	-	39.53**	-	-
24020	-	35.3283**	**	-	74	54	-	38.67**	-	-
Horizontal Radiated Emission Result										
4804	-	41.0888**	**	-	74	54	-	32.91**	-	-
7206	-	46.5112**	**	-	74	54	-	27.49**	-	-
9608	-	49.4624**	**	-	74	54	-	24.54**	-	-
12010	-	51.0583**	**	-	74	54	-	22.94**	-	-
14412	-	53.7463**	**	-	74	54	-	20.25**	-	-
16814	-	55.7169**	**	-	74	54	-	18.28**	-	-
19216	-	34.5280**	**	-	74	54	-	39.47**	-	-
21618	-	33.7010**	**	-	74	54	-	40.30**	-	-
24020	-	34.5489**	**	-	74	54	-	39.45**	-	-

Remarks: Pass Result	Marginal Result	Fail Result

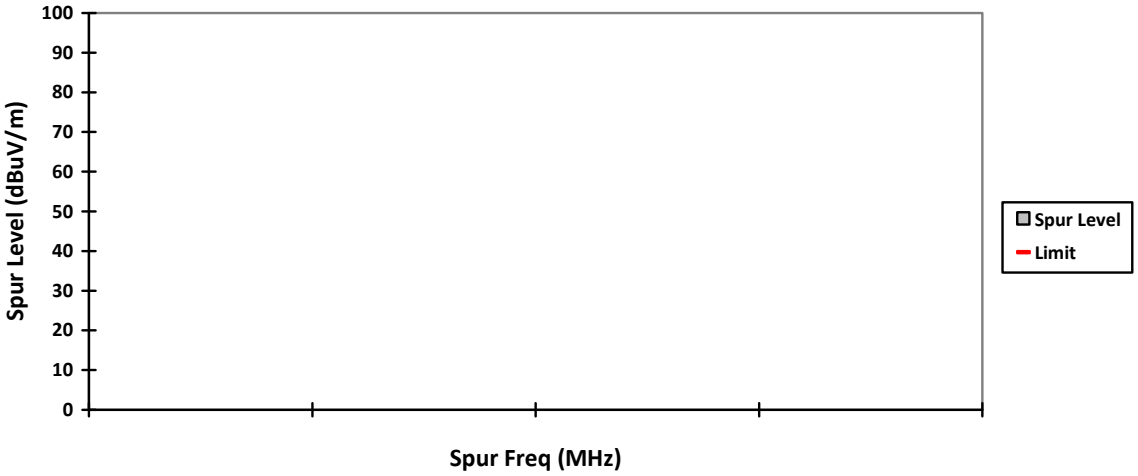
Temperature (degC): 24.5 **Humidity (%): 70.3**
Test Performed by: Nazrin&Fendi **Test Date: Fri, Aug 14, 2020**
System MU: 4.03dB

Remarks: ** Indicates the spurious emission could not be detected due to noise limitations or ambient.
***Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported.**

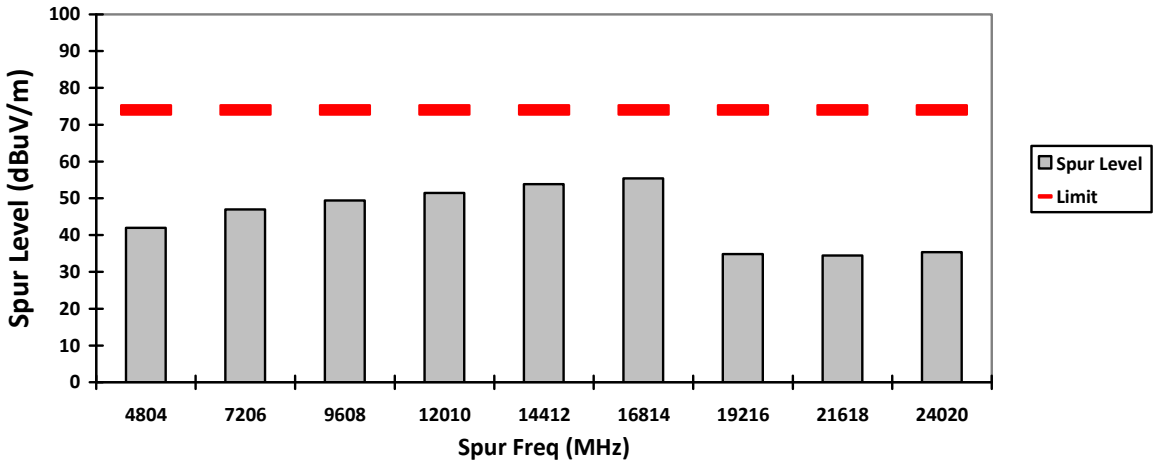
VERTICAL, QPK



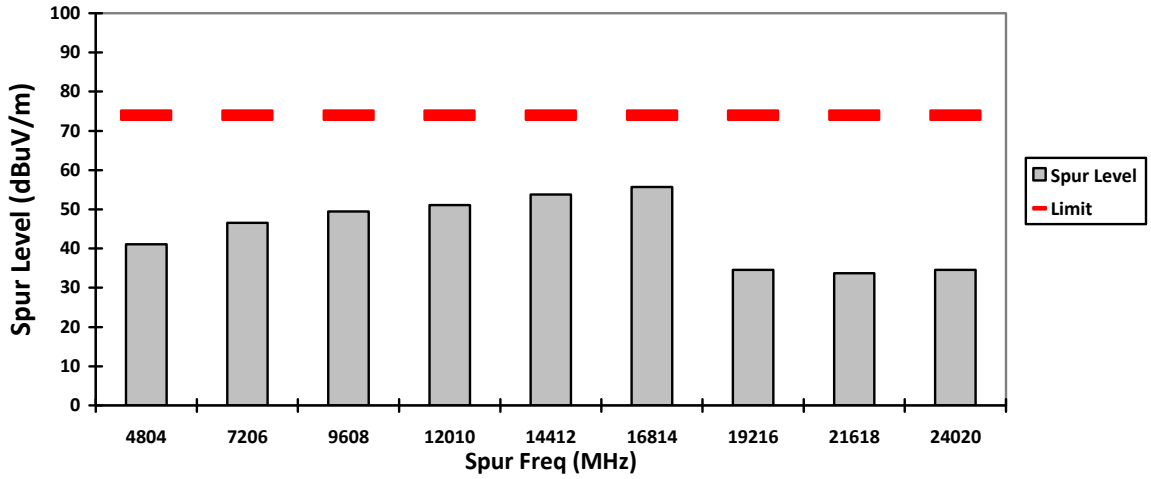
HORIZONTAL, QPK



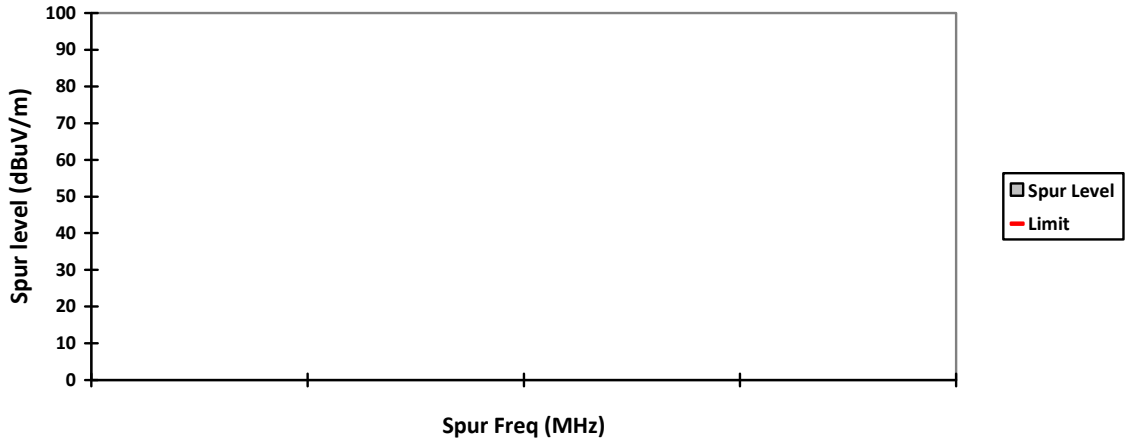
VERTICAL, PK



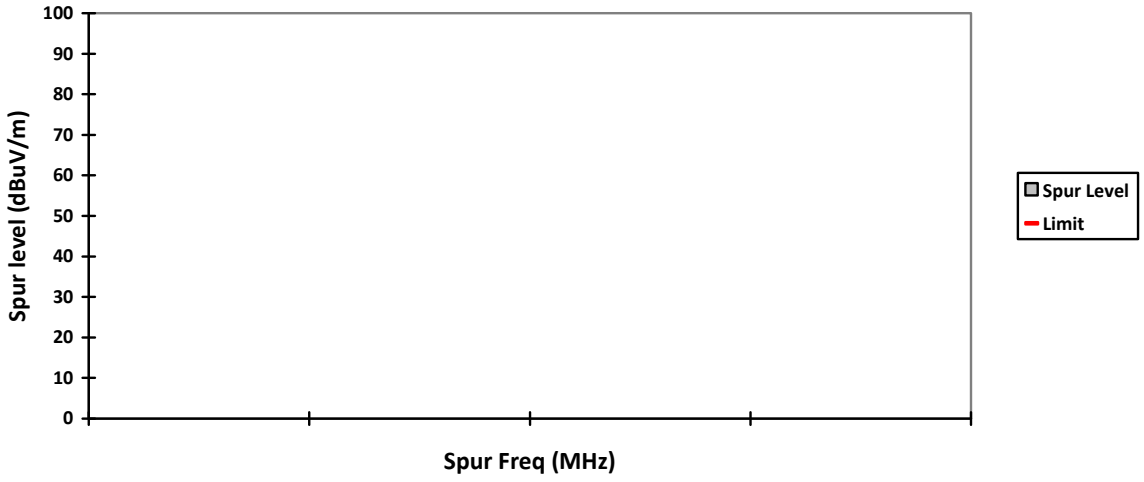
HORIZONTAL, PK



VERTICAL, AV



HORIZONTAL, AV



Test: Bluetooth SAC Transmitter Radiated Emission
Model#: AAH90ZDU9RH1AN S/N: 734TWP0311 EMC SR ID#: 18058-EMC-00037
Battery: PMNN4804A Accessory: AN000348A01
Test Channel: Mid Test Frequency: 2441.0000 MHz Test Standard: ANSI C63.10-2013
Worst Case Plane: Z-Plane (8DPSK)

Radiated Emission (Mid Channel) tabular data

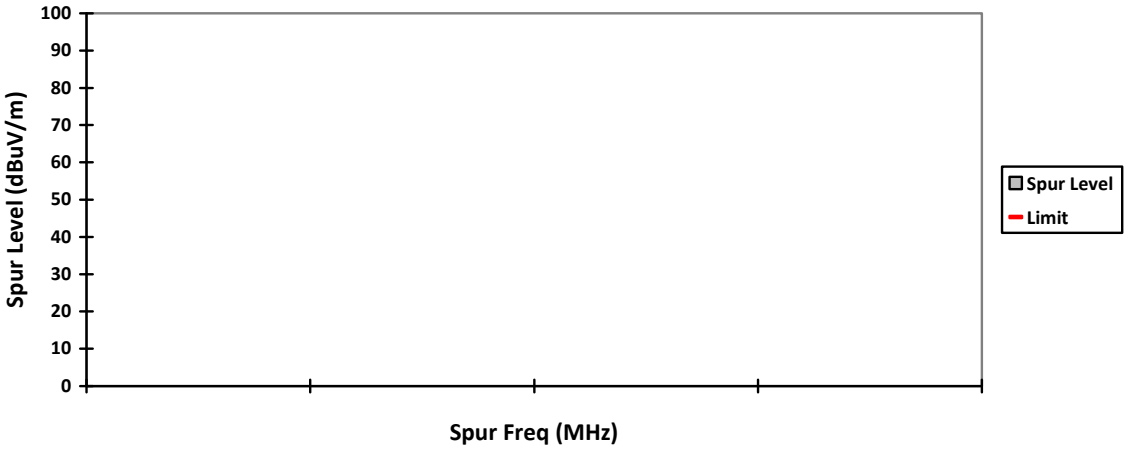
Vertical Radiated Emission Result										
Spur Freq (MHz)	Spur level QPK (dBµV/m)	Spur level PK (dBµV/m)	Spur level AV (dBµV/m)	Limit QPK (dBµV/m)	Limit PK (dBµV/m)	Limit AV (dBµV/m)	Margin QPK (dBµV/m)	Margin PK (dBµV/m)	Margin AV (dBµV/m)	Carrier PK Power (dBµV/m)
4882	-	41.0841**	**	-	74	54	-	32.92**	-	-
7323	-	47.3283**	**	-	74	54	-	26.67**	-	-
9764	-	49.6794**	**	-	74	54	-	24.32**	-	-
12205	-	52.0098**	**	-	74	54	-	21.99**	-	-
14646	-	55.2496**	**	-	74	54	-	18.75**	-	-
17087	-	56.5546**	**	-	74	54	-	17.45**	-	-
19528	-	33.6538**	**	-	74	54	-	40.35**	-	-
21969	-	35.8635**	**	-	74	54	-	38.14**	-	-
24410	-	35.2870**	**	-	74	54	-	38.71**	-	-
Horizontal Radiated Emission Result										
4882	-	42.1364**	**	-	74	54	-	31.86**	-	-
7323	-	45.9060**	**	-	74	54	-	28.09**	-	-
9764	-	49.1241**	**	-	74	54	-	24.88**	-	-
12205	-	52.2426**	**	-	74	54	-	21.76**	-	-
14646	-	54.3774**	**	-	74	54	-	19.62**	-	-
17087	-	55.5867**	**	-	74	54	-	18.41**	-	-
19528	-	33.6002**	**	-	74	54	-	40.40**	-	-
21969	-	35.0836**	**	-	74	54	-	38.92**	-	-
24410	-	35.1714**	**	-	74	54	-	38.83**	-	-

Remarks: Pass Result	Marginal Result	Fail Result

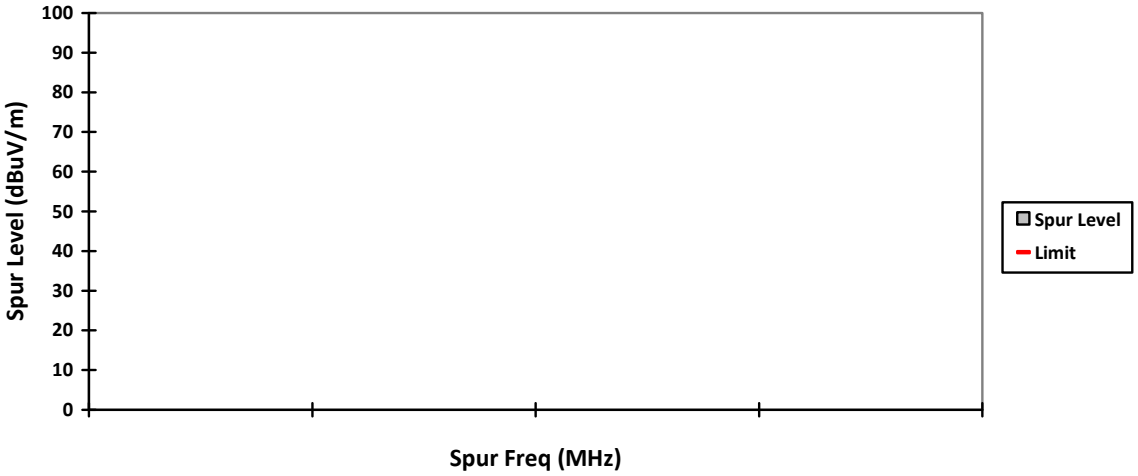
Temperature (degC): 24.5 **Humidity (%): 70.3**
Test Performed by: Nazrin&Fendi **Test Date: Fri, Aug 14, 2020**
System MU: 4.03dB

Remarks: ** Indicates the spurious emission could not be detected due to noise limitations or ambient.
***Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported.**

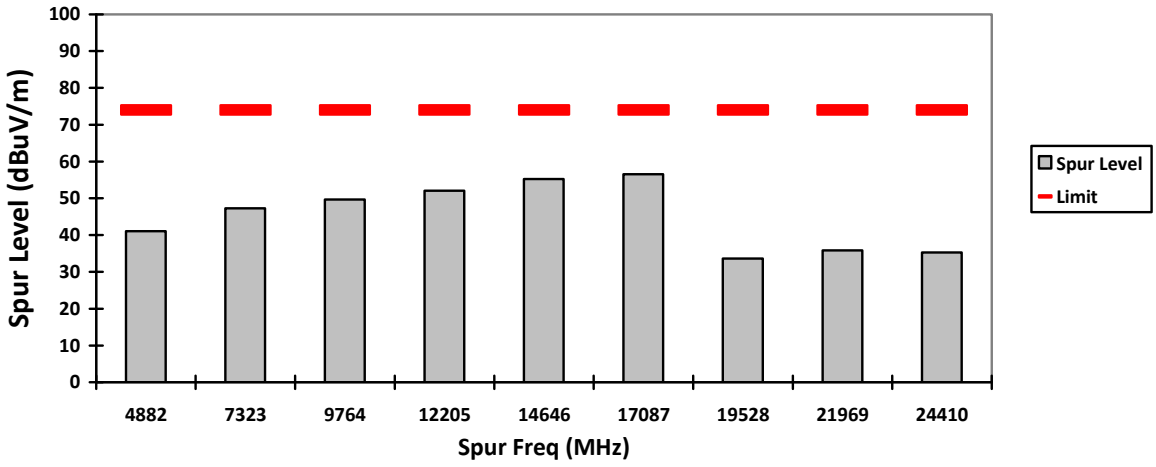
VERTICAL, QPK



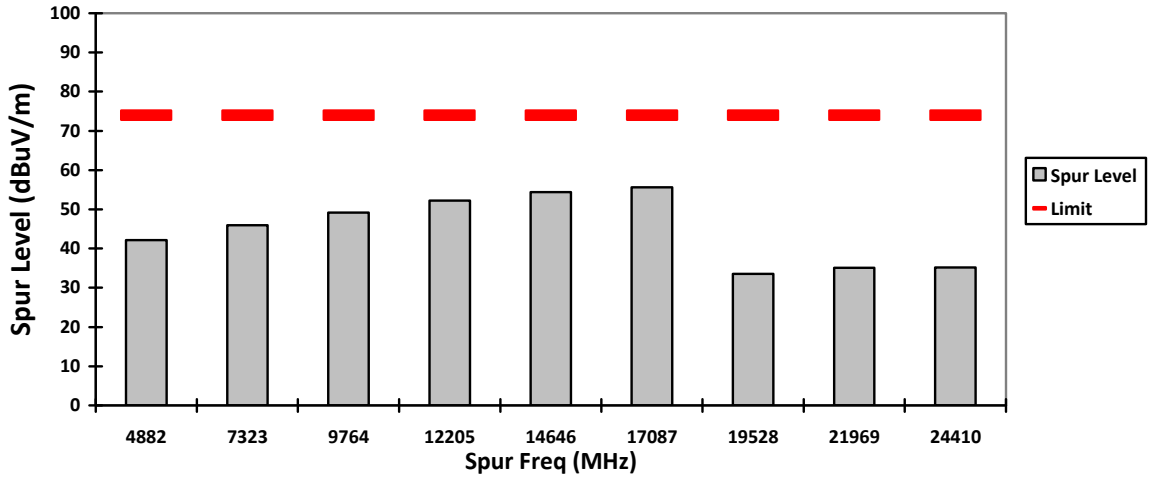
HORIZONTAL, QPK



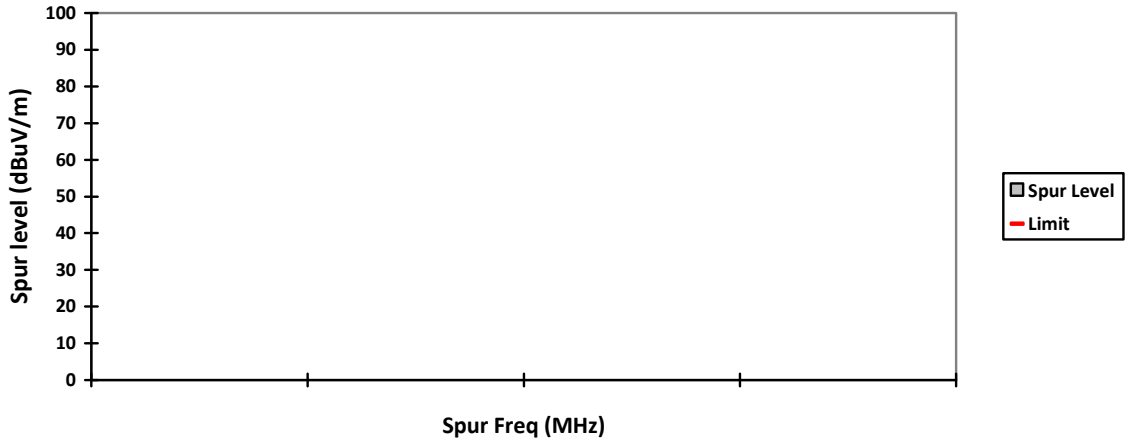
VERTICAL, PK



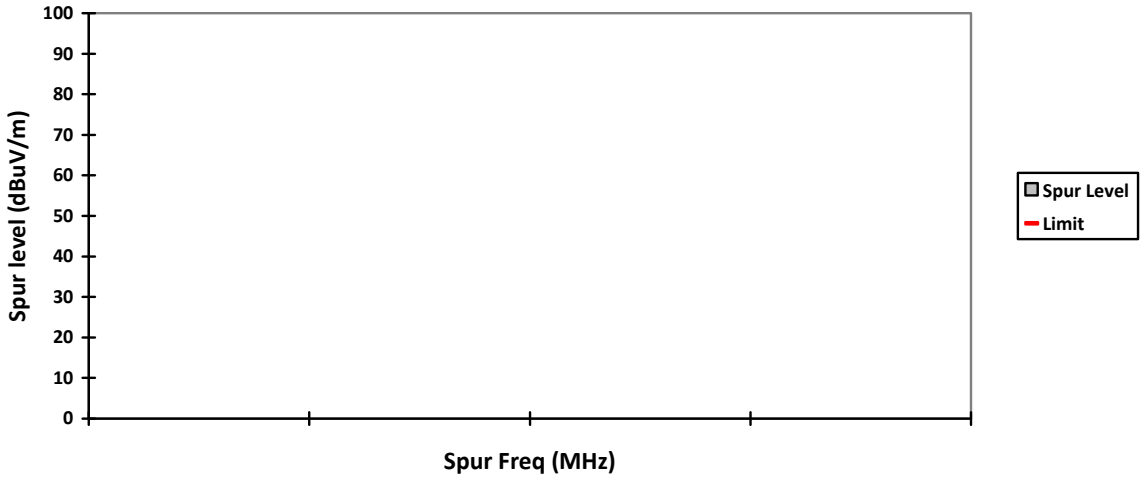
HORIZONTAL, PK



VERTICAL, AV



HORIZONTAL, AV



RH1AN S/N: 734TWP0311 EMC SR ID#: 18058-EMC-00037
Battery: PMNN4804A Accessory: AN000348A01
Test Channel: High Test Frequency: 2480.0000 MHz Test Standard: ANSI C63.10-2013
Worst Case Plane: Z-Plane (8DPSK)

Radiated Emission (High Channel) tabular data

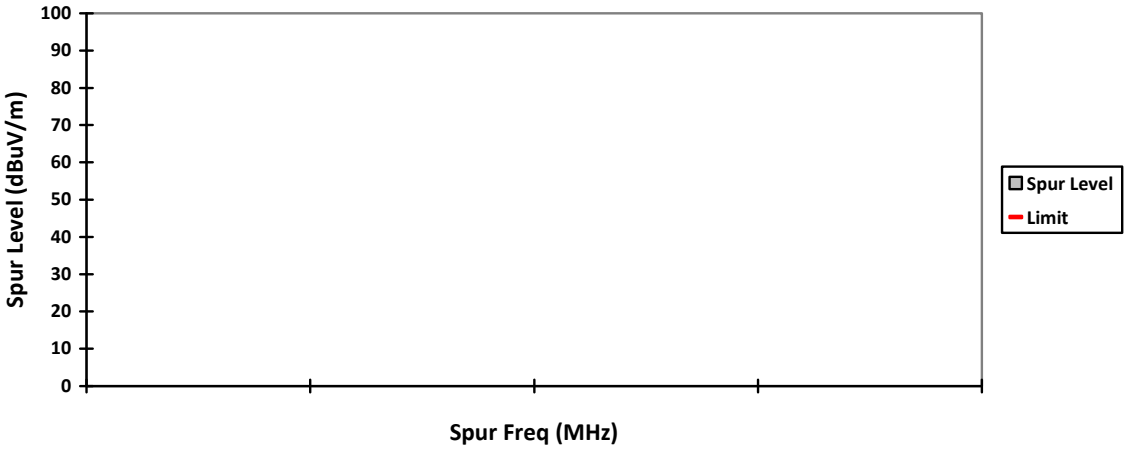
Vertical Radiated Emission Result										
Spur Freq (MHz)	Spur level QPK (dBµV/m)	Spur level PK (dBµV/m)	Spur level AV (dBµV/m)	Limit QPK (dBµV/m)	Limit PK (dBµV/m)	Limit AV (dBµV/m)	Margin QPK (dBµV/m)	Margin PK (dBµV/m)	Margin AV (dBµV/m)	Carrier PK Power (dBµV/m)
4960	-	40.8751**	**	-	74	54	-	33.12**	-	-
7440	-	46.3130**	**	-	74	54	-	27.69**	-	-
9920	-	49.7193**	**	-	74	54	-	24.28**	-	-
12400	-	51.5520**	**	-	74	54	-	22.45**	-	-
14880	-	55.2545**	**	-	74	54	-	18.75**	-	-
17360	-	55.6973**	**	-	74	54	-	18.30**	-	-
19840	-	34.0036**	**	-	74	54	-	40.00**	-	-
22320	-	34.5393**	**	-	74	54	-	39.46**	-	-
24800	-	35.7681**	**	-	74	54	-	38.23**	-	-
Horizontal Radiated Emission Result										
4960	-	41.7185**	**	-	74	54	-	32.28**	-	-
7440	-	46.9377**	**	-	74	54	-	27.06**	-	-
9920	-	49.6406**	**	-	74	54	-	24.36**	-	-
12400	-	51.8075**	**	-	74	54	-	22.19**	-	-
14880	-	54.8741**	**	-	74	54	-	19.13**	-	-
17360	-	55.5092**	**	-	74	54	-	18.49**	-	-
19840	-	33.7652**	**	-	74	54	-	40.23**	-	-
22320	-	34.2156**	**	-	74	54	-	39.78**	-	-
24800	-	36.0830**	**	-	74	54	-	37.92**	-	-

Remarks: Pass Result	Marginal Result	Fail Result

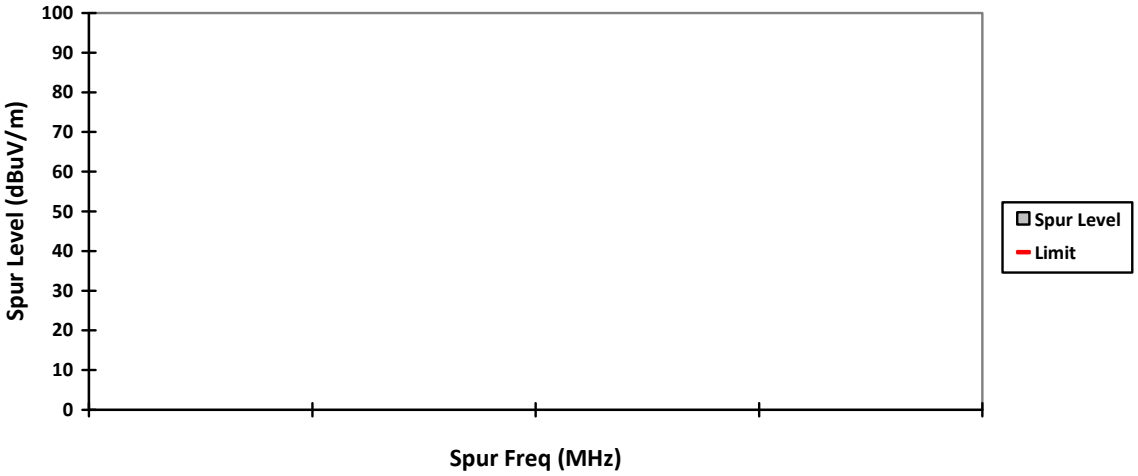
Temperature (degC): 24.5 **Humidity (%): 70.3**
Test Performed by: Nazrin&Fendi **Test Date: Fri, Aug 14, 2020**
System MU: 4.03dB

Remarks: ** Indicates the spurious emission could not be detected due to noise limitations or ambient.
***Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported.**

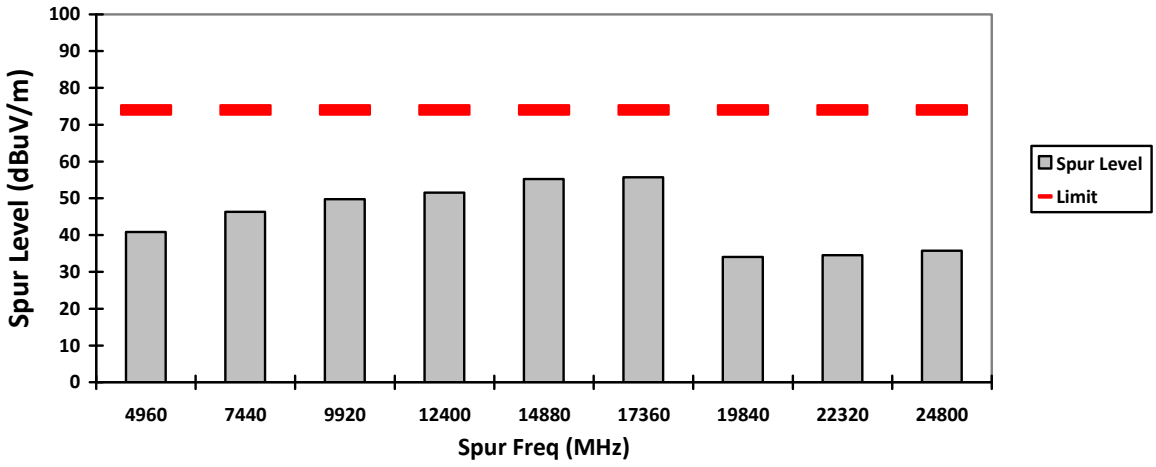
VERTICAL, QPK



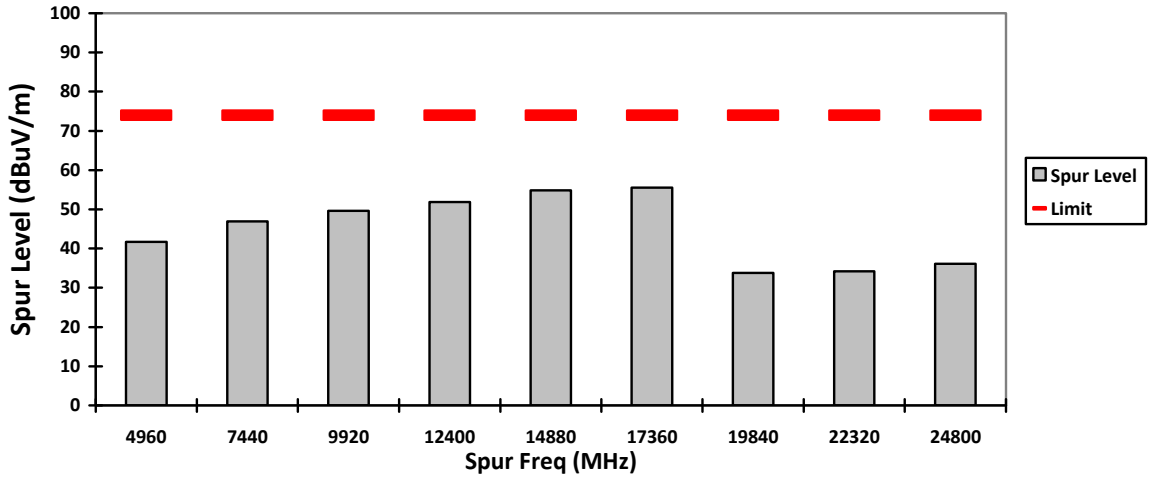
HORIZONTAL, QPK



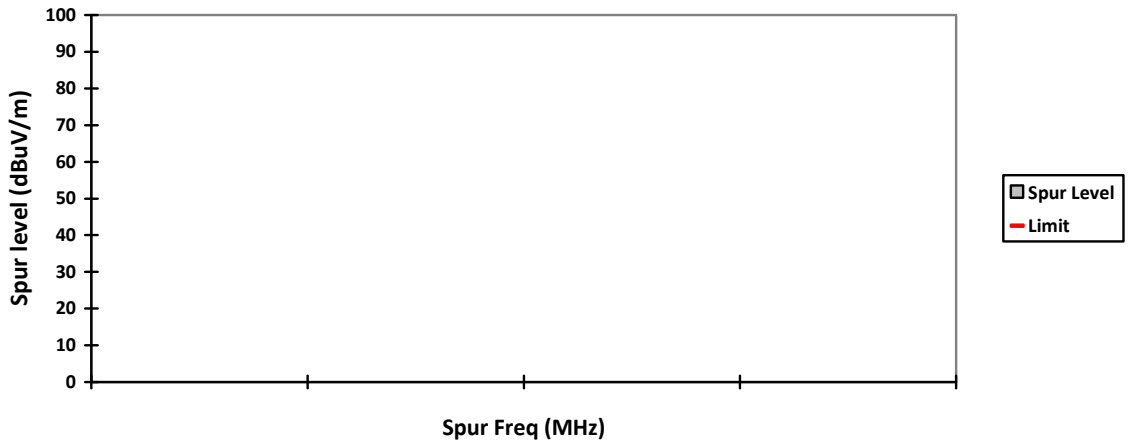
VERTICAL, PK



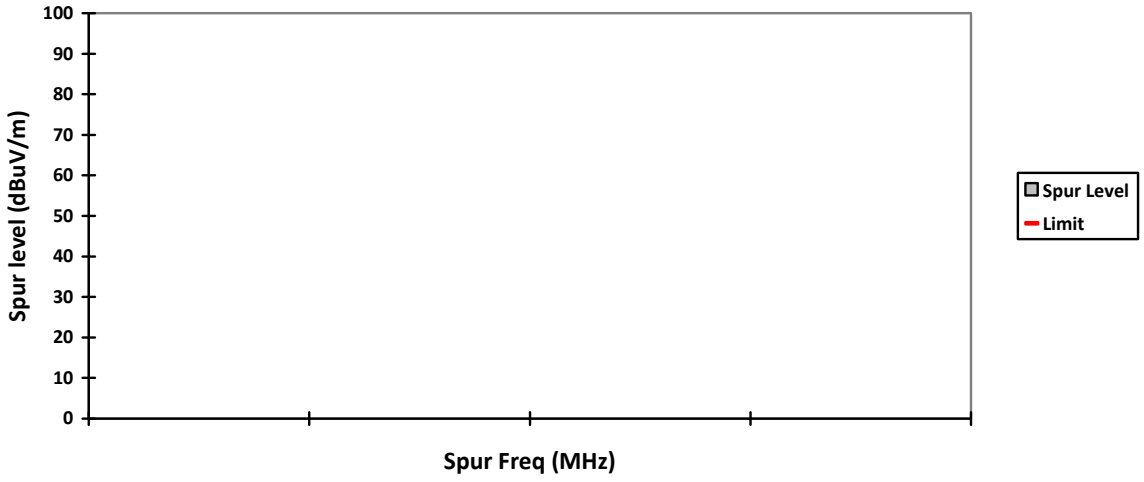
HORIZONTAL, PK



VERTICAL, AV



HORIZONTAL, AV



NOTE:
Transmitter Duty Cycle Calculation, FCC Rule 15.35 (b,c)

Based on the Bluetooth Specification Version 2.1+EDR, and worst case AFH mode, transmitter ON time is independent of packet type (DH1, DH3 and DH5) and packet length, the AFH mode Duty cycle connection factor as below:

Channel hop rate = 800 hops/second (AFH Mode)
Adjusted channel hop rate for DH5 mode = 133.33 hops/second
Time per channel hop = 1 / 133.33 hops/second = 7.5 ms
Time to cycle through all channels = 7.5 x 20 channels = 150 ms
Number of times transmitter hits on one channel = 100 ms / 150 ms = 1 time(s)
Worst case dwell time = 7.5 ms
Duty cycle connection factor = $20\log_{10}$ (7.5ms / 100ms) = **-22.5 dB**

Test: Bluetooth SAC Restricted Band Edge
Model Number: AAH90ZDU9RH1AN S/N: 734TWP0311 EMC SR ID#: 18058-EMC-00037
Battery: PMNN4804A Accessory: AN000348A01
Test Channel: Low Test Frequency: 2402.0000 MHz Test Standard: ANSI C63.10-2013
Worst Case Plane: Z-Plane (GFSK)

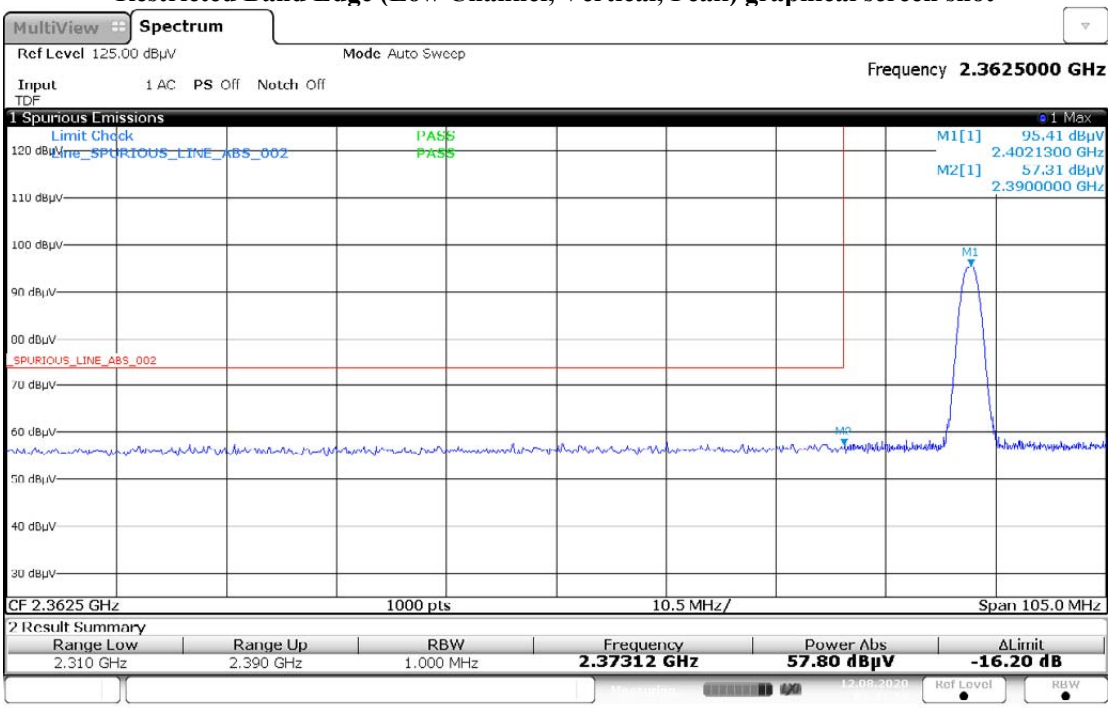
Restricted Band Edge (Low Channel) tabular data

Vertical Radiated Emission Result										
Spur Freq (MHz)	Spur level QPK (dBµV/m)	Spur level PK (dBµV/m)	Spur level AV (dBµV/m)	Limit QPK (dBµV/m)	Limit PK (dBµV/m)	Limit AV (dBµV/m)	Margin QPK (dBµV/m)	Margin PK (dBµV/m)	Margin AV (dBµV/m)	Carrier PK Power (dBµV/m)
2390.0000	-	56.6109	45.1098	-	74.0000	54.0000	-	-17.3891	-8.8902	-
Horizontal Radiated Emission Result										
2390.0000	-	57.3219	45.0624	-	74.0000	54.0000	-	-16.6781	-8.9376	-

Remarks: Pass Result	Marginal Result	Fail Result

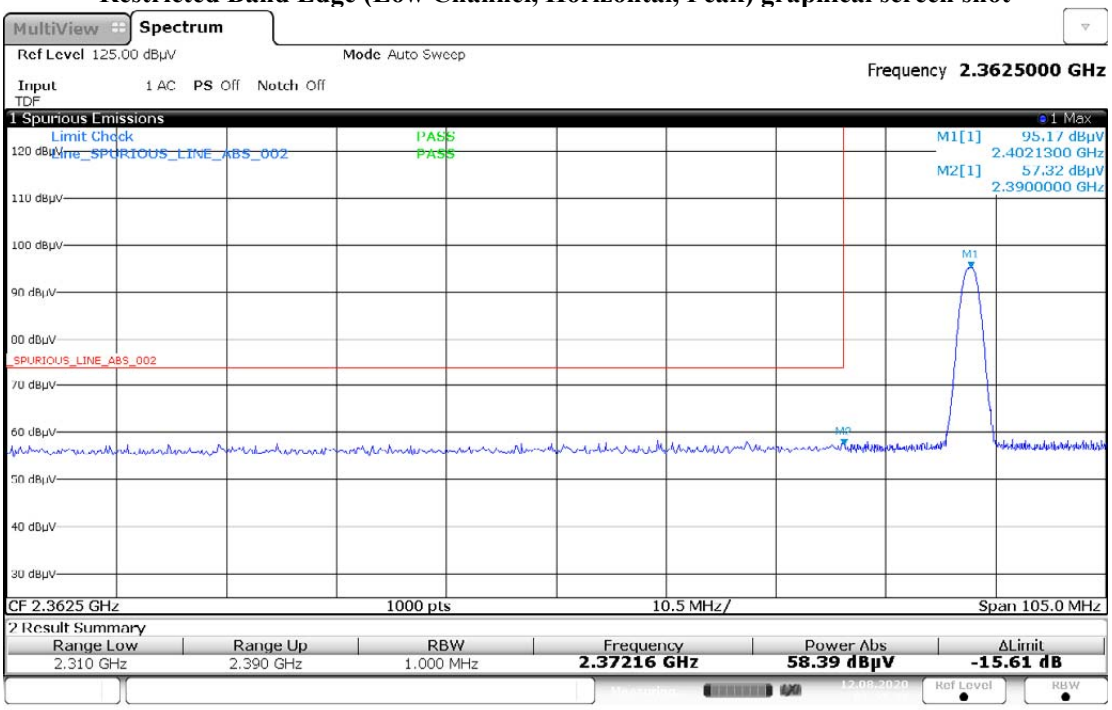
Temperature (degC):23.5 **Humidity (%): 70.3**
Test Performed by: Nazrin&Qawiman **Test Date: Wed, Aug 12, 2020**
System MU: 4.03dB

Restricted Band Edge (Low Channel, Vertical, Peak) graphical screen shot



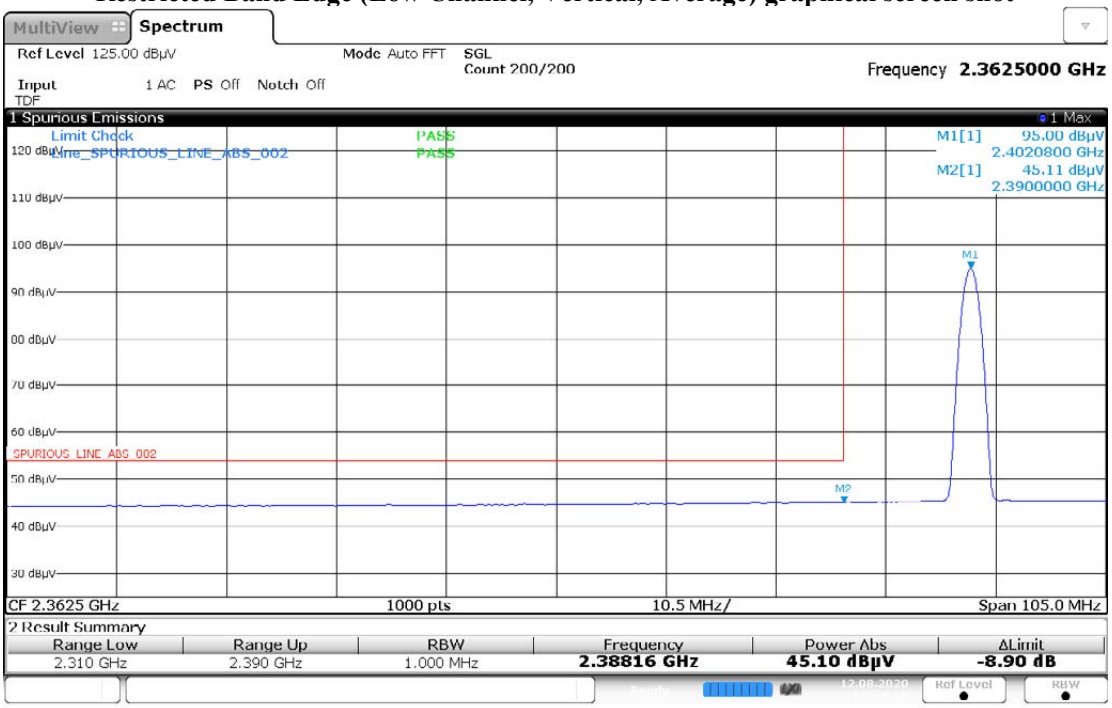
01:31:53 12.08.2020

Restricted Band Edge (Low Channel, Horizontal, Peak) graphical screen shot



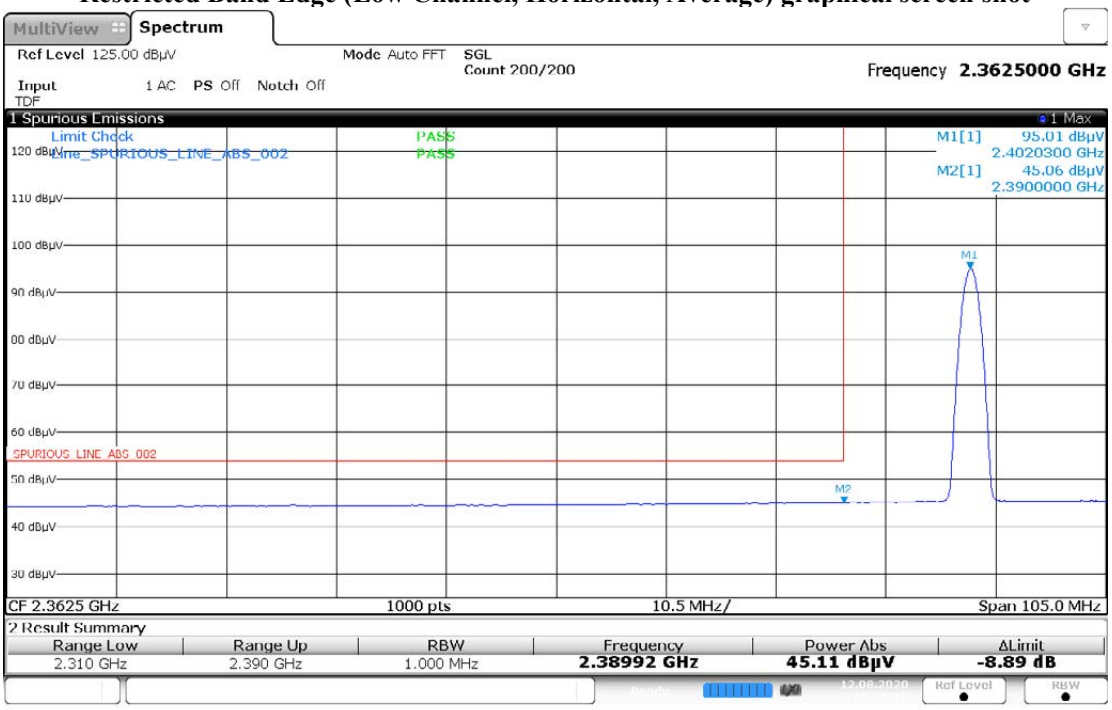
01:35:33 12.08.2020

Restricted Band Edge (Low Channel, Vertical, Average) graphical screen shot



01:16:42 12.08.2020

Restricted Band Edge (Low Channel, Horizontal, Average) graphical screen shot



01:21:10 12.08.2020

Test: Bluetooth SAC Restricted Band Edge
Model Number: AAH90ZDU9RH1AN S/N: 734TWP0311 EMC SR ID#: 18058-EMC-00037
Battery: PMNN4804A Accessory: AN000348A01
Test Channel: High Test Frequency: 2480.0000 MHz Test Standard: ANSI C63.10-2013
Worst Case Plane: Z-Plane (GFSK)

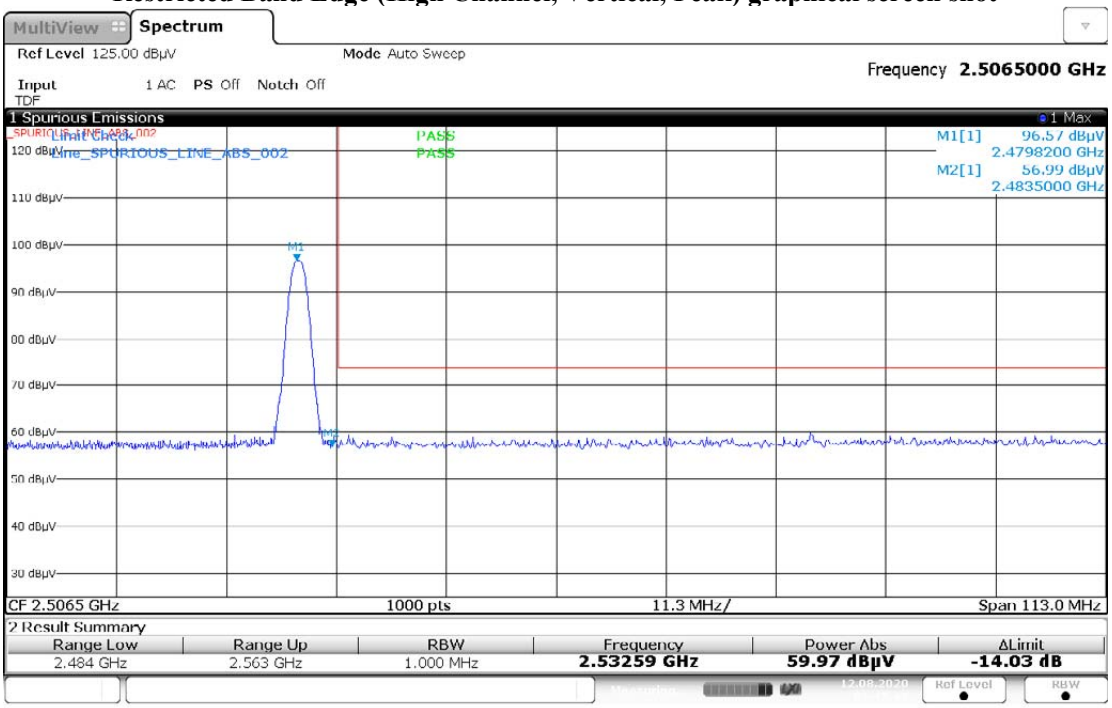
Restricted Band Edge (High Channel) tabular data

Vertical Radiated Emission Result										
Spur Freq (MHz)	Spur level QPK (dBµV/m)	Spur level PK (dBµV/m)	Spur level AV (dBµV/m)	Limit QPK (dBµV/m)	Limit PK (dBµV/m)	Limit AV (dBµV/m)	Margin QPK (dBµV/m)	Margin PK (dBµV/m)	Margin AV (dBµV/m)	Carrier PK Power (dBµV/m)
2483.5000	-	56.9911	45.7488	-	74.0000	54.0000	-	-17.0089	-8.2512	-
Horizontal Radiated Emission Result										
2483.5000	-	57.6354	45.6856	-	74.0000	54.0000	-	-16.3646	-8.3144	-

Remarks: Pass Result	Marginal Result	Fail Result

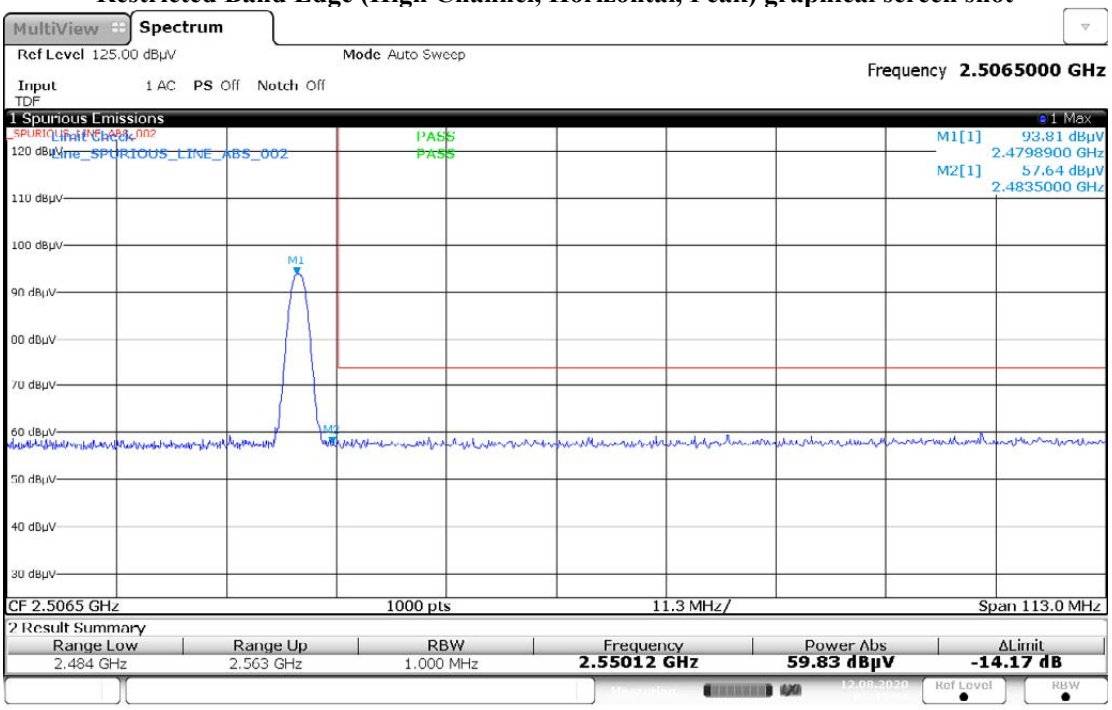
Temperature (degC):23.5 **Humidity (%): 70.3**
Test Performed by: Nazrin&Qawiman **Test Date: Wed, Aug 12, 2020**
System MU: 4.03dB

Restricted Band Edge (High Channel, Vertical, Peak) graphical screen shot



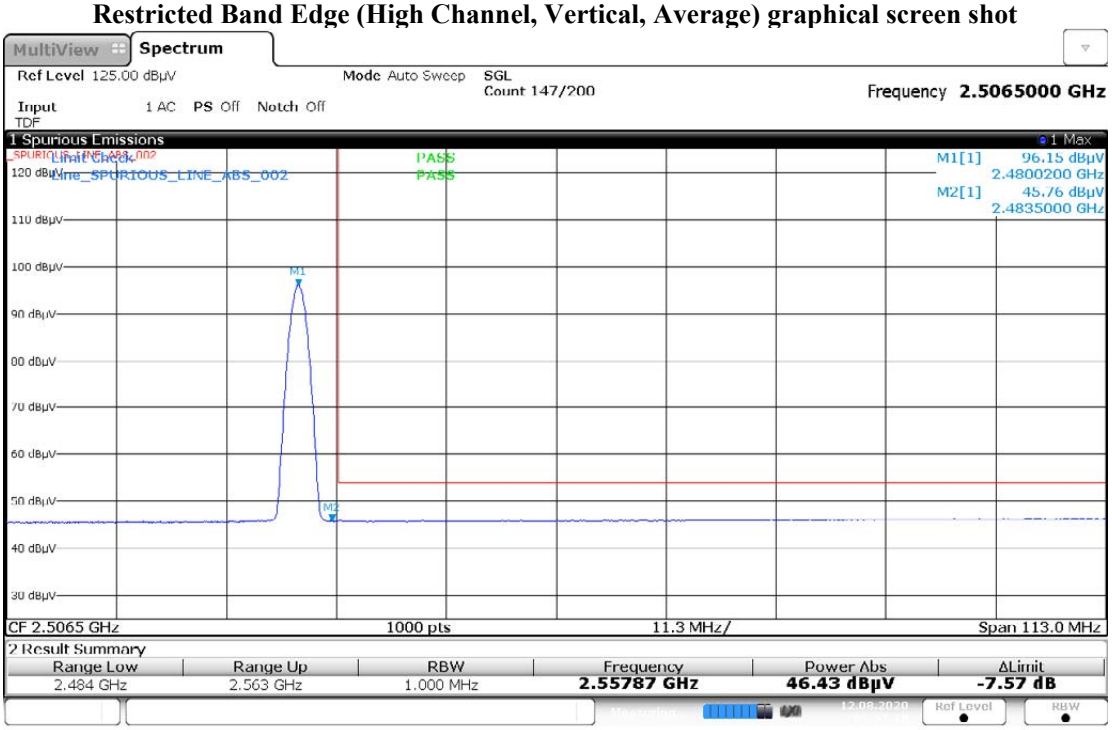
01:43:47 12.08.2020

Restricted Band Edge (High Channel, Horizontal, Peak) graphical screen shot



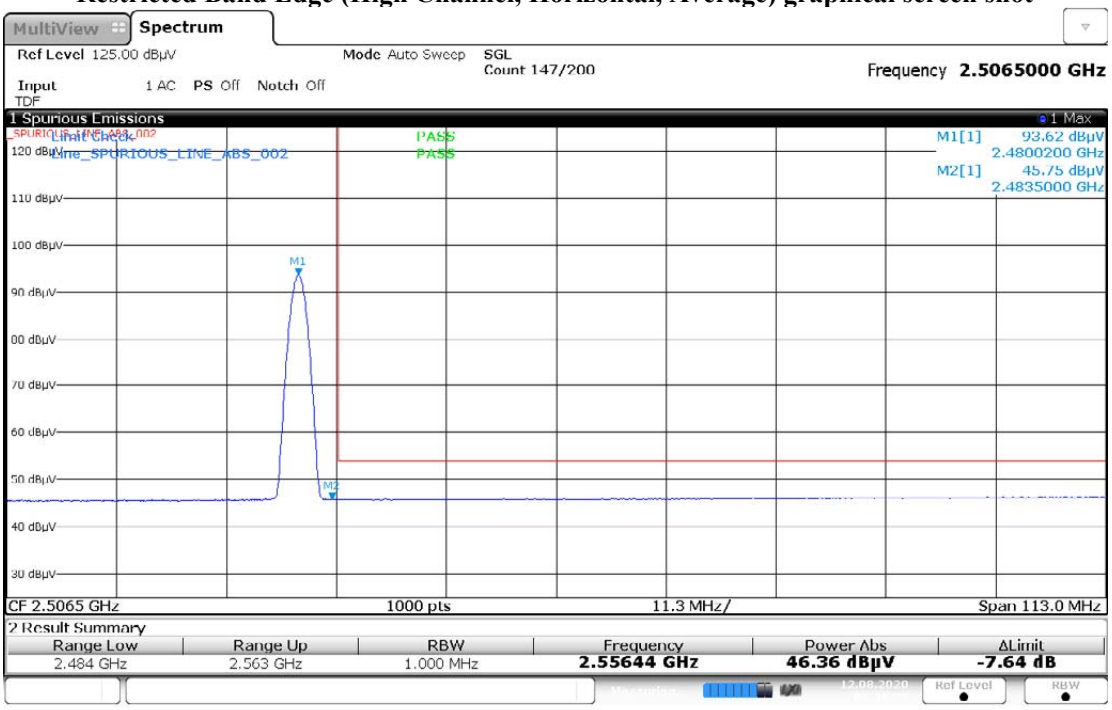
01:47:06 12.08.2020

Restricted Band Edge (High Channel, Vertical, Average) graphical screen shot



01:53:18 12.08.2020

Restricted Band Edge (High Channel, Horizontal, Average) graphical screen shot



01:58:02 12.08.2020

Test: Bluetooth SAC Restricted Band Edge
Model Number: AAH90ZDU9RH1AN S/N: 734TWP0311 EMC SR ID#: 18058-EMC-00037
Battery: PMNN4804A Accessory: AN000348A01
Test Channel: Low Test Frequency: 2402.0000 MHz Test Standard: ANSI C63.10-2013
Worst Case Plane: Z-Plane (DQPSK)

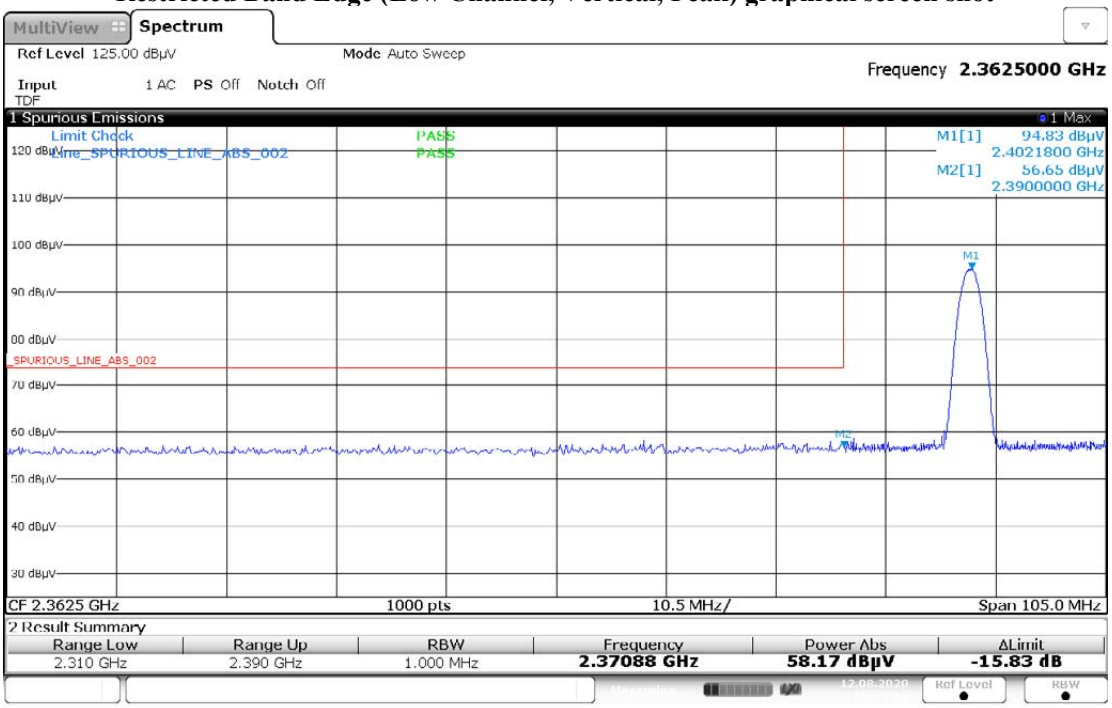
Restricted Band Edge (Low Channel) tabular data

Vertical Radiated Emission Result										
Spur Freq (MHz)	Spur level QPK (dBµV/m)	Spur level PK (dBµV/m)	Spur level AV (dBµV/m)	Limit QPK (dBµV/m)	Limit PK (dBµV/m)	Limit AV (dBµV/m)	Margin QPK (dBµV/m)	Margin PK (dBµV/m)	Margin AV (dBµV/m)	Carrier PK Power (dBµV/m)
2390.0000	-	56.0948	45.0802	-	74.0000	54.0000	-	-17.9052	-8.9198	-
Horizontal Radiated Emission Result										
2390.0000	-	55.9444	45.1135	-	74.0000	54.0000	-	-18.0556	-8.8865	-

Remarks: Pass Result	Marginal Result	Fail Result

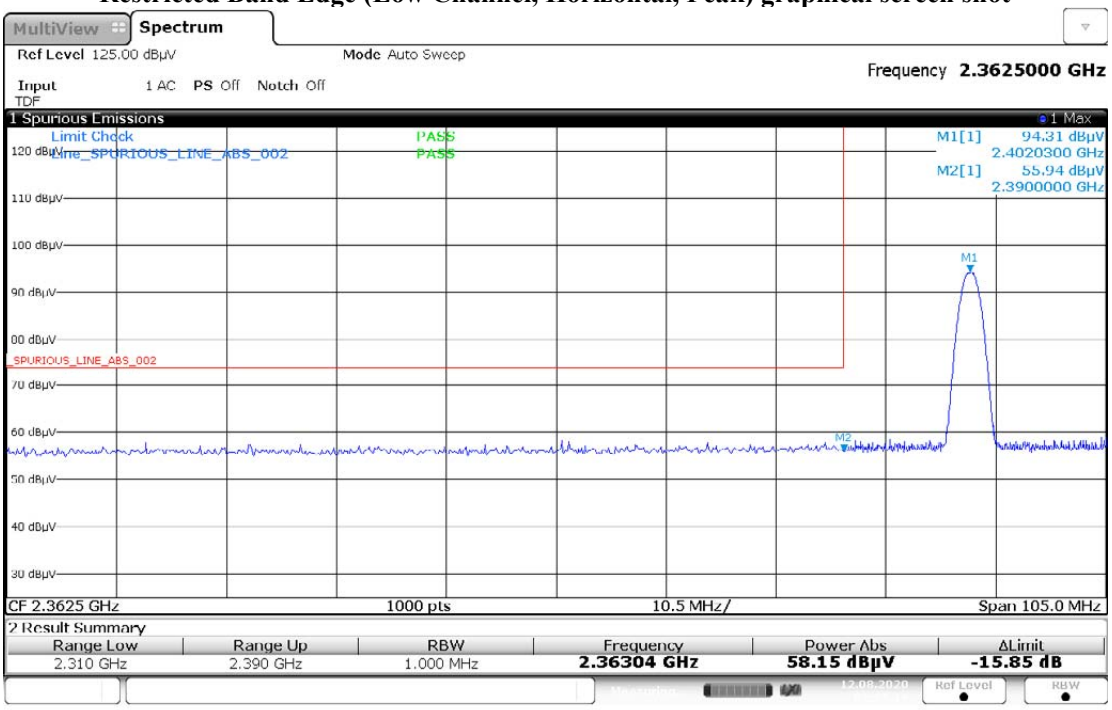
Temperature (degC):23.5 **Humidity (%): 70.3**
Test Performed by: Nazrin&Qawiman **Test Date: Wed, Aug 12, 2020**
System MU: 4.03dB

Restricted Band Edge (Low Channel, Vertical, Peak) graphical screen shot



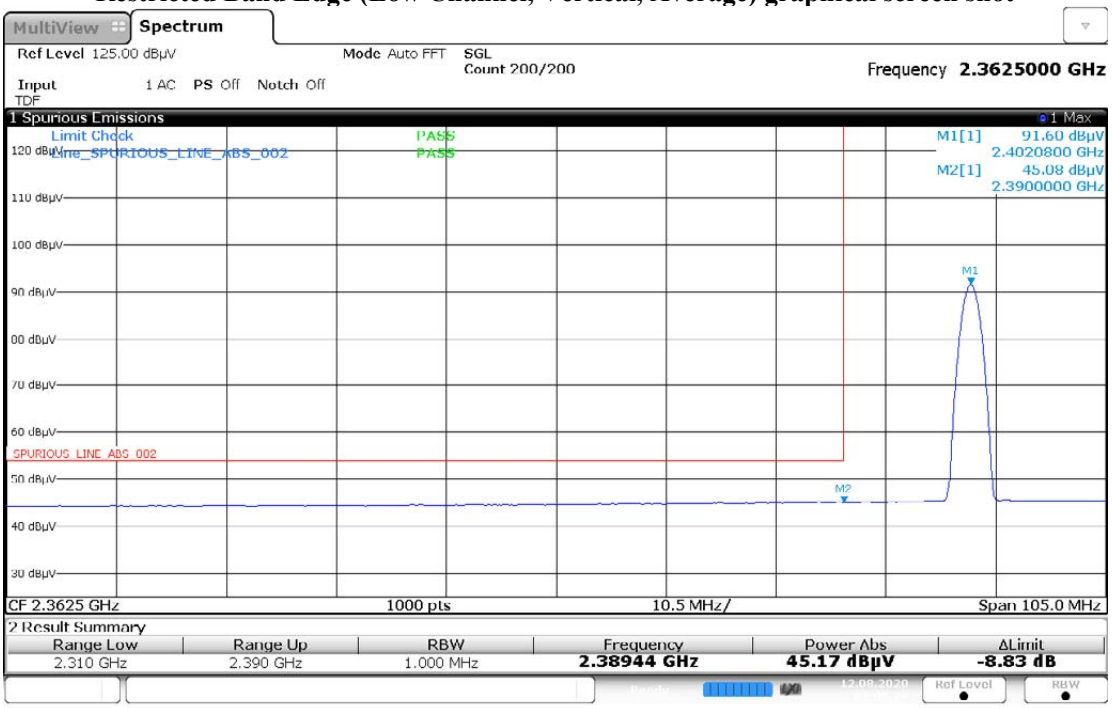
02:19:45 12.08.2020

Restricted Band Edge (Low Channel, Horizontal, Peak) graphical screen shot



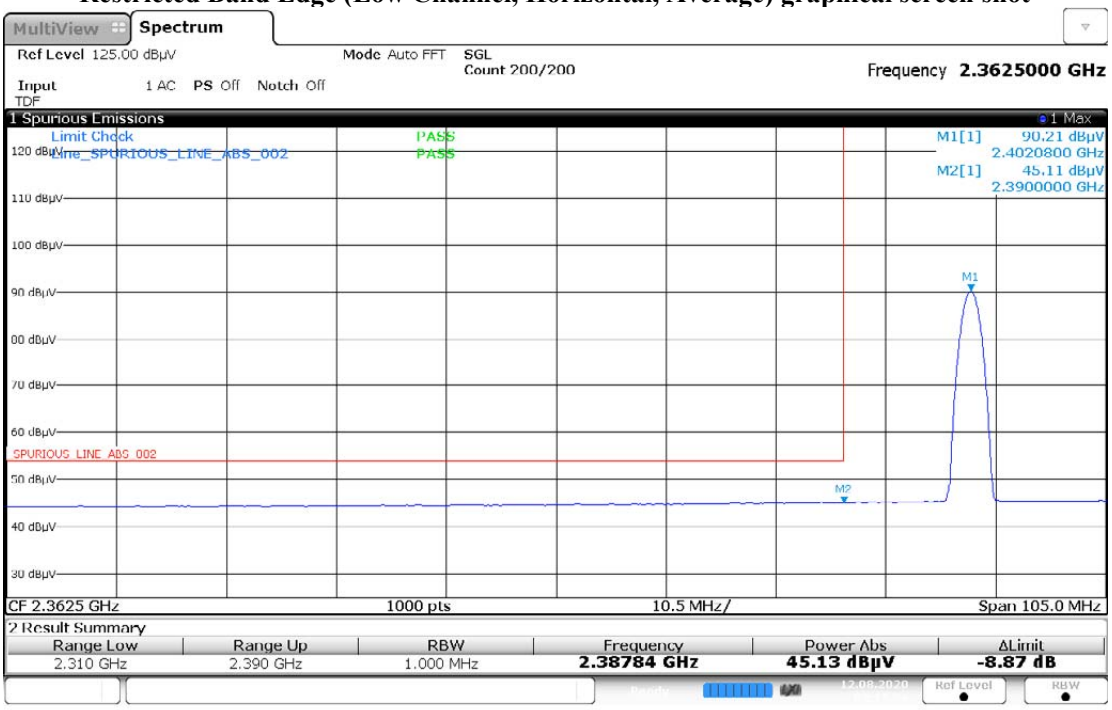
02:23:19 12.08.2020

Restricted Band Edge (Low Channel, Vertical, Average) graphical screen shot



02:08:30 12.08.2020

Restricted Band Edge (Low Channel, Horizontal, Average) graphical screen shot



02:13:05 12.08.2020

Test: Bluetooth SAC Restricted Band Edge
Model Number: AAH90ZDU9RH1AN S/N: 734TWP0311 EMC SR ID#: 18058-EMC-00037
Battery: PMNN4804A Accessory: AN000348A01
Test Channel: High Test Frequency: 2480.0000 MHz Test Standard: ANSI C63.10-2013
Worst Case Plane: Z-Plane (DQPSK)

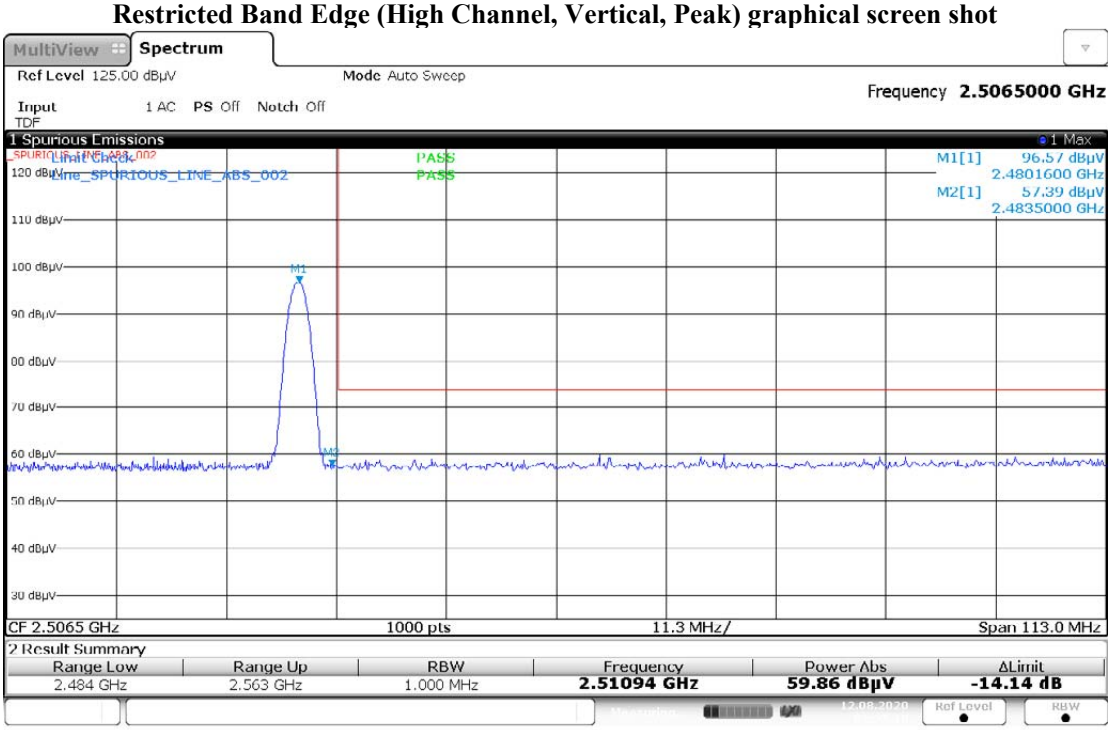
Restricted Band Edge (High Channel) tabular data

Vertical Radiated Emission Result										
Spur Freq (MHz)	Spur level QPK (dBµV/m)	Spur level PK (dBµV/m)	Spur level AV (dBµV/m)	Limit QPK (dBµV/m)	Limit PK (dBµV/m)	Limit AV (dBµV/m)	Margin QPK (dBµV/m)	Margin PK (dBµV/m)	Margin AV (dBµV/m)	Carrier PK Power (dBµV/m)
2483.5000	-	57.3854	45.7488	-	74.0000	54.0000	-	-16.6146	-8.2512	-
Horizontal Radiated Emission Result										
2483.5000	-	57.6954	45.6602	-	74.0000	54.0000	-	-16.3046	-8.3398	-

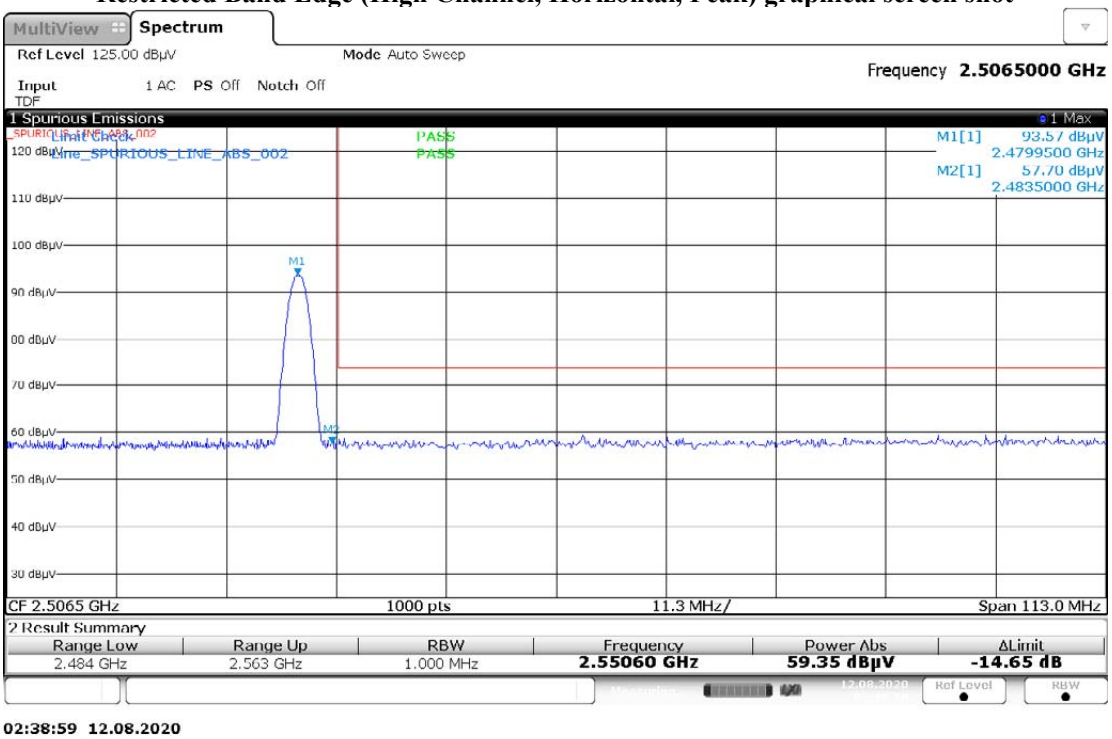
Remarks: Pass Result	Marginal Result	Fail Result

Temperature (degC):23.5 **Humidity (%): 70.3**
Test Performed by: Nazrin&Qawiman **Test Date: Wed, Aug 12, 2020**
System MU: 4.03dB

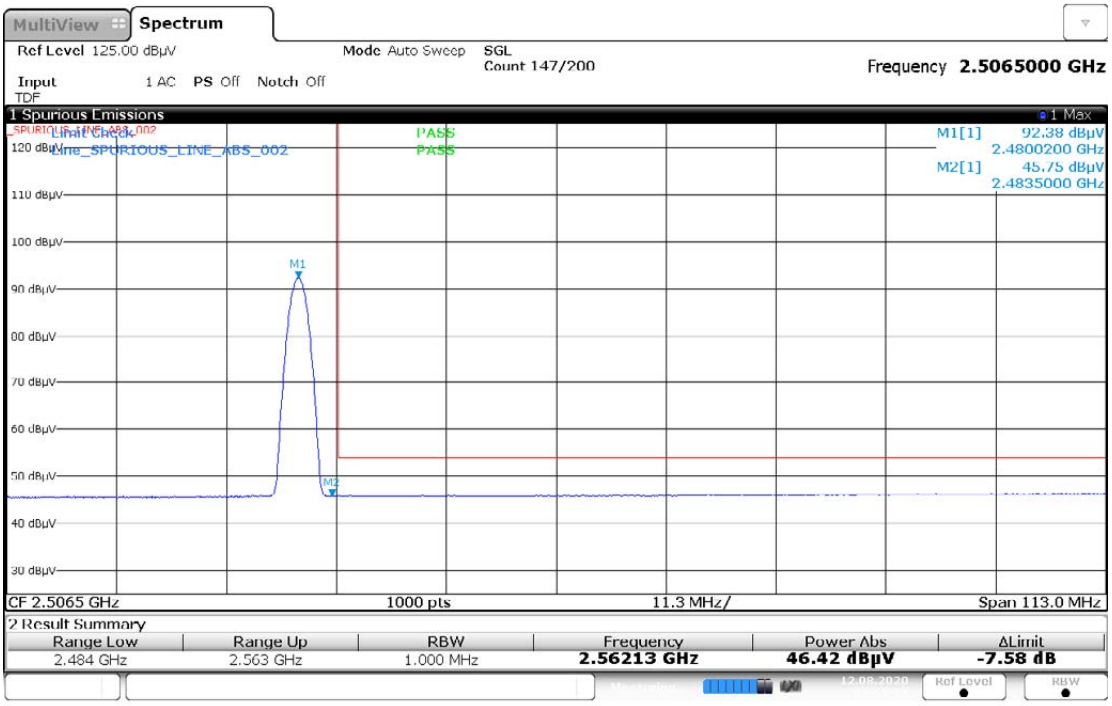
Restricted Band Edge (High Channel, Vertical, Peak) graphical screen shot



Restricted Band Edge (High Channel, Horizontal, Peak) graphical screen shot

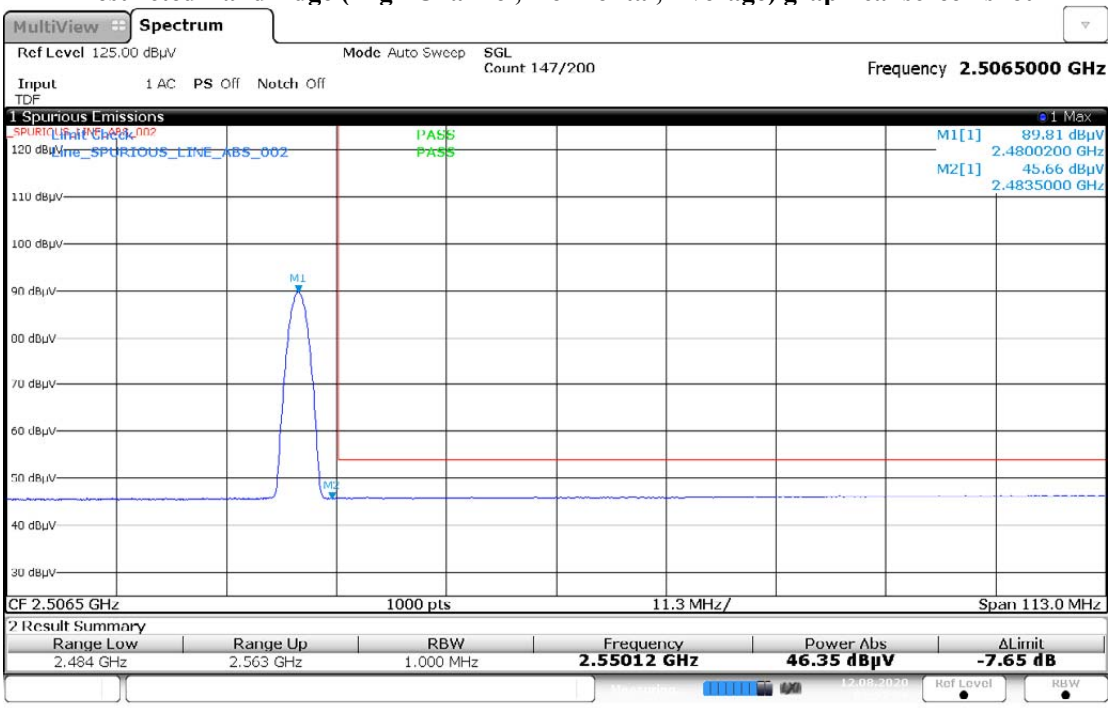


Restricted Band Edge (High Channel, Vertical, Average) graphical screen shot



02:52:25 12.08.2020

Restricted Band Edge (High Channel, Horizontal, Average) graphical screen shot



02:57:10 12.08.2020

Test: Bluetooth SAC Restricted Band Edge
Model Number: AAH90ZDU9RH1AN S/N: 734TWP0311 EMC SR ID#: 18058-EMC-00037
Battery: PMNN4804A Accessory: AN000348A01
Test Channel: Low Test Frequency: 2402.0000 MHz Test Standard: ANSI C63.10-2013
Worst Case Plane: Z-Plane (8DPSK)

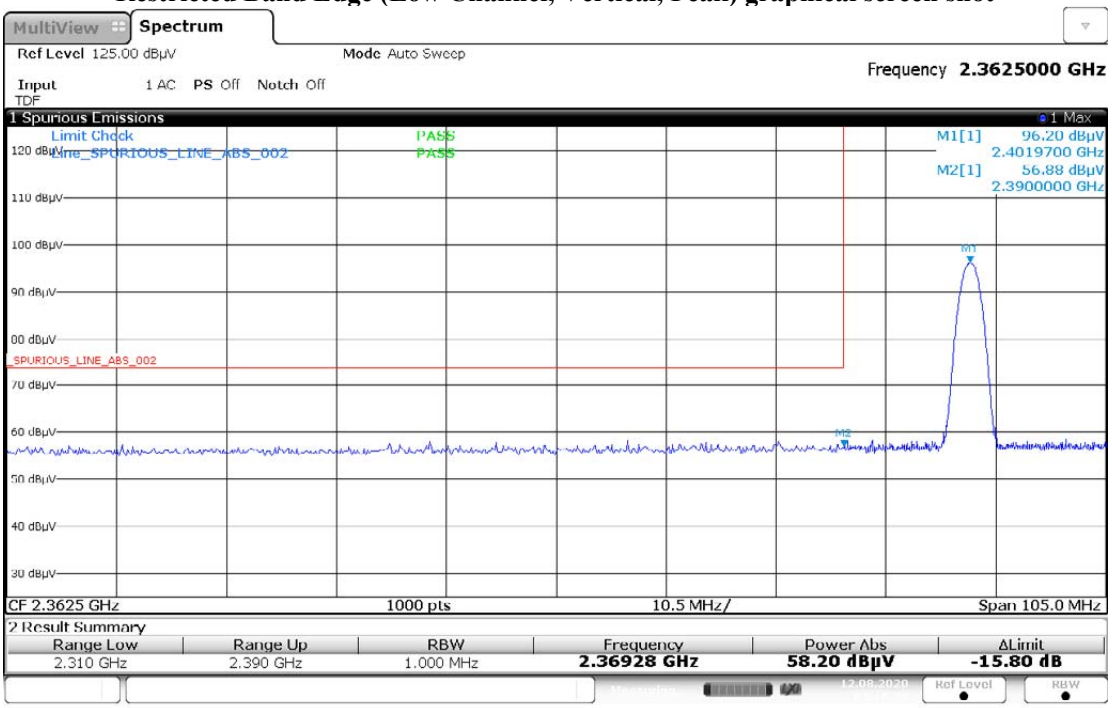
Restricted Band Edge (Low Channel) tabular data

Vertical Radiated Emission Result										
Spur Freq (MHz)	Spur level QPK (dBµV/m)	Spur level PK (dBµV/m)	Spur level AV (dBµV/m)	Limit QPK (dBµV/m)	Limit PK (dBµV/m)	Limit AV (dBµV/m)	Margin QPK (dBµV/m)	Margin PK (dBµV/m)	Margin AV (dBµV/m)	Carrier PK Power (dBµV/m)
2390.0000	-	56.8823	45.0961	-	74.0000	54.0000	-	-17.1177	-8.9039	-
Horizontal Radiated Emission Result										
2390.0000	-	56.9166	45.0929	-	74.0000	54.0000	-	-17.0834	-8.9071	-

Remarks: Pass Result	Marginal Result	Fail Result

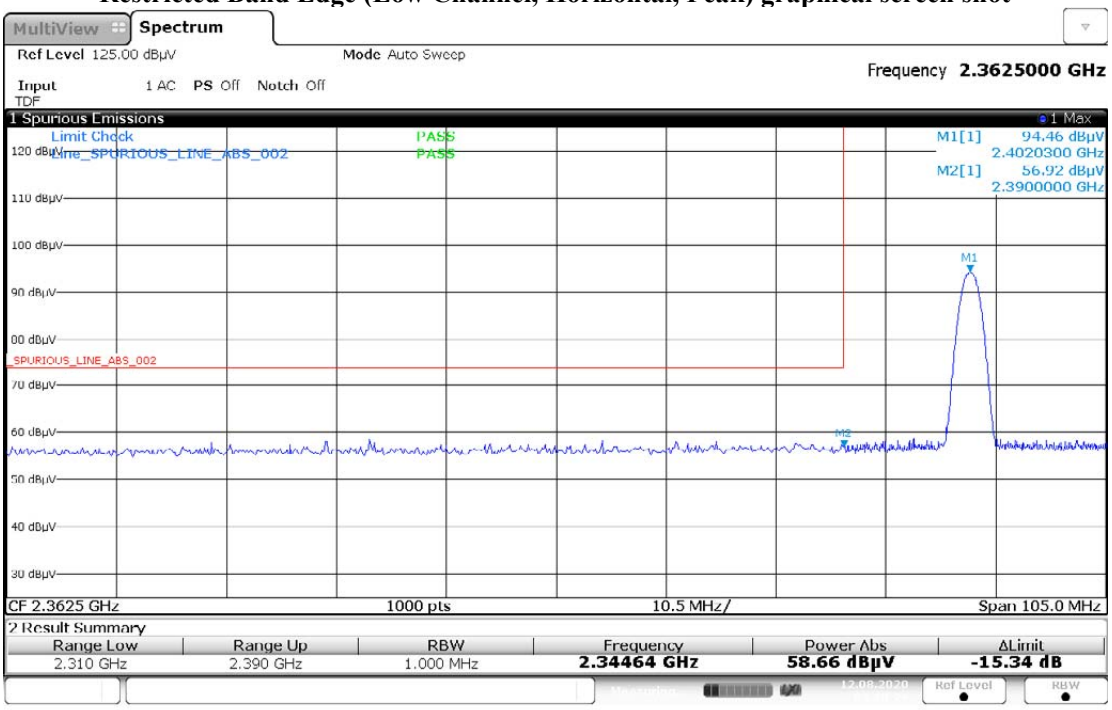
Temperature (degC):23.5 **Humidity (%): 70.3**
Test Performed by: Nazrin&Qawiman **Test Date: Wed, Aug 12, 2020**
System MU: 4.03dB

Restricted Band Edge (Low Channel, Vertical, Peak) graphical screen shot



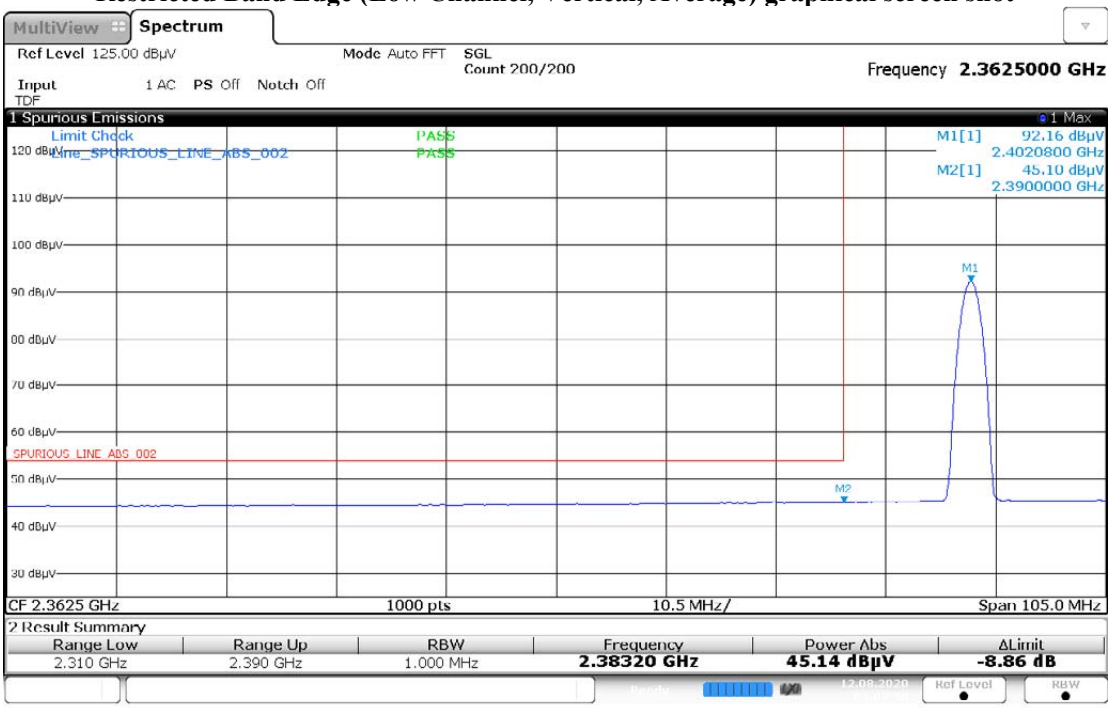
03:16:33 12.08.2020

Restricted Band Edge (Low Channel, Horizontal, Peak) graphical screen shot



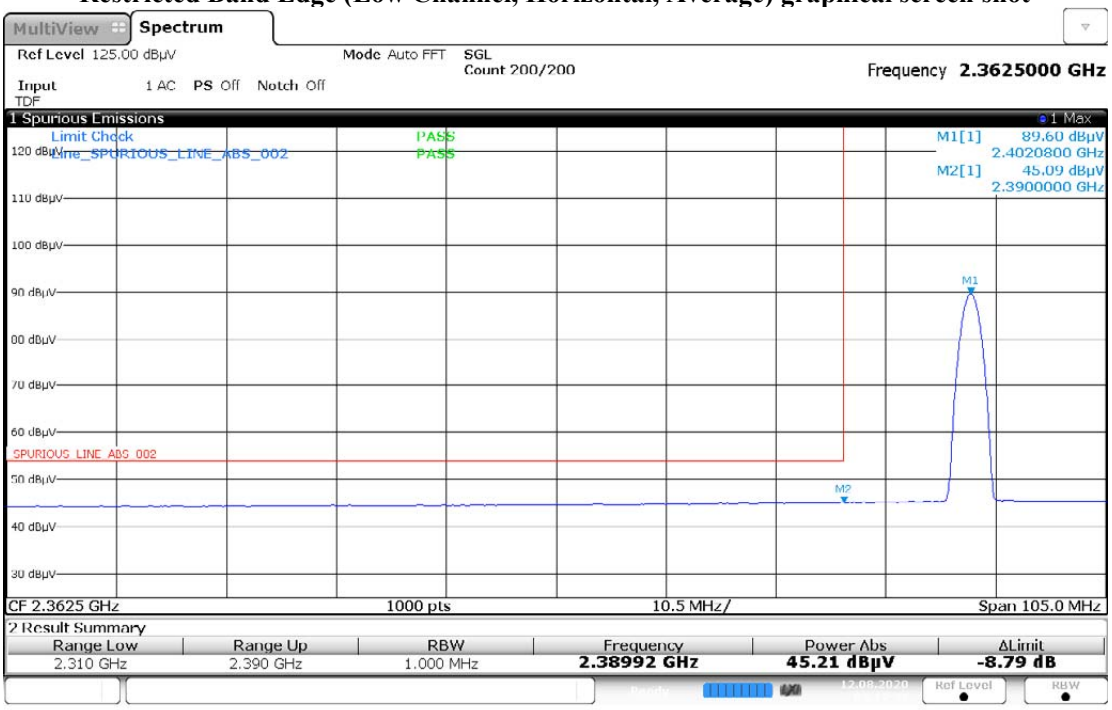
03:20:29 12.08.2020

Restricted Band Edge (Low Channel, Vertical, Average) graphical screen shot



03:07:39 12.08.2020

Restricted Band Edge (Low Channel, Horizontal, Average) graphical screen shot



03:12:32 12.08.2020

Test: Bluetooth SAC Restricted Band Edge
Model Number: AAH90ZDU9RH1AN S/N: 734TWP0311 EMC SR ID#: 18058-EMC-00037
Battery: PMNN4804A Accessory: AN000348A01
Test Channel: High Test Frequency: 2480.0000 MHz Test Standard: ANSI C63.10-2013
Worst Case Plane: Z-Plane (8DPSK)

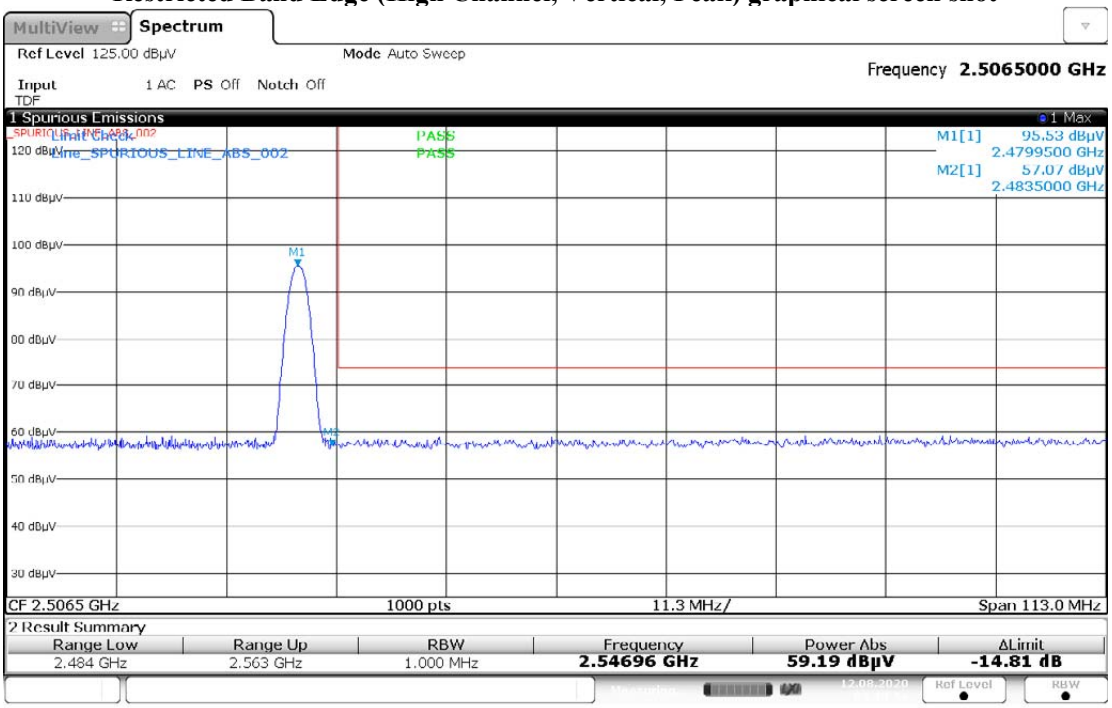
Restricted Band Edge (High Channel) tabular data

Vertical Radiated Emission Result										
Spur Freq (MHz)	Spur level QPK (dBµV/m)	Spur level PK (dBµV/m)	Spur level AV (dBµV/m)	Limit QPK (dBµV/m)	Limit PK (dBµV/m)	Limit AV (dBµV/m)	Margin QPK (dBµV/m)	Margin PK (dBµV/m)	Margin AV (dBµV/m)	Carrier PK Power (dBµV/m)
2483.5000	-	57.0736	45.8240	-	74.0000	54.0000	-	-16.9264	-8.1760	-
Horizontal Radiated Emission Result										
2483.5000	-	57.0570	45.7425	-	74.0000	54.0000	-	-16.9430	-8.2575	-

Remarks: Pass Result	Marginal Result	Fail Result

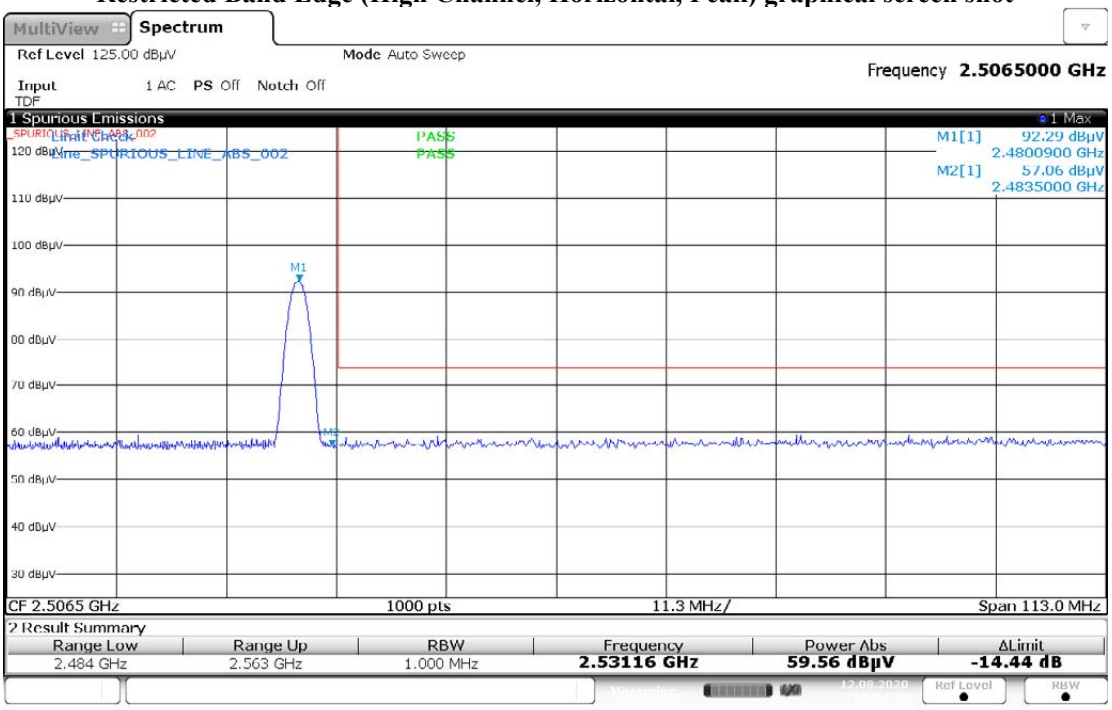
Temperature (degC):23.5 **Humidity (%): 70.3**
Test Performed by: Nazrin&Qawiman **Test Date: Wed, Aug 12, 2020**
System MU: 4.03dB

Restricted Band Edge (High Channel, Vertical, Peak) graphical screen shot



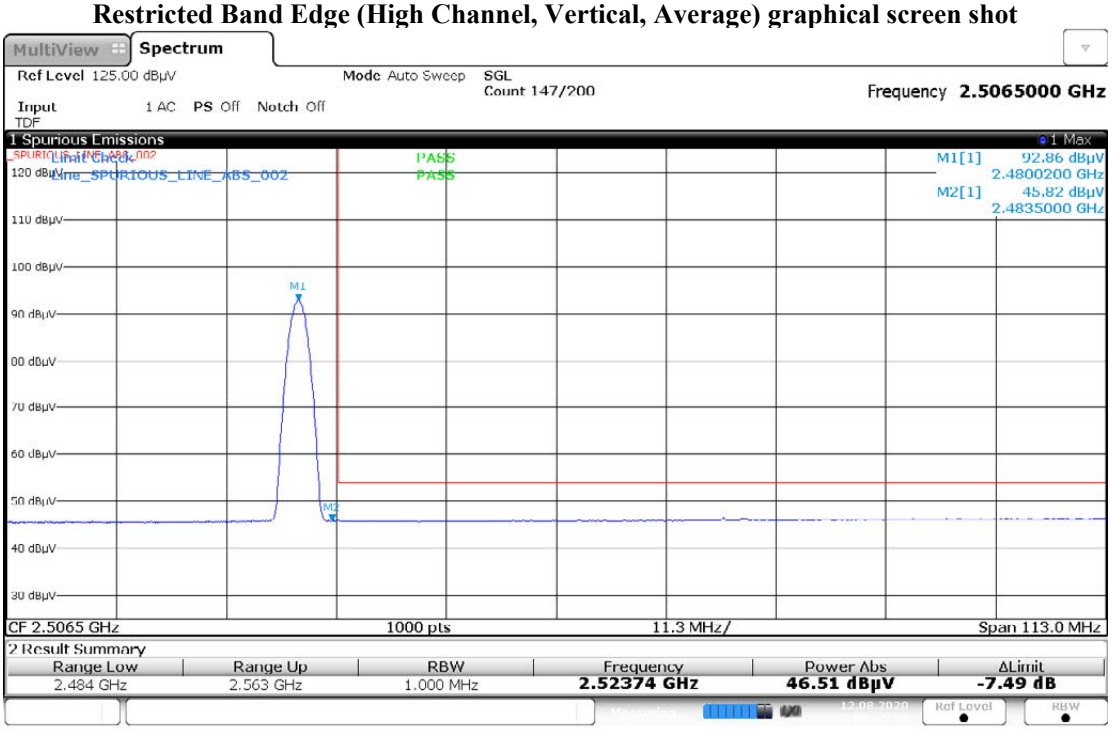
03:30:54 12.08.2020

Restricted Band Edge (High Channel, Horizontal, Peak) graphical screen shot



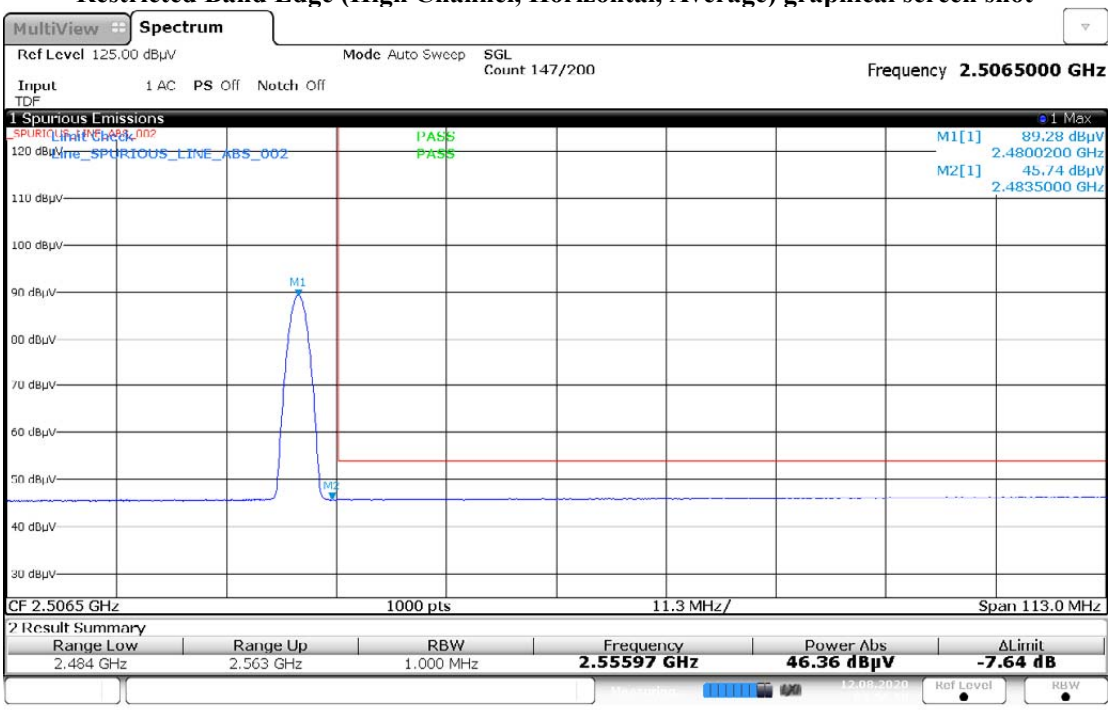
03:34:33 12.08.2020

Restricted Band Edge (High Channel, Vertical, Average) graphical screen shot



03:52:23 12.08.2020

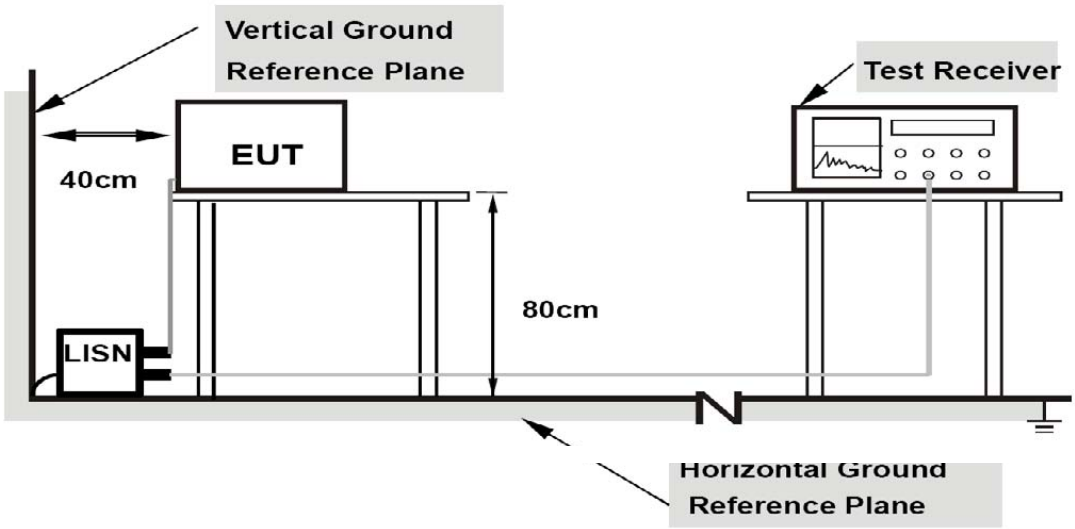
Restricted Band Edge (High Channel, Horizontal, Average) graphical screen shot



03:56:51 12.08.2020

6.9. AC Powerline Conducted Emission

6.9.1. Test Setup



1) Tests were conducted for both Receive and Transmit Mode of the EUT.
2) 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.
3) Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
4) The frequency range from 150 kHz to 30MHz was measured.

6.9.2. Test Limits:

For AC Power Line Conducted Test Limit can be Class A or B depends on product classification.

Limits for conducted disturbance at the mains ports of class A ITE

Frequency range MHz	Limits dB(µV)	
	Quasi-peak	Average
0,15 to 0,50	79	66
0,50 to 30	73	60
NOTE The lower limit shall apply at the transition frequency.		

Table 1: Limits for Conducted Disturbance at the Mains Ports of Class A ITE.

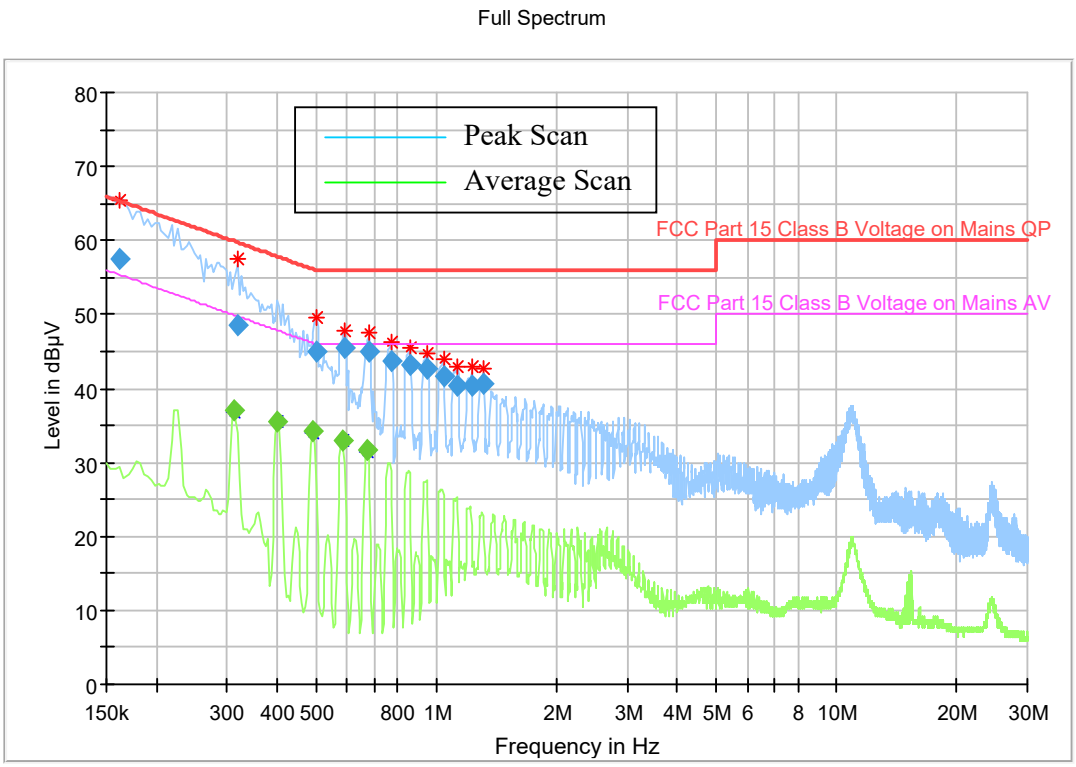
Limits for conducted disturbance at the mains ports of class B ITE

Frequency range MHz	Limits dB(µV)	
	Quasi-peak	Average
0,15 to 0,50	66 to 56	56 to 46
0,50 to 5	56	46
5 to 30	60	50
NOTE 1 The lower limit shall apply at the transition frequencies. NOTE 2 The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.		

Table 2: Limits for Conducted Disturbance at the Mains Ports of Class B ITE

6.9.3. Test Result

1) Charging with Radio in BT Transmit Mode (SUC)

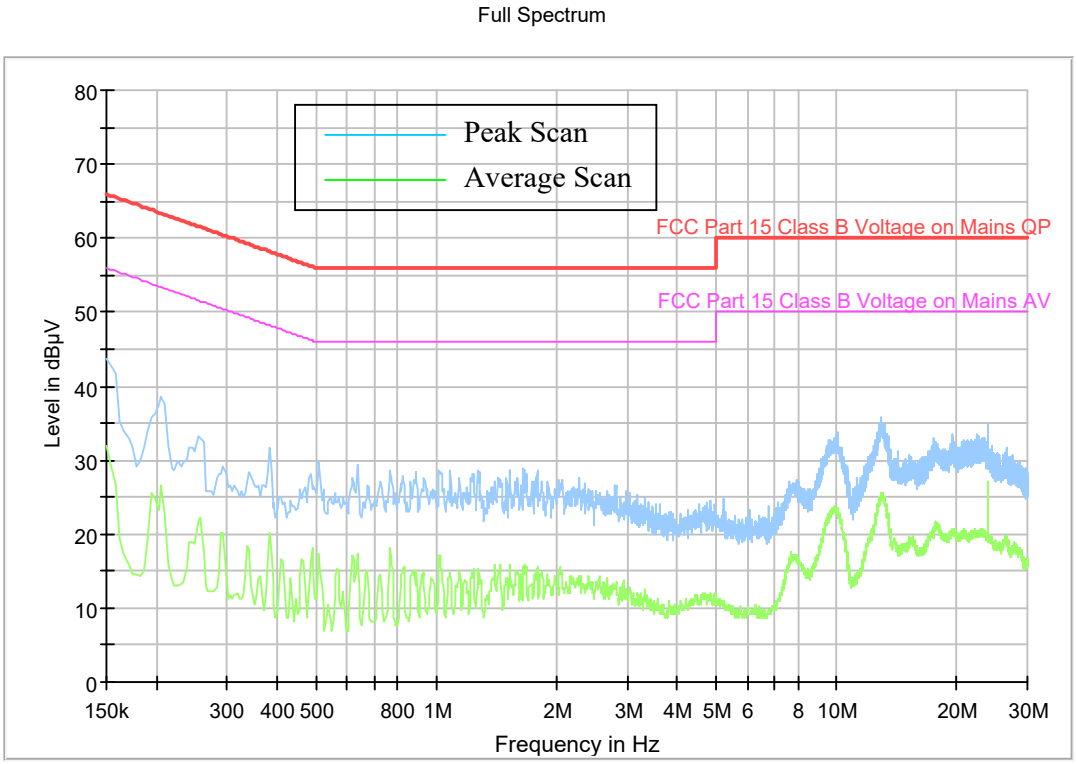


Quasipeak and Average Measurement

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)	Comment
0.162000	57.44	---	65.36	7.92	1000.0	9.000	N	ON	9.7	PASS
0.314000	---	37.18	49.86	12.69	1000.0	9.000	L1	ON	9.6	PASS
0.318000	48.49	---	59.76	11.27	1000.0	9.000	L1	ON	9.6	PASS
0.402000	---	35.65	47.81	12.16	1000.0	9.000	L1	ON	9.6	PASS
0.494000	---	34.33	46.10	11.77	1000.0	9.000	L1	ON	9.6	PASS
0.502000	44.96	---	56.00	11.04	1000.0	9.000	L1	ON	9.6	PASS
0.582000	---	32.98	46.00	13.02	1000.0	9.000	L1	ON	9.6	PASS
0.590000	45.54	---	56.00	10.46	1000.0	9.000	L1	ON	9.6	PASS
0.670000	---	31.60	46.00	14.40	1000.0	9.000	L1	ON	9.6	PASS
0.682000	44.93	---	56.00	11.07	1000.0	9.000	L1	ON	9.6	PASS
0.770000	43.67	---	56.00	12.33	1000.0	9.000	L1	ON	9.6	PASS
0.862000	43.13	---	56.00	12.87	1000.0	9.000	L1	ON	9.6	PASS
0.954000	42.59	---	56.00	13.41	1000.0	9.000	L1	ON	9.6	PASS
1.046000	41.70	---	56.00	14.30	1000.0	9.000	L1	ON	9.6	PASS
1.134000	40.42	---	56.00	15.58	1000.0	9.000	N	ON	9.6	PASS
1.226000	40.48	---	56.00	15.52	1000.0	9.000	N	ON	9.6	PASS
1.318000	40.57	---	56.00	15.43	1000.0	9.000	N	ON	9.6	PASS

*** Expanded Uncertainty (U) = +/- 3.43dB**

2) Charging with Radio in BT Transmit Mode (MUC)



END OF TEST REPORT