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.B

Date/s Tested	:	09-December-2019 to 11-December-2019
Report Issue Date	:	17-December-2019
Manufacturer/Location	:	Motorola Solution Malaysia Sdn Bhd
Requestor	:	SZE KEAT NG
Product Type (PMN)	:	Portable
Model Number (HVIN)	:	H98QDH9PW7BN
Frequency Band	:	2.412-2.462 GHz
Rated / Max RF Output Power	:	802.11b - 31.6 mWatts / 63.1 mWatts 802.11g - 12.5 mWatts / 25.1 mWatts 802.11n (HT20) - 12.5 mWatts / 15.5 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)	:	D20.55.25

The equipment was tested accordance to the requirement listed below:

((2.4GHz Wifi) **PASS**
47CFR Part 15C
ISED RSS 247 Issue 2
February 2017

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Prepared By:

Mohd Helmy Shamsudddin
Test Personnel

Approved Signatory:

Ho Sze Khian
Responsible Engineer

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REVISION HISTORY

Revision History	Description	Date	Originator
Rev. A	Initial Report	**17-Dec-2019**	**Azil Ezzaddin Khalil**
Rev. B	Updated: 1) Applicant Name 2) Applicant Address 3) Changed wording: Approved by: to Approved Signatory:	**20-Feb-2020**	**Mohd Helmy Shamsuddin**

1.0. General Information

EUT Description:

Technologies	2.4GHz Wi-Fi
TX Frequency range	2412MHz – 2462MHz
Modulation Type	DSSS, OFDM
Input/Output	RF Port
Connector type	PROGRAMMING, TEST & ALIGNMENT CABLE
Antenna type	INTERNAL BT/WLAN ANTENNA (RADIO ONLY),
No. of Antenna	1
Antenna Gain	2.0DBI
MIMO supported	No

The EUT contains following accessory devices and data cable:

Item	**Brand**	**Model or P/N**
BATT IMP STD DELTA T RUGGED LIION 5000T	MOTOROLA	PMNN4494A
Antenna U1/GPS STUBBY 380-472MHz, 1575MHz	MOTOROLA	FAF5259A

Channel number and frequency information:

There are two bandwidth systems.
For 20MHz Bandwidth systems (802.11b, 802.11g, 802.11n), use channel 1 ~ channel 11
For 40MHz Bandwidth systems (802.11n), use channel 3 ~ channel 9

Channel	Frequency	Channel	Frequency
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437		

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:

FCC 47 CFR Part 15 Subpart C
KDB 558074 D01 15.247 Meas Guidance v05
ANSI C63.10-2013

A pigtail was soldered out of the Bluetooth/WiFi subsection to allow for conducted tests in this report.

Deviation from standard

Not applicable as no deviation from standard test method

2.0. Summary of Test Results

FCC Clause	ISED Clause	Test Item	Result	Remark	Serial number tested
15.205, 15.209, 15.247 (d)	RSS-247 5.5	Radiated Emission within Restricted Bands	Pass	Evaluate on worst case channel from SR05882-EMC-00065	756TVX0059
15.207	RSS-Gen 8.8	AC Powerline Conducted Emission	NA	Not Performed.	Not Performed.
15.203	-	Antenna Requirement	NA	No antenna connector is used.	Not Performed.

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

4.0. Equipment List

Radiated Emission Station (SW Version: EMC FCC RE v1.6.0)

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 (0-60V / 0-50A, 1000W)	6032A	MY41001736	25-May-19	25-May-20
SIGNAL GENERATOR	SMB 100A	181117	8-Nov-18	8-Nov-21
EMI TEST RECEIVER	ESW44	101750	24-Jul-19	24-Jul-20
EMI TEST RECEIVER	ESIB26	100017	19-Jul-19	19-Jul-20
5m Semi-anechoic Chamber	S800-HX	J2308	No Cal. Req'd	No Cal. Req'd
BILOG ANTENNA	CBL6112D	30991	5-Aug-19	5-Aug-20
BILOG ANTENNA	CBL6112B	2964	16-Feb-18	16-Feb-20
DATA LOGGER	SDL500	A.016800	19-Mar-19	18-Mar-20
SYSTEM CONTROLLER	SC104V	050806-1	No Cal. Req'd	No Cal. Req'd
TURNTABLE FLUSH MOUNT 2M	FM2011	NA	No Cal. Req'd	No Cal. Req'd
ANTENNA POSITIONING TOWER	TLT2	NA	No Cal. Req'd	No Cal. Req'd
BROAD-BAND HORN ANTENNA	BBHA9170	BBHA9170255	21-Dec-18	21-Dec-19
18 - 40GHz PREAMPLIFIER	Miteq Hi Gain Sucoflex	001	No Cal. Req'd	No Cal. Req'd
PREAMPLIFIER	PAM-0118	269	24-May-19	24-May-22
LOOP ANTENNA	6502	00208416	5-Sep-19	5-Sep-20
Test Software	EMC_FCC_IC_Bluetooth_RE_Test			
Version	EMC_FCC_RE_v1.6.1			

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	Modulation	Available Channel	Tested Channel	Modulation Technology	Data Modulation Type	Date Rate (Mbps)	Mode	Environmental Conditions
Test Mode	802.11n (HT20)	1 to 11	1	OFDM	BPSK	6.5	SISO	23.6°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	Modulation	Available Channel	Tested Channel	Modulation Technology	Data Modulation Type	Date Rate (Mbps)	Mode	Environmental Conditions
Test Mode	802.11n (HT20)	1 to 11	1	OFDM	BPSK	6.5	SISO	23.6°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.

EUT Configure Mode	Modulation	Available Channel	Tested Channel	Modulation Technology	Data Modulation Type	Date Rate (Mbps)	Environmental Conditions
Application Mode	802.11bgn mixed	1 to 11	AUTO	DSSS, OFDM	AUTO	AUTO	Not Performed.

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	Modulation	Available Channel	Tested Channel	Modulation Technology	Data Modulation Type	Data Rate (Mbps)	Mode	Environmental Conditions
Test Mode	802.11b	1 to 11	1,6,11	DSSS	QPSK	2	SISO	Not Performed.
Test Mode	802.11g	1 to 11	1,6,11	OFDM	BPSK	6	SISO	Not Performed.
Test Mode	802.11n (HT20)	1 to 11	1,6,11	OFDM	BPSK	6.5	SISO	Not Performed.

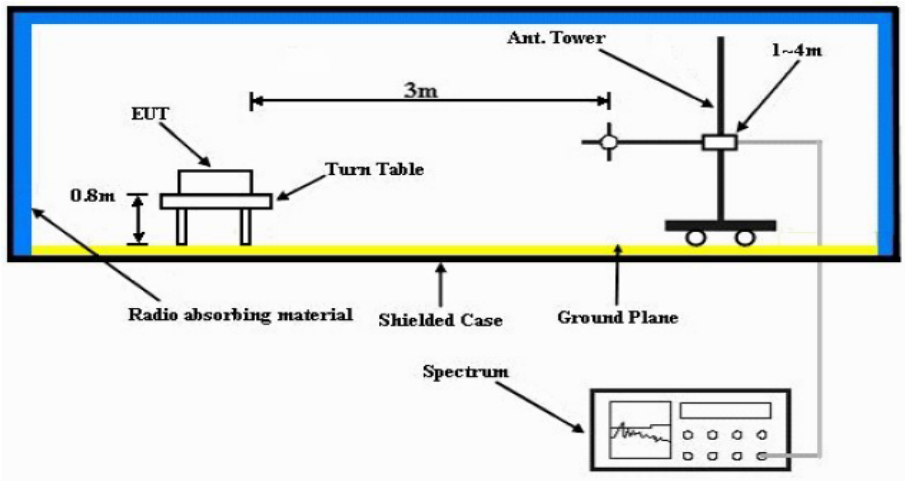
Duty Cycle of Test Signal

802.11b: Duty cycle of test signal is ≥98%. (Refer to Clause 6.3 for duty cycle test signal)
802.11g and 802.11n (HT20 & HT40): Duty cycle of test signal is ≤98%. (Refer to Clause 6.3 for duty cycle test signal)

6.0. Transmitter Test Parameters

6.1. Radiated Emission within restricted Bands

6.1.1. Test Setup



a. The EUT is placed on the top of a rotating table 0.8m above the ground (<1GHz) and 1.5m above the ground (>1GHz) 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.

6.1.2. 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.

Test Data:

Motorola Solutions. **FCC ID: AZ489FT7077, IC ID: 109U-89FT7077**

Test: WIFI SAC Transmitter Radiated Emission
Model#: H98QDH9PW7BN S/N: 756TVX0059 EMC SR ID#: 03195-EMC-00099
Battery: PMNN4494A Accessory: FAF5259A
Test Channel: Low Test Frequency: 2412.0000 MHz Test Standard: ANSI C63.10-2013
Worst Case Plane: X-Plane (802.11n)

Radiated Emission (Low Channel) tabular data

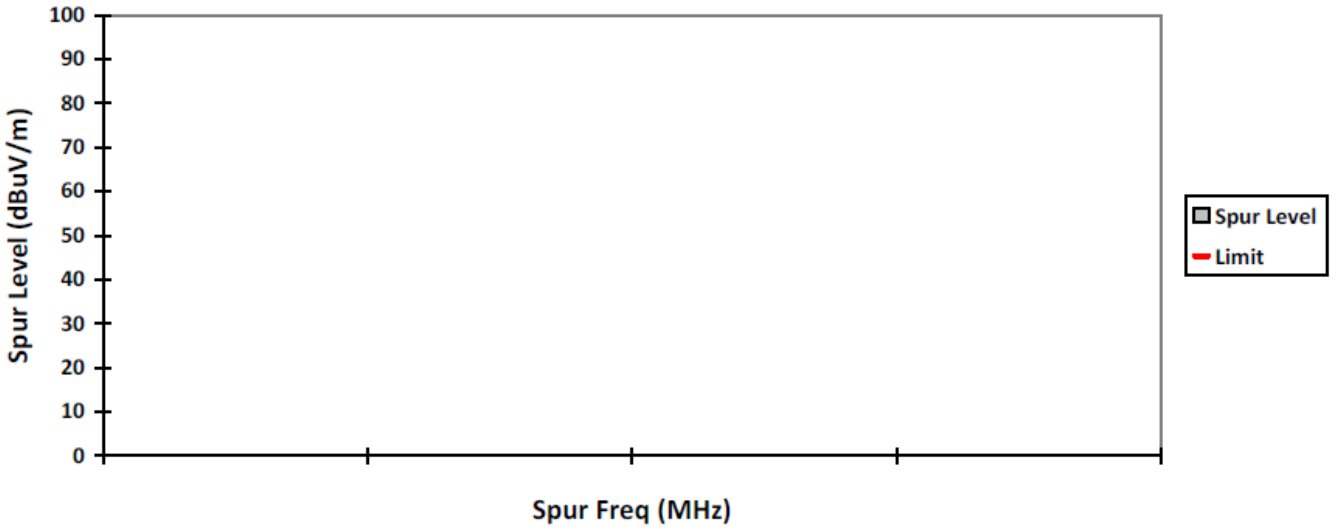
Vertical Radiated Emission Result										
Spur Freq (MHz)	Spur level QPK (dBµV/m)	Spur level PK (dBµV/m)	Spur level AV (dBµV/m)	Limit QPK (dBµV/m)	Limit PK (dBµV/m)	Limit AV (dBµV/m)	Margin QPK (dBµV/m)	Margin PK (dBµV/m)	Margin AV (dBµV/m)	Carrier PK Power (dBµV/m)
4824	-	42.0539**	**	-	74	54	-	31.95**	-	-
7236	-	45.8580**	**	-	74	54	-	28.14**	-	-
9648	-	49.6667**	**	-	74	54	-	24.33**	-	-
12060	-	51.8353**	**	-	74	54	-	22.16**	-	-
14472	-	54.2398**	**	-	74	54	-	19.76**	-	-
16884	-	56.4722**	**	-	74	54	-	17.53**	-	-
19296	-	34.9496**	**	-	74	54	-	39.05**	-	-
21708	-	34.6501**	**	-	74	54	-	39.35**	-	-
24120	-	34.3636**	**	-	74	54	-	39.64**	-	-
Horizontal Radiated Emission Result										
4824	-	41.8071**	**	-	74	54	-	32.19**	-	-
7236	-	45.8970**	**	-	74	54	-	28.10**	-	-
9648	-	49.1757**	**	-	74	54	-	24.82**	-	-
12060	-	51.6020**	**	-	74	54	-	22.40**	-	-
14472	-	53.7073**	**	-	74	54	-	20.29**	-	-
16884	-	56.3722**	**	-	74	54	-	17.63**	-	-
19296	-	33.9247**	**	-	74	54	-	40.08**	-	-
21708	-	33.9936**	**	-	74	54	-	40.01**	-	-
24120	-	34.4135**	**	-	74	54	-	39.59**	-	-

Remarks: Pass Result	Marginal Result	Fail Result

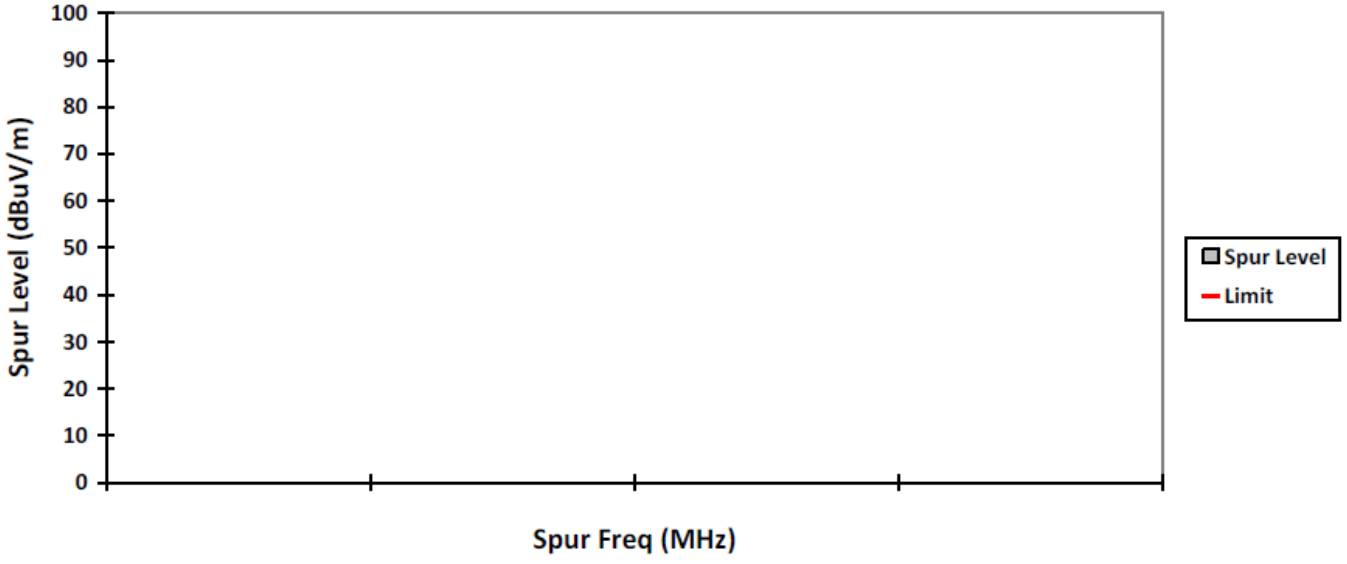
Temperature (degC): 23.6 **Humidity (%): 70.1**
Test Performed by: Nazrin&Qawiman **Test Date: Tue, Dec 10, 2019**
System MU: 5.01dB

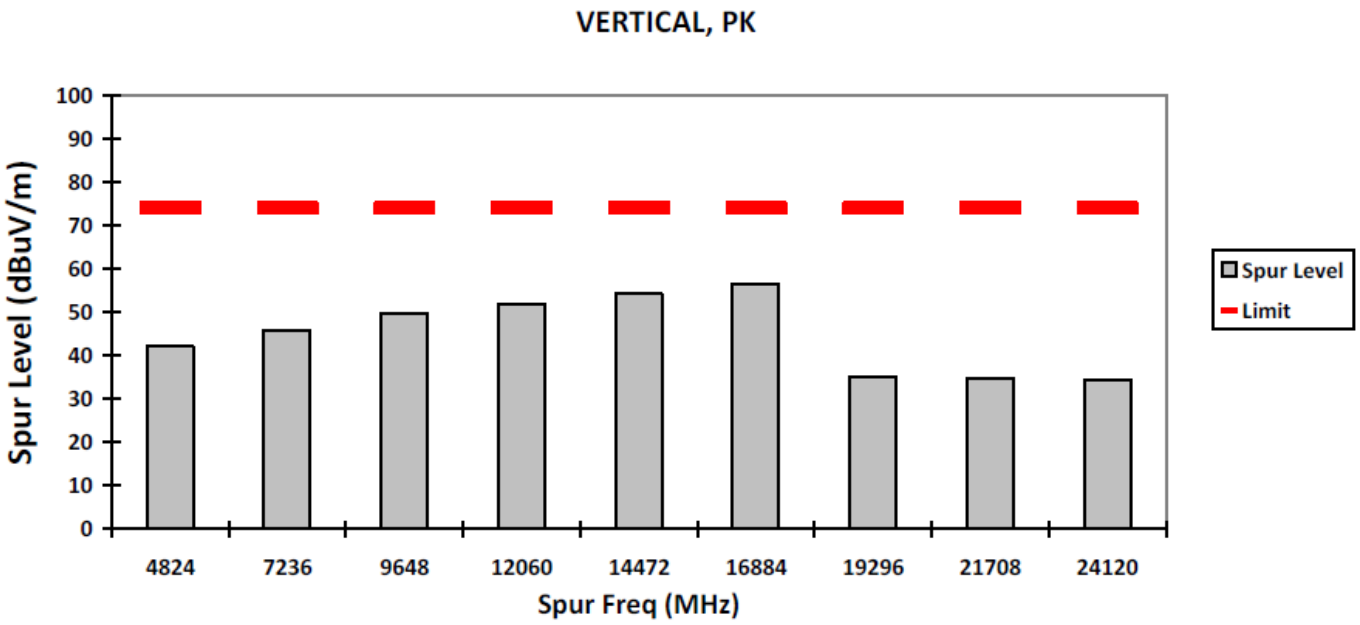
Remarks: ** Indicates the spurious emission could not be detected due to noise limitations or ambient.
***Pursuant to CFR 47 Part 2.1057 (c), emissions attenuated more than 20 dB below the permissible limit are not reported.**

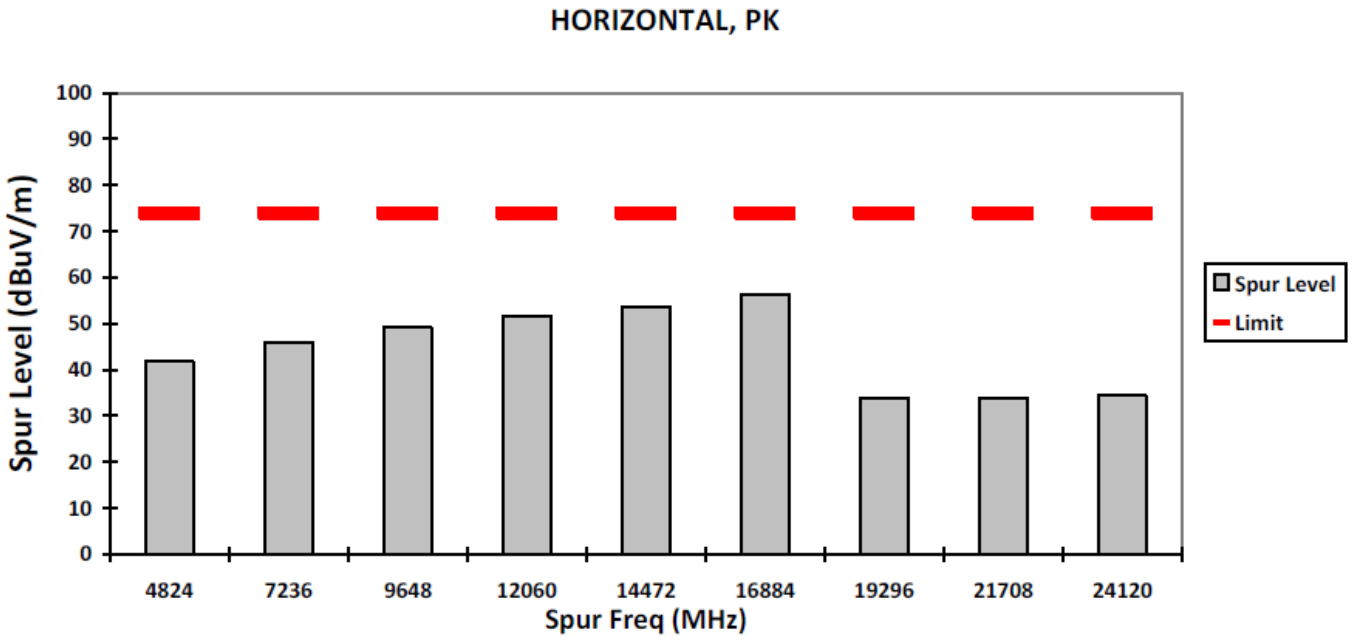
VERTICAL, QPK

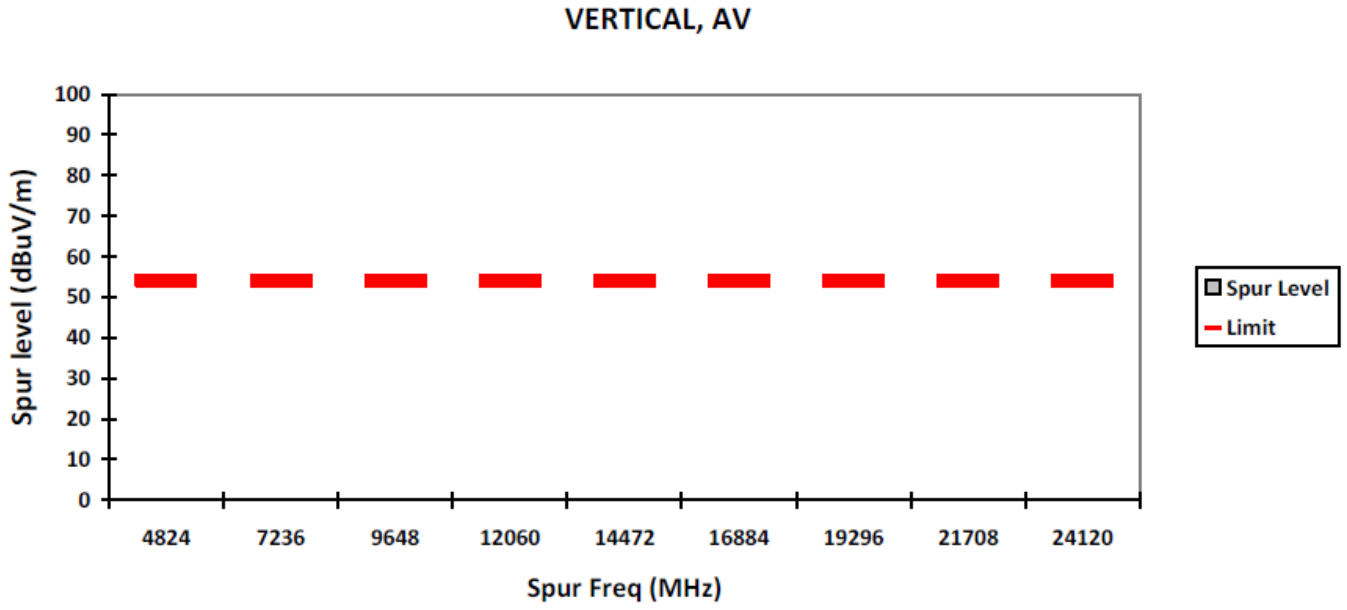


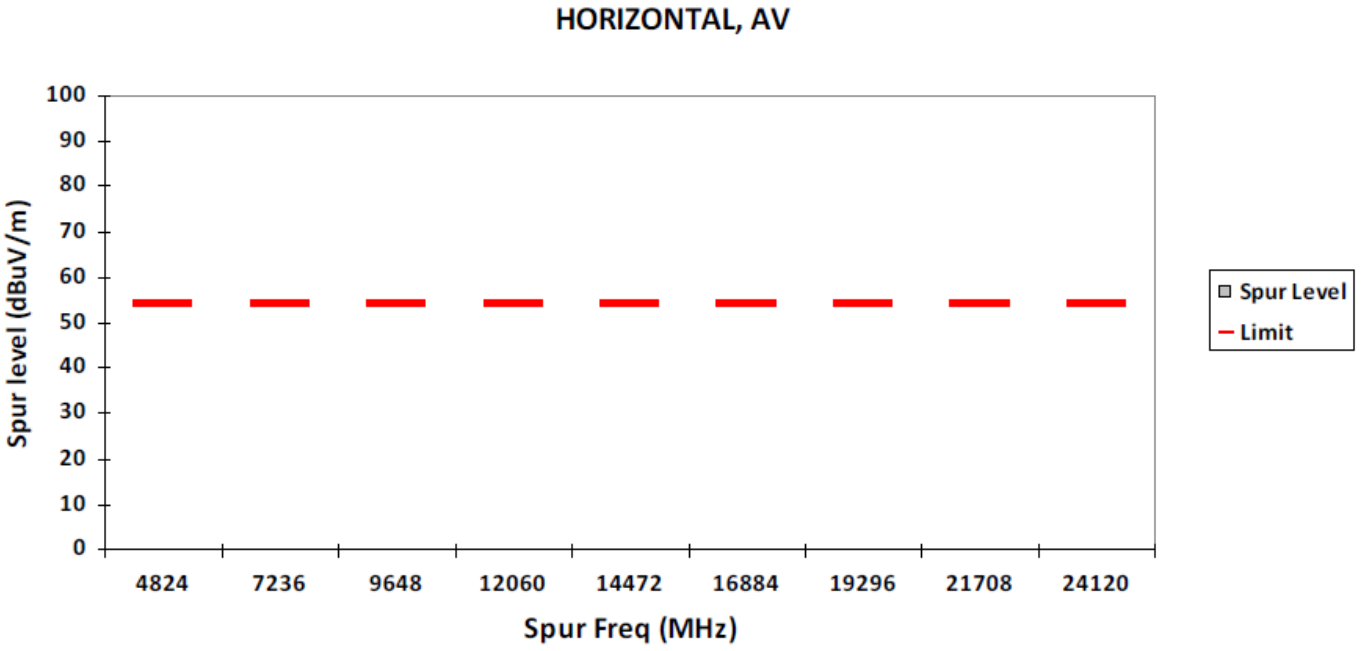
HORIZONTAL, QPK




VERTICAL, PK
Spur Level (dBuV/m)
100
90
80
70
60
50
40
30
20
10
0
4824
7236
9648
12060
14472
16884
19296
21708
24120
Spur Freq (MHz)
Spur Level
Limit

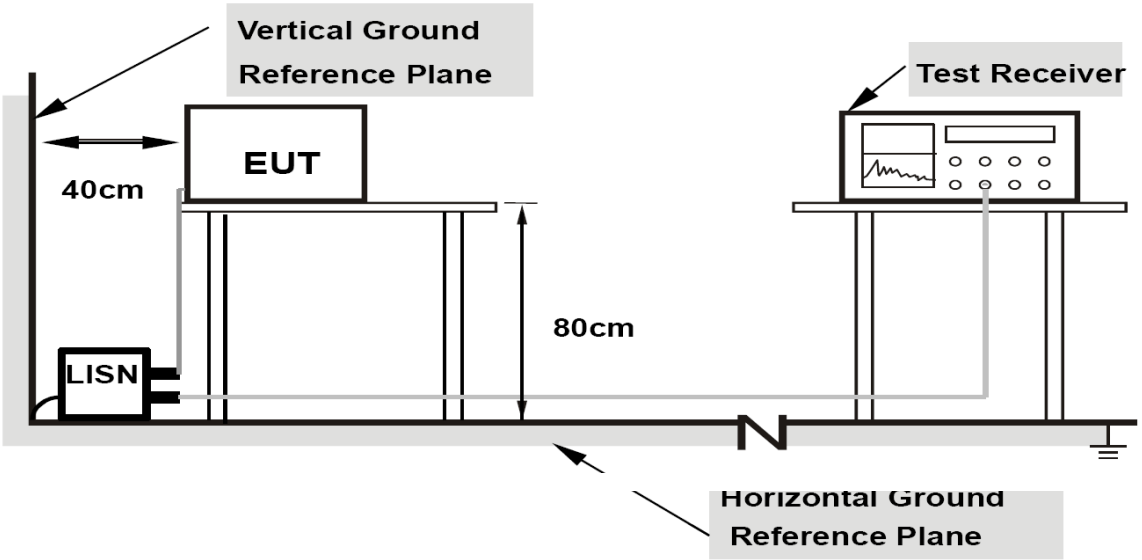

HORIZONTAL, PK
Spur Level (dBuV/m)
100
90
80
70
60
50
40
30
20
10
0
4824
7236
9648
12060
14472
16884
19296
21708
24120
Spur Freq (MHz)
Spur Level
Limit


VERTICAL, AV
Spur level (dBuV/m)
100
90
80
70
60
50
40
30
20
10
0
4824
7236
9648
12060
14472
16884
19296
21708
24120
Spur Freq (MHz)
Spur Level
Limit


HORIZONTAL, AV
Spur level (dBuV/m)
100
90
80
70
60
50
40
30
20
10
0
4824
7236
9648
12060
14472
16884
19296
21708
24120
Spur Freq (MHz)
Spur Level
Limit

AC Powerline Conducted Emission

6.1.3. 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.

6.1.4. 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

6.1.5. Test Result

Not Applicable. Testing is not required, radio shall turn off during charging mode

END OF TEST REPORT