

FCC Test Report

Report No.: RF170824C11F

FCC ID: RID-LM513

Test Model: LM-513H

Received Date: Mar. 22, 2018

Test Date: Nov. 01 ~ Dec. 20, 2017 (For Hybrid Mode (125kHz Bandwidth, 64 channels) & Hybrid Mode (500kHz Bandwidth, 8 channels))
May 14 ~ May 21, 2018 (For DTS Mode (500kHz Bandwidth, 42 channels))

Issued Date: May 23, 2018

Applicant: GlobalSat WorldCom Corporation

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FCC Registration / Designation Number: 788550 / TW0003



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Release Control Record

Issue No.	Description	Date Issued
RF170824C11F	Original release	May 23, 2018

1 Certificate of Conformity

Product: LoRa Module

Brand: GlobalSat

Test Model: LM-513H

Sample Status: Engineering Sample

Applicant: GlobalSat WorldCom Corporation

Test Date: Nov. 01 ~ Dec. 20, 2017 (For Hybrid Mode (125kHz Bandwidth, 64 channels) & Hybrid Mode (500kHz Bandwidth, 8 channels))
May 14 ~ May 21, 2018 (For DTS Mode (500kHz Bandwidth, 42 channels))

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

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by : Pettie Chen, **Date:** May 23, 2018
Pettie Chen / Senior Specialist

Approved by : Bruce Chen, **Date:** May 23, 2018
Bruce Chen / Project Engineer

2 Summary of Test Results

Hybrid Mode (125kHz Bandwidth, 64 channels)

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -16.89dB at 16.94736MHz.
15.247(a)(1)(i)	Number of Hopping Frequency Used	Pass	Meet the requirement of limit.
15.247(a)(1)(i)	Dwell Time on Each Channel	Pass	Meet the requirement of limit.
15.247(a)(1)(i)	Frequency Hopping Sequence Spread Spectrum System	Pass	Meet the requirement of limit.
15.247(a)(1)(i)	Minimum Number of Hopping Channels	N/A	Refer to Note
15.247(a)(2)	500 kHz Minimum Bandwidth	N/A	Refer to Note
15.247(b)(2)	Maximum Peak Output Power	Pass	Meet the requirement of limit.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -2.9dB at 252.08MHz.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	Antenna connector is SMA Reverse not a standard connector.

N/A: Not Applicable

Note: There is no requirement for this type of hybrid system to comply with the 500 kHz minimum bandwidth normally associated with a DTS transmission; and, there is no minimum number of hopping channels associated with this type of hybrid system.

Hybrid Mode (500kHz Bandwidth, 8 channels)

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -17.04dB at 16.94736MHz.
15.247(a)(1)(i)	Number of Hopping Frequency Used	Pass	Meet the requirement of limit.
15.247(a)(1)(i)	Dwell Time on Each Channel	Pass	Meet the requirement of limit.
15.247(a)(1)(i)	Frequency Hopping Sequence Spread Spectrum System	Pass	Meet the requirement of limit.
15.247(a)(1)(i)	Minimum Number of Hopping Channels	N/A	Refer to Note
15.247(a)(2)	500 kHz Minimum Bandwidth	N/A	Refer to Note
15.247(b)(2)	Maximum Peak Output Power	Pass	Meet the requirement of limit.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -0.8dB at 1818.80MHz.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	Antenna connector is SMA Reverse not a standard connector.

N/A: Not Applicable

Note: There is no requirement for this type of hybrid system to comply with the 500 kHz minimum bandwidth normally associated with a DTS transmission; and, there is no minimum number of hopping channels associated with this type of hybrid system.

DTS Mode (500kHz Bandwidth, 42 channels)

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -16.28dB at 0.53318MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -4.7dB at 57.07MHz.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.247(a)(2)	6dB bandwidth	Pass	Meet the requirement of limit.
15.247(b)	Conducted power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	Antenna connector is SMA Reverse not a standard connector.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) ($\pm$)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.94 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	3.63 dB
	200MHz ~ 1000MHz	3.64 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	LoRa Module	
Brand	GlobalSat	
Test Model	LM-513H	
Sample Status	Engineering Sample	
Power Supply Rating	5.0Vdc from host equipment	
Modulation Type	FSK, GFSK and OOK	
Transfer Rate	21.9kbps	
Operating Frequency	902.3~914.9MHz (Hybrid Mode 125kHz Bandwidth) 903~914.2MHz (Hybrid Mode 500kHz Bandwidth) 902.9~927.5MHz (DTS Mode 500kHz Bandwidth)	
Number of Channel	Hybrid Mode (125kHz Bandwidth, 64 channels)	64
	Hybrid Mode (500kHz Bandwidth, 8 channels)	8
	DTS Mode (500kHz Bandwidth, 42 channels)	42
Channel Spacing	Hybrid Mode (125kHz Bandwidth, 64 channels)	0.2MHz
	Hybrid Mode (500kHz Bandwidth, 8 channels)	1.6MHz
	DTS Mode (500kHz Bandwidth, 42 channels)	0.6MHz
Output Power	Hybrid Mode (125kHz Bandwidth, 64 channels)	84.140mW
	Hybrid Mode (500kHz Bandwidth, 8 channels)	85.507mW
	DTS Mode (500kHz Bandwidth, 42 channels)	58.749mW
Antenna Type	Refer to Note	
Antenna Connector	Refer to Note	
Accessory Device	Antenna (Refer to Note) (Option)	
Cable Supplied	NA	

Note:

1. This report is prepared for FCC class II permissive change. The difference compared with original report is adding new frequency band (Digital Transmission System: 902.9~927.5MHz). All tests had been tested.
2. The following antenna was provided to the EUT. (Option)

No	Antenna Type	Antenna Connector	Brand	Model	Gain
1	Dipole	SMA Male Reverse	Master Wave	98619ZRSX003-715	2.95dBi
2	Dipole	SMA Male Reverse	Cortec	AN0915-3901BRS	-1.0dBi

*Antenna Model: 98619ZRSX003-715 was for the final tests.

3. After pre-testing Modulation Type: FSK, GFSK and OOK, FSK was the worst case for the final tests.

3.2 Description of Test Modes

64 channels are provided for Hybrid Mode (125kHz Bandwidth):

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	902.3	16	905.5	32	908.7	48	911.9
1	902.5	17	905.7	33	908.9	49	912.1
2	902.7	18	905.9	34	909.1	50	912.3
3	902.9	19	906.1	35	909.3	51	912.5
4	903.1	20	906.3	36	909.5	52	912.7
5	903.3	21	906.5	37	909.7	53	912.9
6	903.5	22	906.7	38	909.9	54	913.1
7	903.7	23	906.9	39	910.1	55	913.3
8	903.9	24	907.1	40	910.3	56	913.5
9	904.1	25	907.3	41	910.5	57	913.7
10	904.3	26	907.5	42	910.7	58	913.9
11	904.5	27	907.7	43	910.9	59	914.1
12	904.7	28	907.9	44	911.1	60	914.3
13	904.9	29	908.1	45	911.3	61	914.5
14	905.1	30	908.3	46	911.5	62	914.7
15	905.3	31	908.5	47	911.7	63	914.9

8 channels are provided for Hybrid Mode (500kHz Bandwidth):

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	903.0	2	906.2	4	909.4	6	912.6
1	904.6	3	907.8	5	911.0	7	914.2

42 channels are provided for DTS Mode (500kHz Bandwidth):

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
1	902.9	12	909.5	23	916.1	34	922.7
2	903.5	13	910.1	24	916.7	35	923.3
3	904.1	14	910.7	25	917.3	36	923.9
4	904.7	15	911.3	26	917.9	37	924.5
5	905.3	16	911.9	27	918.5	38	925.1
6	905.9	17	912.5	28	919.1	39	925.7
7	906.5	18	913.1	29	919.7	40	926.3
8	907.1	19	913.7	30	920.3	41	926.9
9	907.7	20	914.3	31	920.9	42	927.5
10	908.3	21	914.9	32	921.5		
11	908.9	22	915.5	33	922.1		

3.2.1 Test Mode Applicability and Tested Channel Detail

Hybrid Mode (125kHz Bandwidth, 64 channels)

EUT Configure Mode	Applicable to				Description
	RE $\geq$ 1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

Where RE $\geq$ 1G: Radiated Emission above 1GHz & Bandedge Measurement
RE<1G: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission
APCM: Antenna Port Conducted Measurement

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane**.

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 Type
-	0 to 63	0, 31, 63	FSK

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 Type
-	0 to 63	0, 31, 63	FSK

Power Line Conducted Emission Test:

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
-	0 to 63	0	FSK

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 Type
-	0 to 63	0, 31, 63	FSK

Test Condition:

Applicable to	Environmental Conditions	Input Power (System)	Tested by
RE $\geq$ 1G	25 deg. C, 66% RH	120Vac, 60Hz	James Yang
RE<1G	25 deg. C, 66% RH	120Vac, 60Hz	James Yang
PLC	25 deg. C, 65% RH	120Vac, 60Hz	Greg Lin
APCM	25 deg. C, 60% RH	120Vac, 60Hz	Cedric Wu

Hybrid Mode (500kHz Bandwidth, 8 channels)

EUT Configure Mode	Applicable to				Description
	RE $\geq$ 1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

Where RE $\geq$ 1G: Radiated Emission above 1GHz & Bandedge Measurement
 RE<1G: Radiated Emission below 1GHz
 PLC: Power Line Conducted Emission
 APCM: Antenna Port Conducted Measurement

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane**.

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 Type
-	0 to 7	0, 4, 7	FSK

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 Type
-	0 to 7	0, 4, 7	FSK

Power Line Conducted Emission Test:

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
-	0 to 7	0	FSK

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 Type
-	0 to 7	0, 4, 7	FSK

Test Condition:

Applicable to	Environmental Conditions	Input Power (System)	Tested by
RE $\geq$ 1G	25 deg. C, 66% RH	120Vac, 60Hz	James Yang
RE<1G	25 deg. C, 66% RH	120Vac, 60Hz	James Yang
PLC	25 deg. C, 65% RH	120Vac, 60Hz	Greg Lin
APCM	25 deg. C, 60% RH	120Vac, 60Hz	Cedric Wu

DTS Mode (500kHz Bandwidth, 42 channels)

EUT Configure Mode	Applicable to				Description
	RE $\geq$ 1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

Where RE $\geq$ 1G: Radiated Emission above 1GHz & Bandedge Measurement
 RE<1G: Radiated Emission below 1GHz
 PLC: Power Line Conducted Emission
 APCM: Antenna Port Conducted Measurement

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-plane**.

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 Type
-	1 to 42	1, 21, 42	FSK

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 Type
-	1 to 42	1, 21, 42	FSK

Power Line Conducted Emission Test:

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
-	1 to 42	1	FSK

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 Type
-	1 to 42	1, 21, 42	FSK

Test Condition:

Applicable to	Environmental Conditions	Input Power (System)	Tested by
RE $\geq$ 1G	25 deg. C, 70% RH	120Vac, 60Hz	Noah Chang
RE<1G	25 deg. C, 70% RH	120Vac, 60Hz	Luis Lee
PLC	25 deg. C, 70% RH	120Vac, 60Hz	Matthew Yang
APCM	25 deg. C, 60% RH	120Vac, 60Hz	Chris Lin

3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

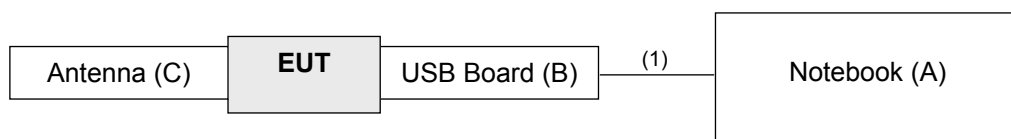
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	Lenovo	S430	MP-2DBFW	PD92230BNHU	For Hybrid Mode (125kHz Bandwidth, 64 channels) & Hybrid Mode (500kHz Bandwidth, 8 channels)
		DELL	E5520	8Y4DMQ1	FCC DoC Approved	For DTS Mode (500kHz Bandwidth, 42 channels)
B.	USB Board	GlobalSat	GS-EB-NLT100-01-V0.2	NA	NA	Provided by manufacturer
C.	Antenna	Master Wave	98619ZRSX003-715	NA	NA	Provided by manufacturer (Option)

Note: All power cords of the above support units are non-shielded (1.8m).

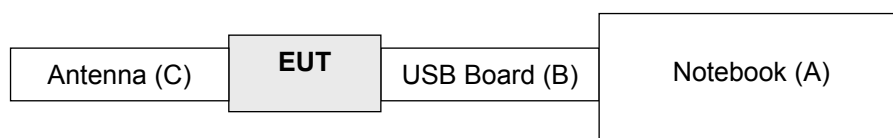
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB cable	1	1	Y	0	-

3.3.1 Configuration of System under Test

For Radiated Emission Test of Hybrid Mode (125kHz Bandwidth, 64 channels) & Hybrid Mode (500kHz Bandwidth, 8 channels)



For Conducted Emission Test of Hybrid Mode (125kHz Bandwidth, 64 channels) & Hybrid Mode (500kHz Bandwidth, 8 channels) and DTS Mode (500kHz Bandwidth, 42 channels)



3.4 General Description of Applied Standards

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

FCC Part 15, Subpart C (15.247)

KDB 558074 D01 DTS Meas Guidance v04

FCC KDB Publication Number: 453039

ANSI C63.10:2013

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

4 Test Types and Results (Hybrid Mode (125kHz Bandwidth, 64 channels))

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

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 30dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, 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 30dB under any condition of modulation.

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver KEYSIGHT	N9038A	MY55420137	Mar. 27, 2017	Mar. 26, 2018
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100269	May 11, 2017	May 10, 2018
BILOG Antenna SCHWARZBECK	VULB9168	9168-148	Dec. 28, 2016 Dec. 11, 2017	Dec. 27, 2017 Dec. 10, 2018
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1169	Dec. 27, 2016 Dec. 12, 2017	Dec. 26, 2017 Dec. 11, 2018
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Dec. 14, 2016 Dec. 01, 2017	Dec. 13, 2017 Nov. 30, 2018
Loop Antenna EMCI	EM-6879	269	Aug. 11, 2017	Aug. 10, 2018
Preamplifier Agilent (Below 1GHz)	8447D	2944A10638	Aug. 08, 2017	Aug. 07, 2018
Preamplifier Agilent (Above 1GHz)	8449B	3008A01638	Feb. 22, 2017	Feb. 21, 2018
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-02 (248780+MY13377)	Aug. 08, 2017	Aug. 07, 2018
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-(250795/4)	Aug. 08, 2017	Aug. 07, 2018
RF signal cable Woken	8D-FB	Cable-CH9-01	Aug. 01, 2017	Jul. 31, 2018
Software BV ADT	ADT_Radiated_ V7.6.15.9.4	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower & Turn BV ADT	AT100	AT93021705	NA	NA
Turn Table BV ADT	TT100	TT93021705	NA	NA
Turn Table Controller BV ADT	SC100	SC93021705	NA	NA

- Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 9.
3. The FCC Designation Number is TW0003. The number will be varied with the Lab location and scope as attached.
4. The IC Site Registration No. is IC 7450F-9.

4.1.3 Test Procedures

For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Both X and Y axes of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

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

For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

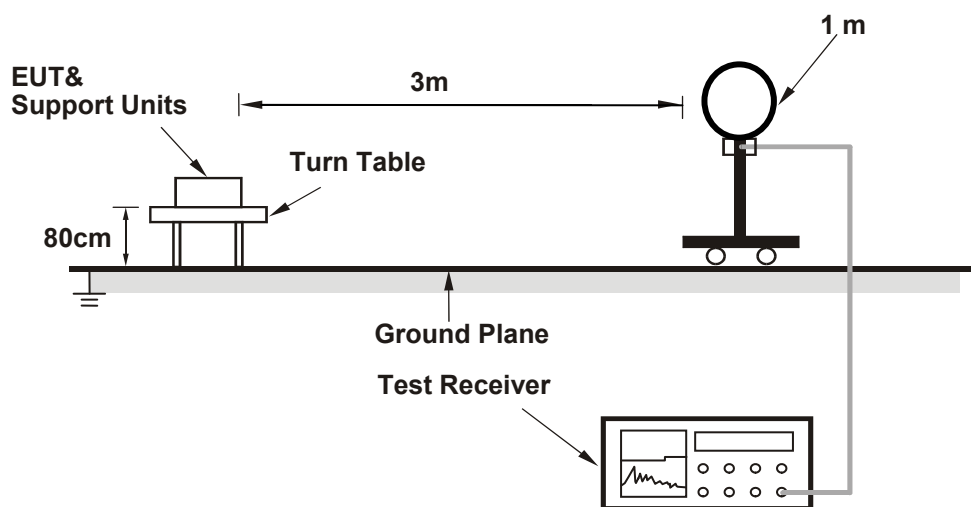
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

4.1.4 Deviation from Test Standard

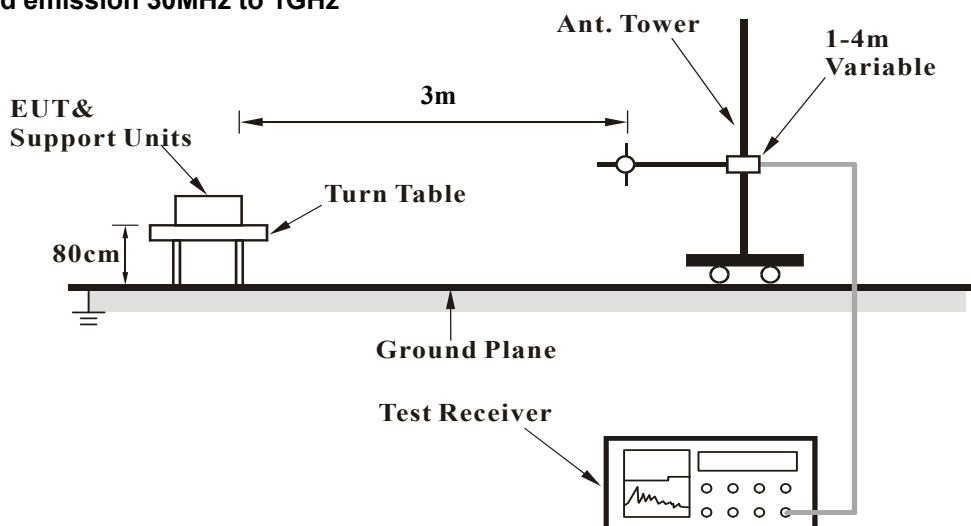
No deviation.

4.1.5 Test Setup

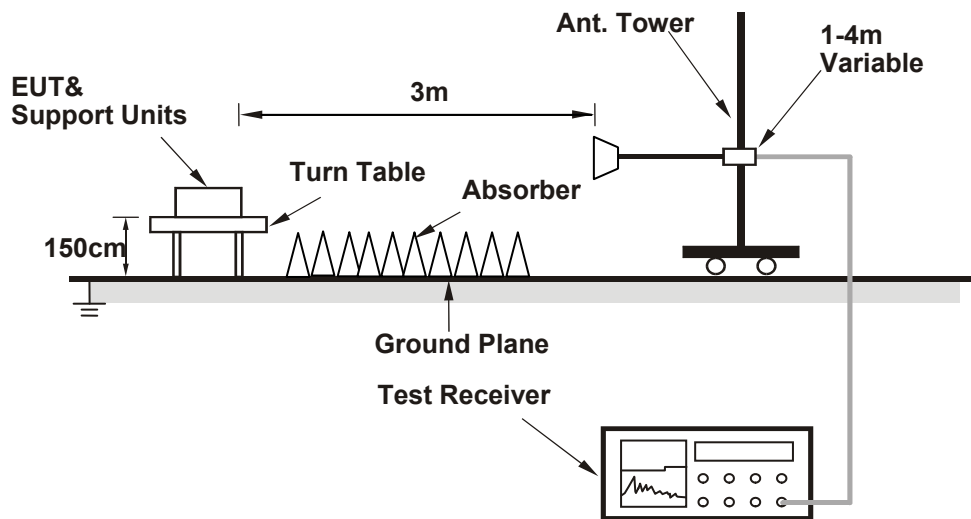
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

- Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1GHz Data:

CHANNEL	TX Channel 0	DETECTOR	Peak (PK)
FREQUENCY RANGE	30MHz ~ 10GHz	FUNCTION	Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#902.00	71.2 PK	89.3	-18.1	1.00 H	201	46.2	25.0
2	#902.00	63.5 AV	89.2	-25.7	1.00 H	201	38.5	25.0
3	*902.30	119.3 PK			1.00 H	201	94.3	25.0
4	*902.30	119.2 AV			1.00 H	201	94.2	25.0
5	#1804.60	50.7 PK	74.0	-23.3	1.51 H	246	56.9	-6.2
6	#1804.60	49.0 AV	54.0	-5.0	1.51 H	246	55.2	-6.2
7	2706.90	52.2 PK	74.0	-21.8	1.51 H	159	54.6	-2.4
8	2706.90	49.8 AV	54.0	-4.2	1.51 H	159	52.2	-2.4
9	#7218.40	54.1 PK	74.0	-19.9	1.01 H	333	45.6	8.5
10	#7218.40	48.6 AV	54.0	-5.4	1.01 H	333	40.1	8.5
11	8120.70	55.6 PK	74.0	-18.4	2.57 H	41	45.6	10.0
12	8120.70	49.1 AV	54.0	-4.9	2.57 H	41	39.1	10.0
13	9023.00	53.8 PK	74.0	-20.2	2.51 H	90	42.8	11.0
14	9023.00	43.4 AV	54.0	-10.6	2.51 H	90	32.4	11.0
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#902.00	64.8 PK	80.9	-16.1	1.00 V	78	39.8	25.0
2	#902.00	56.1 AV	80.8	-24.7	1.00 V	78	31.1	25.0
3	*902.30	110.9 PK			1.00 V	78	85.9	25.0
4	*902.30	110.8 AV			1.00 V	78	85.8	25.0
5	#1804.60	47.1 PK	74.0	-26.9	2.46 V	119	53.3	-6.2
6	#1804.60	44.7 AV	54.0	-9.3	2.46 V	119	50.9	-6.2
7	2706.90	47.1 PK	74.0	-26.9	2.58 V	141	49.5	-2.4
8	2706.90	43.0 AV	54.0	-11.0	2.58 V	141	45.4	-2.4
9	#7218.40	52.6 PK	74.0	-21.4	2.72 V	16	44.1	8.5
10	#7218.40	45.2 AV	54.0	-8.8	2.72 V	16	36.7	8.5
11	8120.70	55.6 PK	74.0	-18.4	3.03 V	21	45.6	10.0
12	8120.70	48.3 AV	54.0	-5.7	3.03 V	21	38.3	10.0
13	9023.00	53.0 PK	74.0	-21.0	3.58 V	6	42.0	11.0
14	9023.00	42.6 AV	54.0	-11.4	3.58 V	6	31.6	11.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

CHANNEL	TX Channel 31	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	30MHz ~ 10GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*908.50	118.8 PK			1.00 H	200	93.6	25.2
2	*908.50	118.7 AV			1.00 H	200	93.5	25.2
3	#1817.00	51.4 PK	74.0	-22.6	3.45 H	278	57.6	-6.2
4	#1817.00	49.4 AV	54.0	-4.6	3.45 H	278	55.6	-6.2
5	2725.50	50.1 PK	74.0	-23.9	1.00 H	69	52.5	-2.4
6	2725.50	46.7 AV	54.0	-7.3	1.00 H	69	49.1	-2.4
7	#6359.50	51.9 PK	74.0	-22.1	1.00 H	41	45.7	6.2
8	#6359.50	40.8 AV	54.0	-13.2	1.00 H	41	34.6	6.2
9	7268.00	56.6 PK	74.0	-17.4	2.98 H	75	47.8	8.8
10	7268.00	49.9 AV	54.0	-4.1	2.98 H	75	41.1	8.8
11	8176.50	56.3 PK	74.0	-17.7	1.17 H	238	46.4	9.9
12	8176.50	45.7 AV	54.0	-8.3	1.17 H	238	35.8	9.9
13	9085.00	58.0 PK	74.0	-16.0	1.00 H	121	46.8	11.2
14	9085.00	47.2 AV	54.0	-6.8	1.00 H	121	36.0	11.2

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*908.50	112.4 PK			1.01 V	23	87.2	25.2
2	*908.50	112.3 AV			1.01 V	23	87.1	25.2
3	#1817.00	47.2 PK	74.0	-26.8	2.37 V	116	53.4	-6.2
4	#1817.00	45.1 AV	54.0	-8.9	2.37 V	116	51.3	-6.2
5	2725.50	44.1 PK	74.0	-29.9	2.47 V	146	46.5	-2.4
6	2725.50	40.8 AV	54.0	-13.2	2.47 V	146	43.2	-2.4
7	#6359.50	48.0 PK	74.0	-26.0	2.67 V	86	41.8	6.2
8	#6359.50	37.5 AV	54.0	-16.5	2.67 V	86	31.3	6.2
9	7268.00	53.6 PK	74.0	-20.4	2.78 V	18	44.8	8.8
10	7268.00	46.7 AV	54.0	-7.3	2.78 V	18	37.9	8.8
11	8176.50	54.8 PK	74.0	-19.2	3.08 V	29	44.9	9.9
12	8176.50	44.6 AV	54.0	-9.4	3.08 V	29	34.7	9.9
13	9085.00	55.9 PK	74.0	-18.1	3.48 V	11	44.7	11.2
14	9085.00	45.7 AV	54.0	-8.3	3.48 V	11	34.5	11.2

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

CHANNEL	TX Channel 63	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	30MHz ~ 10GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*914.90	119.3 PK			1.00 H	18	94.0	25.3
2	*914.90	119.2 AV			1.00 H	18	93.9	25.3
3	#928.00	63.9 PK	89.3	-25.4	1.00 H	18	38.4	25.5
4	#928.00	55.0 AV	89.2	-34.2	1.00 H	18	29.5	25.5
5	#1829.80	51.9 PK	74.0	-22.1	3.43 H	279	57.9	-6.0
6	#1829.80	49.7 AV	54.0	-4.3	3.43 H	279	55.7	-6.0
7	2744.70	50.9 PK	74.0	-23.1	3.78 H	61	53.2	-2.3
8	2744.70	46.8 AV	54.0	-7.2	3.78 H	61	49.1	-2.3
9	#6404.30	51.9 PK	74.0	-22.1	1.01 H	44	45.5	6.4
10	#6404.30	40.4 AV	54.0	-13.6	1.01 H	44	34.0	6.4
11	7319.20	56.8 PK	74.0	-17.2	1.02 H	74	47.8	9.0
12	7319.20	50.4 AV	54.0	-3.6	1.02 H	74	41.4	9.0
13	8234.10	55.5 PK	74.0	-18.5	1.18 H	238	45.6	9.9
14	8234.10	45.1 AV	54.0	-8.9	1.18 H	238	35.2	9.9
15	9149.00	58.2 PK	74.0	-15.8	1.00 H	120	46.8	11.4
16	9149.00	49.1 AV	54.0	-4.9	1.00 H	120	37.7	11.4
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*914.90	111.5 PK			1.00 V	133	86.2	25.3
2	*914.90	111.4 AV			1.00 V	133	86.1	25.3
3	#928.00	65.4 PK	81.5	-16.1	1.00 V	133	39.9	25.5
4	#928.00	55.1 AV	81.4	-26.3	1.00 V	133	29.6	25.5
5	#1829.80	47.2 PK	74.0	-26.8	2.38 V	117	53.2	-6.0
6	#1829.80	45.2 AV	54.0	-8.8	2.38 V	117	51.2	-6.0
7	2744.70	44.2 PK	74.0	-29.8	2.46 V	143	46.5	-2.3
8	2744.70	40.8 AV	54.0	-13.2	2.46 V	143	43.1	-2.3
9	#6404.30	48.0 PK	74.0	-26.0	2.69 V	83	41.6	6.4
10	#6404.30	37.5 AV	54.0	-16.5	2.69 V	83	31.1	6.4
11	7319.20	52.9 PK	74.0	-21.1	2.69 V	17	43.9	9.0
12	7319.20	46.7 AV	54.0	-7.3	2.69 V	17	37.7	9.0
13	8234.10	54.7 PK	74.0	-19.3	3.03 V	26	44.8	9.9
14	8234.10	44.5 AV	54.0	-9.5	3.03 V	26	34.6	9.9
15	9149.00	55.9 PK	74.0	-18.1	3.46 V	12	44.5	11.4
16	9149.00	45.8 AV	54.0	-8.2	3.46 V	12	34.4	11.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

Below 1GHz Data:

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	32.81	27.8 QP	40.0	-12.2	1.99 H	14	43.0	-15.2
2	215.21	38.3 QP	43.5	-5.2	1.99 H	159	54.5	-16.2
3	252.08	41.3 QP	46.0	-4.7	1.00 H	88	55.3	-14.0
4	498.51	34.6 QP	46.0	-11.4	1.49 H	101	44.0	-9.4
5	597.47	34.4 QP	46.0	-11.6	1.00 H	127	42.0	-7.6
6	705.16	39.3 QP	46.0	-6.7	1.49 H	15	45.4	-6.1
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	32.81	30.1 QP	40.0	-9.9	1.51 V	327	45.3	-15.2
2	190.95	35.9 QP	43.5	-7.6	1.00 V	105	51.8	-15.9
3	234.61	38.1 QP	46.0	-7.9	1.00 V	276	53.4	-15.3
4	399.55	29.3 QP	46.0	-16.7	1.51 V	34	40.4	-11.1
5	508.21	33.6 QP	46.0	-12.4	1.00 V	16	42.8	-9.2
6	599.41	31.3 QP	46.0	-14.7	1.00 V	15	38.8	-7.5

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

CHANNEL	TX Channel 31	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	32.81	24.5 QP	40.0	-15.5	1.01 H	15	39.7	-15.2
2	196.77	33.3 QP	43.5	-10.2	1.01 H	167	49.4	-16.1
3	252.08	43.1 QP	46.0	-2.9	1.01 H	167	57.1	-14.0
4	290.88	36.3 QP	46.0	-9.7	1.01 H	106	48.8	-12.5
5	504.33	33.6 QP	46.0	-12.4	1.50 H	113	42.9	-9.3
6	734.27	34.8 QP	46.0	-11.2	1.50 H	159	40.2	-5.4
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	32.81	32.6 QP	40.0	-7.4	1.00 V	213	47.8	-15.2
2	213.27	29.4 QP	43.5	-14.1	1.00 V	264	45.6	-16.2
3	304.47	27.4 QP	46.0	-18.6	1.49 V	97	39.7	-12.3
4	511.12	34.7 QP	46.0	-11.3	1.49 V	17	43.9	-9.2
5	598.44	33.5 QP	46.0	-12.5	1.00 V	14	41.0	-7.5
6	761.43	30.6 QP	46.0	-15.4	1.00 V	142	35.3	-4.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

CHANNEL	TX Channel 63	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	33.78	25.6 QP	40.0	-14.4	1.00 H	356	40.7	-15.1
2	201.63	38.9 QP	43.5	-4.6	1.00 H	121	55.1	-16.2
3	246.25	41.0 QP	46.0	-5.0	1.49 H	164	55.4	-14.4
4	310.29	33.9 QP	46.0	-12.1	1.00 H	115	46.0	-12.1
5	496.57	33.8 QP	46.0	-12.2	1.49 H	117	43.3	-9.5
6	764.34	30.1 QP	46.0	-15.9	1.00 H	47	34.7	-4.6
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	32.81	30.6 QP	40.0	-9.4	1.50 V	188	45.8	-15.2
2	163.79	34.1 QP	43.5	-9.4	1.00 V	208	47.6	-13.5
3	238.49	35.5 QP	46.0	-10.5	1.00 V	353	50.3	-14.8
4	303.50	32.7 QP	46.0	-13.3	1.50 V	97	45.0	-12.3
5	505.30	33.7 QP	46.0	-12.3	1.00 V	5	43.0	-9.3
6	599.41	31.7 QP	46.0	-14.3	1.00 V	169	39.2	-7.5

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

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

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

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

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Nov. 29, 2016	Nov. 28, 2017
			Nov. 23, 2017	Nov. 22, 2018
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond1-01	Sep. 05, 2017	Sep. 04, 2018
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Mar. 10, 2017	Mar. 09, 2018
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 15, 2017	Aug. 14, 2018
Software ADT	BV ADT_Cond_ V7.3.7.3	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in HwaYa Shielded Room 1.

3. The VCCI Site Registration No. is C-2040.

4.2.3 Test Procedures

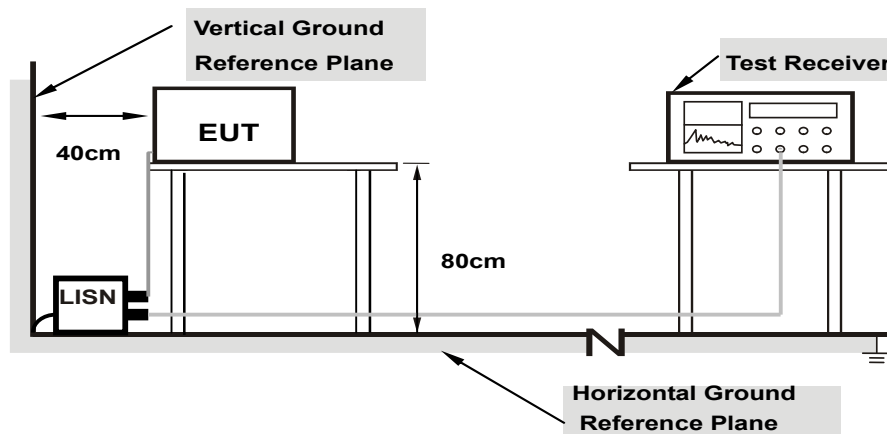
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

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

4.2.6 EUT Operating Conditions

Same as 4.1.6.

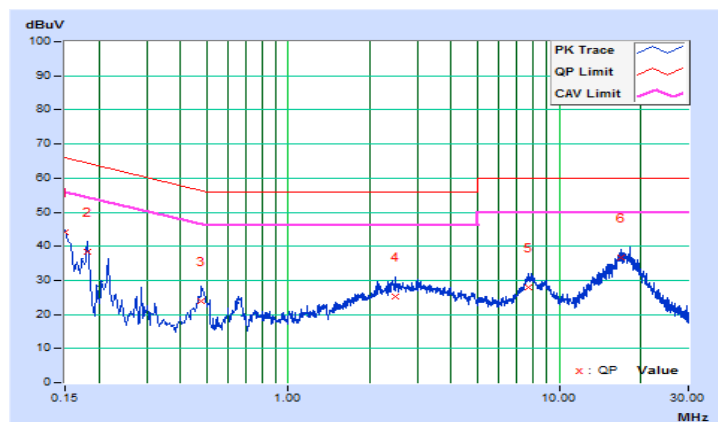
4.2.7 Test Results

Channel	TX Channel 0	Phase	Line (L)
Detector Function	Quasi-Peak (QP) / Average (AV)		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.45	33.58	22.64	44.03	33.09	66.00	56.00	-21.97	-22.91
2	0.18122	10.45	27.98	10.96	38.43	21.41	64.43	54.43	-26.00	-33.02
3	0.47844	10.51	13.47	3.45	23.98	13.96	56.37	46.37	-32.39	-32.41
4	2.49209	10.55	14.87	9.53	25.42	20.08	56.00	46.00	-30.58	-25.92
5	7.71976	10.82	17.03	11.09	27.85	21.91	60.00	50.00	-32.15	-28.09
6	16.94736	11.27	25.50	21.84	36.77	33.11	60.00	50.00	-23.23	-16.89

Remarks:

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

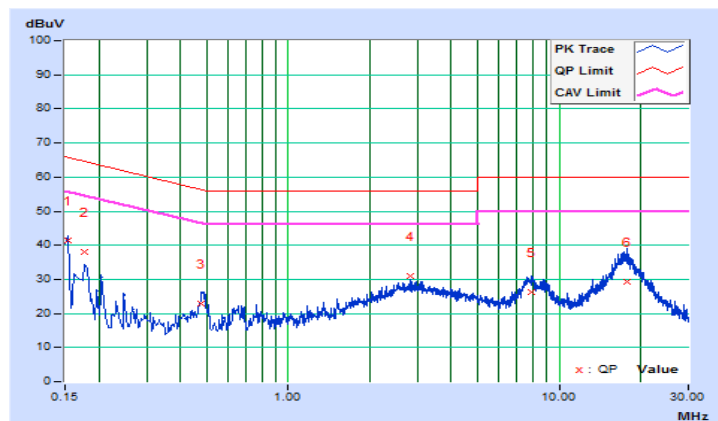


Channel	TX Channel 0	Phase	Neutral (N)
Detector Function	Quasi-Peak (QP) / Average (AV)		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
	[MHz]		[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	10.21	31.07	15.57	41.28	25.78	65.79	55.79	-24.51	-30.01
2	0.17744	10.21	27.82	14.76	38.03	24.97	64.60	54.60	-26.57	-29.63
3	0.47915	10.24	12.73	3.03	22.97	13.27	56.35	46.35	-33.38	-33.08
4	2.82053	10.35	20.59	10.15	30.94	20.50	56.00	46.00	-25.06	-25.50
5	7.91135	10.58	15.62	9.75	26.20	20.33	60.00	50.00	-33.80	-29.67
6	17.72545	10.97	18.22	14.00	29.19	24.97	60.00	50.00	-30.81	-25.03

Remarks:

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

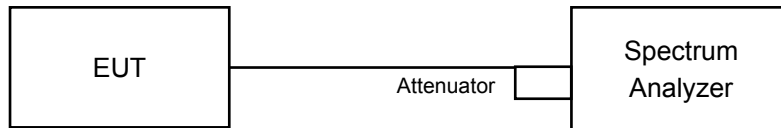


4.3 Number of Hopping Frequency Used

4.3.1 Limits of Hopping Frequency Used Measurement

There is no minimum number of hopping channels associated with this type of hybrid system.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

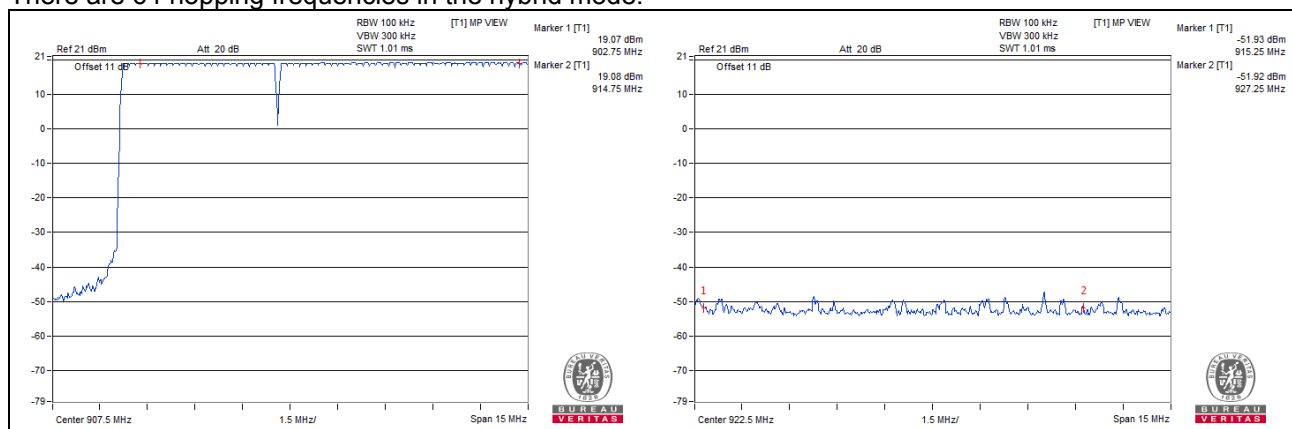
- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
- Set the SA on View mode and then plot the result on SA screen.
- Repeat above procedures until all frequencies measured were complete.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 Test Results

There are 64 hopping frequencies in the hybrid mode.

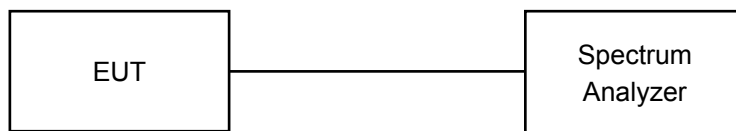


4.4 Dwell Time on Each Channel

4.4.1 Limits of Dwell Time on Each Channel Measurement

A hybrid system must comply with a 0.4 second/channel maximum dwell time when the hopping function is turned on.

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

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

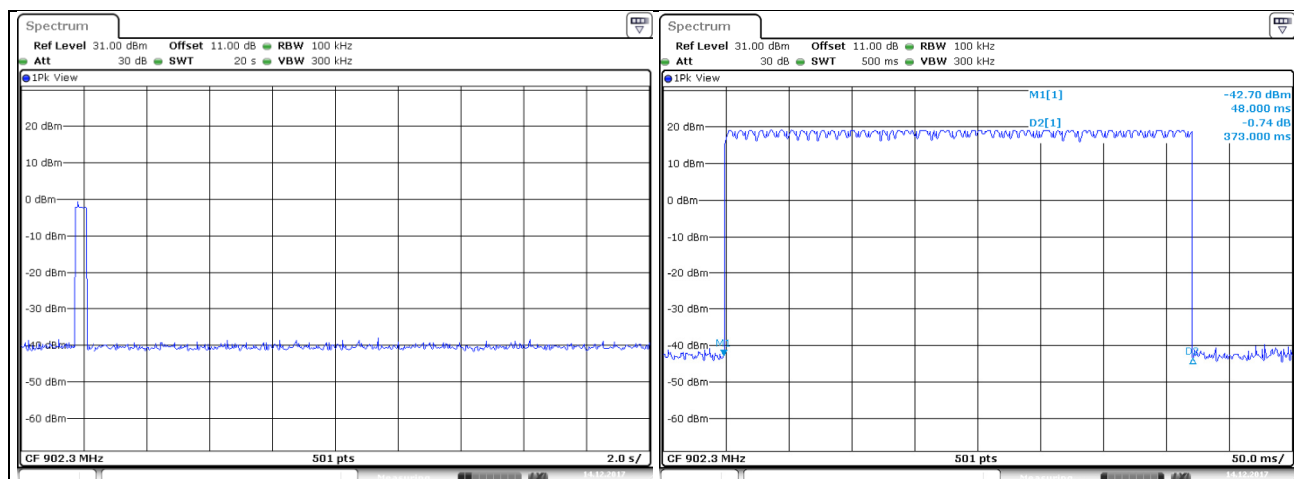
4.4.5 Deviation from Test Standard

No deviation.

4.4.6 Test Results

Number of transmission in a time period	Length of transmission time (msec)	Result (msec)	Limit (msec)
1 time	373	373	400

Note: Test plots of the transmitting time slot are shown on following.

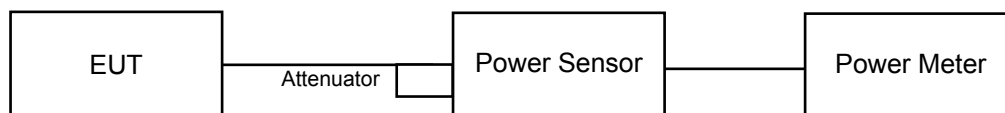


4.5 Conducted Output Power Measurement

4.5.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 902-928 MHz bands: 1 Watt (30dBm)

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

An average power sensor was used on the output port of the EUT. A power meter was used to read the response of the average power sensor. Record the power level.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Condition

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

4.5.7 Test Results

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Pass / Fail
0	902.3	84.140	19.25	30.00	Pass
31	908.5	83.560	19.22	30.00	Pass
63	914.9	83.176	19.20	30.00	Pass

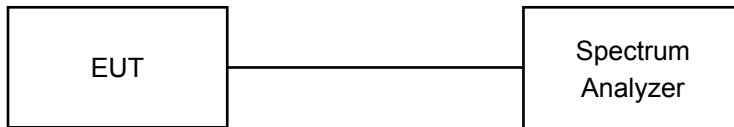
4.6 Power Spectral Density Measurement

4.6.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm.

A hybrid system must comply with the power density standard of 8 dBm in any 3 kHz band when the frequency hopping function is turned off

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.6.4 Test Procedure

- Set instrument center frequency to DTS channel center frequency.
- Set span to at least 1.5 times the OBW.
- Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set VBW $\geq 3 \times \text{RBW}$.
- Detector = power averaging (RMS) or sample detector (when RMS not available).
- Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span/RBW}$.
- Sweep time = auto couple.
- Employ trace averaging (RMS) mode over a minimum of 100 traces.
- Use the peak marker function to determine the maximum amplitude level.

4.6.5 Deviation from Test Standard

No deviation.

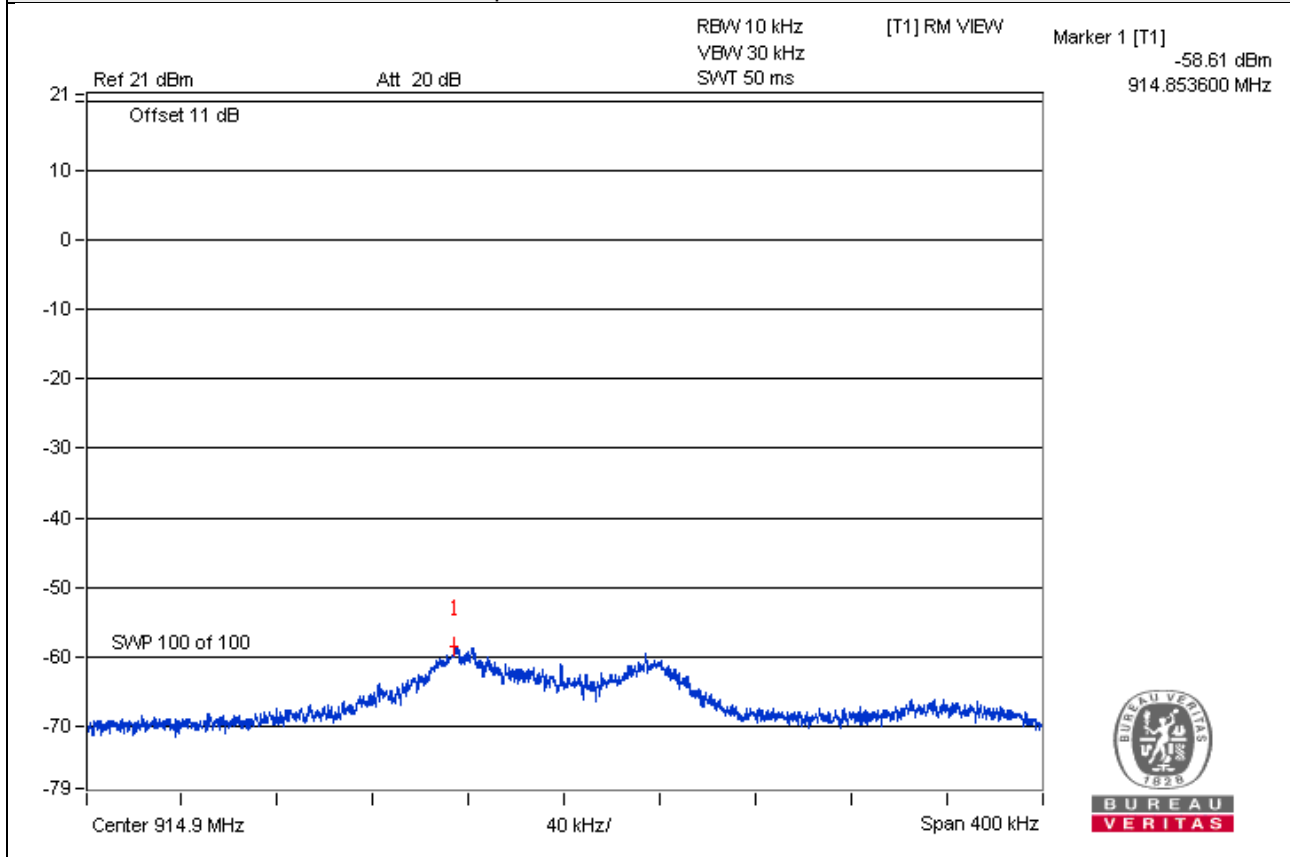
4.6.6 EUT Operating Condition

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

4.6.7 Test Results

Channel	Freq. (MHz)	PSD (dBm/10kHz)	Limit (dBm/3kHz)	Pass / Fail
0	902.3	-59.73	8.00	Pass
31	908.5	-59.44	8.00	Pass
63	914.9	-58.61	8.00	Pass

Spectrum Plot of Worst Value

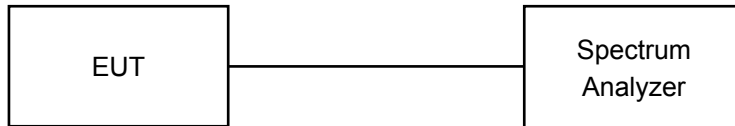


4.7 Conducted Out of Band Emission Measurement

4.7.1 Limits of Conducted Out Of Band Emission Measurement

Below 30dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

4.7.2 Test Setup



4.7.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.7.4 Test Procedure

MEASUREMENT PROCEDURE REF

- Set the RBW = 100 kHz.
- Set the VBW $\geq$ 300 kHz.
- Detector = average.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOB

- Set RBW = 100 kHz.
- Set VBW $\geq$ 300 kHz.
- Detector = average.
- Sweep = auto couple.
- Trace Mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

4.7.5 Deviation from Test Standard

No deviation.

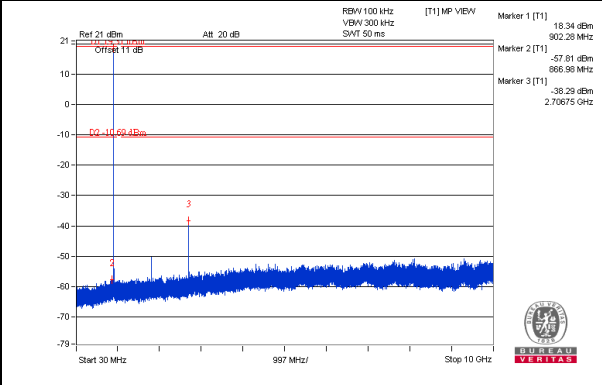
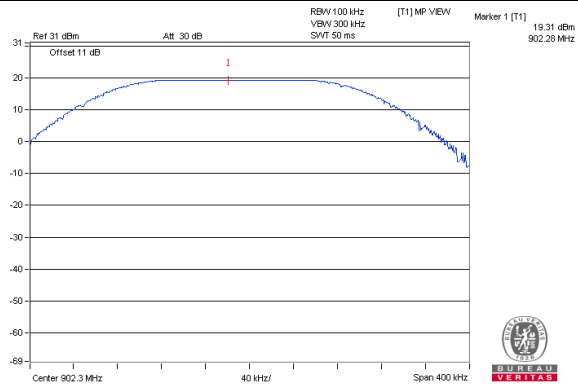
4.7.6 EUT Operating Condition

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

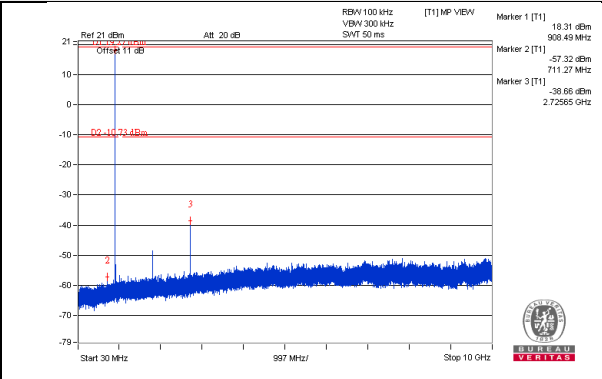
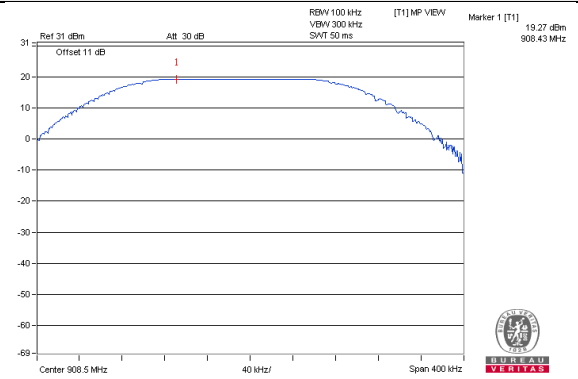
4.7.7 Test Results

The spectrum plots are attached on the following images. D1 line indicates the highest level, D2 line indicates the 30dB offset below D1. It shows compliance with the requirement.

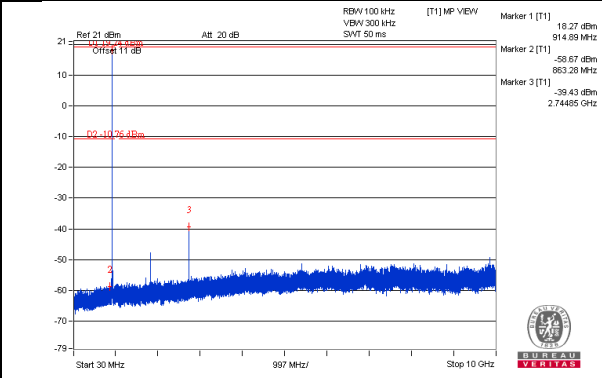
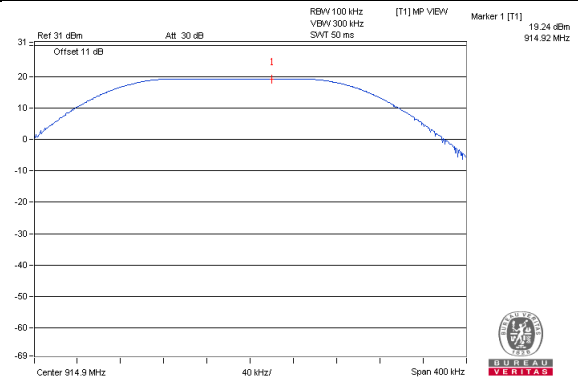
CH 0



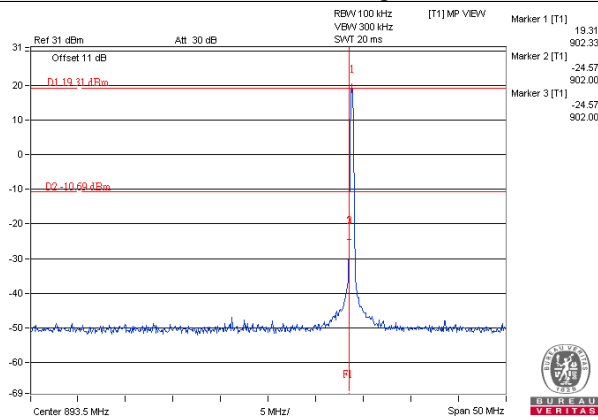
CH 31



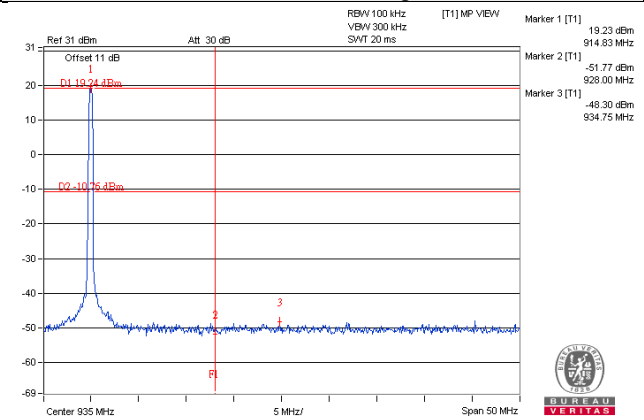
CH 63



CH 0 Band edge



CH 63 Band edge



5 Test Types and Results (Hybrid Mode (500kHz Bandwidth, 8 channels))

5.1 Radiated Emission and Bandedge Measurement

5.1.1 Limits of Radiated Emission and Bandedge Measurement

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 30dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, 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 30dB under any condition of modulation.

5.1.2 Test Instruments

Same as 4.1.2.

5.1.3 Test Procedures

Same as 4.1.3.

5.1.4 Deviation from Test Standard

No deviation.

5.1.5 Test Setup

Same as 4.1.5.

5.1.6 EUT Operating Conditions

Same as 4.1.6.

5.1.7 Test Results

Above 1GHz Data:

CHANNEL	TX Channel 0	DETECTOR	Peak (PK)
FREQUENCY RANGE	30MHz ~ 10GHz	FUNCTION	Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#902.00	64.8 PK	89.8	-25.0	1.00 H	202	39.8	25.0
2	#902.00	55.0 AV	84.8	-29.8	1.00 H	202	30.0	25.0
3	*903.00	119.8 PK			1.00 H	202	94.8	25.0
4	*903.00	114.8 AV			1.00 H	202	89.8	25.0
5	#1806.00	54.6 PK	74.0	-19.4	1.00 H	174	60.8	-6.2
6	#1806.00	51.9 AV	54.0	-2.1	1.00 H	174	58.1	-6.2
7	2709.00	50.2 PK	74.0	-23.8	1.00 H	3	52.6	-2.4
8	2709.00	46.4 AV	54.0	-7.6	1.00 H	3	48.8	-2.4
9	#7224.00	56.8 PK	74.0	-17.2	1.15 H	337	48.2	8.6
10	#7224.00	45.9 AV	54.0	-8.1	1.15 H	337	37.3	8.6
11	8127.00	55.9 PK	74.0	-18.1	2.75 H	43	46.0	9.9
12	8127.00	48.2 AV	54.0	-5.8	2.75 H	43	38.3	9.9
13	9030.00	56.7 PK	74.0	-17.3	2.52 H	92	45.7	11.0
14	9030.00	43.7 AV	54.0	-10.3	2.52 H	92	32.7	11.0
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#902.00	64.2 PK	78.5	-14.3	1.00 V	219	39.2	25.0
2	#902.00	54.6 AV	73.8	-19.2	1.00 V	219	29.6	25.0
3	*903.00	108.5 PK			1.00 V	219	83.5	25.0
4	*903.00	103.8 AV			1.00 V	219	78.8	25.0
5	#1806.00	50.3 PK	74.0	-23.7	2.47 V	118	56.5	-6.2
6	#1806.00	47.4 AV	54.0	-6.6	2.47 V	118	53.6	-6.2
7	2709.00	46.9 PK	74.0	-27.1	2.54 V	139	49.3	-2.4
8	2709.00	43.4 AV	54.0	-10.6	2.54 V	139	45.8	-2.4
9	#7224.00	54.2 PK	74.0	-19.8	2.74 V	14	45.6	8.6
10	#7224.00	43.4 AV	54.0	-10.6	2.74 V	14	34.8	8.6
11	8127.00	55.6 PK	74.0	-18.4	3.01 V	25	45.7	9.9
12	8127.00	47.0 AV	54.0	-7.0	3.01 V	25	37.1	9.9
13	9030.00	52.8 PK	74.0	-21.2	3.53 V	11	41.8	11.0
14	9030.00	42.5 AV	54.0	-11.5	3.53 V	11	31.5	11.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

CHANNEL	TX Channel 4	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	30MHz ~ 10GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*909.40	118.7 PK			1.00 H	204	93.5	25.2
2	*909.40	114.0 AV			1.00 H	204	88.8	25.2
3	#1818.80	55.2 PK	74.0	-18.8	1.00 H	177	61.3	-6.1
4	#1818.80	53.5 AV	54.0	-0.5	1.00 H	177	59.6	-6.1
5	2728.20	50.2 PK	74.0	-23.8	1.00 H	5	52.6	-2.4
6	2728.20	46.3 AV	54.0	-7.7	1.00 H	5	48.7	-2.4
7	7275.20	56.9 PK	74.0	-17.1	1.13 H	329	48.1	8.8
8	7275.20	45.9 AV	54.0	-8.1	1.13 H	329	37.1	8.8
9	8184.60	55.7 PK	74.0	-18.3	2.73 H	42	45.8	9.9
10	8184.60	48.1 AV	54.0	-5.9	2.73 H	42	38.2	9.9
11	9094.00	57.1 PK	74.0	-16.9	2.51 H	94	45.9	11.2
12	9094.00	44.0 AV	54.0	-10.0	2.51 H	94	32.8	11.2

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*909.40	111.8 PK			1.00 V	20	86.6	25.2
2	*909.40	107.1 AV			1.00 V	20	81.9	25.2
3	#1818.80	51.5 PK	74.0	-22.5	2.49 V	117	57.6	-6.1
4	#1818.80	49.6 AV	54.0	-4.4	2.49 V	117	55.7	-6.1
5	2728.20	46.8 PK	74.0	-27.2	2.53 V	136	49.2	-2.4
6	2728.20	43.2 AV	54.0	-10.8	2.53 V	136	45.6	-2.4
7	7275.20	54.3 PK	74.0	-19.7	2.71 V	17	45.5	8.8
8	7275.20	43.5 AV	54.0	-10.5	2.71 V	17	34.7	8.8
9	8184.60	55.7 PK	74.0	-18.3	2.98 V	27	45.8	9.9
10	8184.60	46.8 AV	54.0	-7.2	2.98 V	27	36.9	9.9
11	9094.00	53.1 PK	74.0	-20.9	3.51 V	14	41.9	11.2
12	9094.00	42.7 AV	54.0	-11.3	3.51 V	14	31.5	11.2

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

CHANNEL	TX Channel 7	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	30MHz ~ 10GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*914.20	119.9 PK			1.00 H	204	94.6	25.3
2	*914.20	115.0 AV			1.00 H	204	89.7	25.3
3	#928.00	65.1 PK	89.9	-24.8	1.00 H	204	39.6	25.5
4	#928.00	55.2 AV	85.0	-29.8	1.00 H	204	29.7	25.5
5	#1828.40	53.8 PK	74.0	-20.2	3.43 H	19	59.9	-6.1
6	#1828.40	51.6 AV	54.0	-2.4	3.43 H	19	57.7	-6.1
7	2742.60	51.0 PK	74.0	-23.0	3.76 H	65	53.3	-2.3
8	2742.60	46.6 AV	54.0	-7.4	3.76 H	65	48.9	-2.3
9	7313.60	56.6 PK	74.0	-17.4	1.00 H	77	47.6	9.0
10	7313.60	50.5 AV	54.0	-3.5	1.00 H	77	41.5	9.0
11	8227.80	55.5 PK	74.0	-18.5	1.16 H	237	45.6	9.9
12	8227.80	45.0 AV	54.0	-9.0	1.16 H	237	35.1	9.9
13	9142.00	58.1 PK	74.0	-15.9	1.01 H	118	46.7	11.4
14	9142.00	48.9 AV	54.0	-5.1	1.01 H	118	37.5	11.4
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*914.20	108.1 PK			1.00 V	18	82.8	25.3
2	*914.20	103.9 AV			1.00 V	18	78.6	25.3
3	#928.00	65.0 PK	78.1	-13.1	1.00 V	18	39.5	25.5
4	#928.00	54.9 AV	73.9	-19.0	1.00 V	18	29.4	25.5
5	#1828.40	49.7 PK	74.0	-24.3	2.40 V	116	55.8	-6.1
6	#1828.40	47.5 AV	54.0	-6.5	2.40 V	116	53.6	-6.1
7	2742.60	44.3 PK	74.0	-29.7	2.47 V	144	46.6	-2.3
8	2742.60	40.7 AV	54.0	-13.3	2.47 V	144	43.0	-2.3
9	7313.60	52.8 PK	74.0	-21.2	2.72 V	19	43.8	9.0
10	7313.60	46.8 AV	54.0	-7.2	2.72 V	19	37.8	9.0
11	8227.80	54.7 PK	74.0	-19.3	3.01 V	27	44.8	9.9
12	8227.80	44.4 AV	54.0	-9.6	3.01 V	27	34.5	9.9
13	9142.00	55.8 PK	74.0	-18.2	3.41 V	15	44.4	11.4
14	9142.00	45.9 AV	54.0	-8.1	3.41 V	15	34.5	11.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

Below 1GHz worst-case data:

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	105.58	26.9 QP	43.5	-16.6	1.49 H	66	44.2	-17.3
2	199.69	39.4 QP	43.5	-4.1	1.00 H	75	55.5	-16.1
3	250.14	41.9 QP	46.0	-4.1	1.00 H	135	56.1	-14.2
4	301.56	34.3 QP	46.0	-11.7	1.00 H	196	46.6	-12.3
5	499.48	34.1 QP	46.0	-11.9	1.49 H	100	43.5	-9.4
6	729.41	34.7 QP	46.0	-11.3	1.49 H	15	40.3	-5.6
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	32.81	32.1 QP	40.0	-7.9	1.50 V	208	47.3	-15.2
2	215.21	34.6 QP	43.5	-8.9	1.01 V	102	50.8	-16.2
3	297.68	27.7 QP	46.0	-18.3	1.50 V	203	40.2	-12.5
4	501.42	33.9 QP	46.0	-12.1	1.01 V	24	43.3	-9.4
5	599.41	33.7 QP	46.0	-12.3	1.01 V	15	41.2	-7.5
6	760.46	30.5 QP	46.0	-15.5	1.01 V	139	35.2	-4.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

CHANNEL	TX Channel 4	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	33.78	27.3 QP	40.0	-12.7	1.00 H	7	42.4	-15.1
2	202.60	38.6 QP	43.5	-4.9	1.00 H	126	54.8	-16.2
3	236.55	42.7 QP	46.0	-3.3	1.00 H	137	57.6	-14.9
4	270.51	40.0 QP	46.0	-6.0	1.00 H	191	53.1	-13.1
5	485.89	33.2 QP	46.0	-12.8	1.50 H	184	42.8	-9.6
6	598.44	33.2 QP	46.0	-12.8	1.50 H	148	40.7	-7.5
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	32.81	33.0 QP	40.0	-7.0	1.00 V	346	48.2	-15.2
2	71.62	26.7 QP	40.0	-13.3	1.00 V	136	42.4	-15.7
3	203.57	34.0 QP	43.5	-9.5	1.50 V	60	50.2	-16.2
4	286.03	28.6 QP	46.0	-17.4	1.50 V	242	41.2	-12.6
5	496.57	34.9 QP	46.0	-11.1	1.00 V	34	44.4	-9.5
6	598.44	32.5 QP	46.0	-13.5	1.00 V	42	40.0	-7.5

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

CHANNEL	TX Channel 7	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	33.78	25.2 QP	40.0	-14.8	1.49 H	356	40.3	-15.1
2	211.33	40.2 QP	43.5	-3.3	1.49 H	172	56.4	-16.2
3	241.40	42.6 QP	46.0	-3.4	1.49 H	156	57.1	-14.5
4	262.75	42.0 QP	46.0	-4.0	1.00 H	155	55.6	-13.6
5	500.45	34.3 QP	46.0	-11.7	1.49 H	107	43.7	-9.4
6	759.49	29.7 QP	46.0	-16.3	1.00 H	47	34.4	-4.7
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	33.78	33.7 QP	40.0	-6.3	1.01 V	211	48.8	-15.1
2	214.24	36.8 QP	43.5	-6.7	1.01 V	103	53.0	-16.2
3	314.17	30.6 QP	46.0	-15.4	1.50 V	59	42.7	-12.1
4	508.21	32.5 QP	46.0	-13.5	1.01 V	35	41.7	-9.2
5	599.41	33.9 QP	46.0	-12.1	1.01 V	48	41.4	-7.5
6	767.25	29.7 QP	46.0	-16.3	1.01 V	153	34.3	-4.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

5.2 Conducted Emission Measurement

5.2.1 Limits of Conducted Emission Measurement

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

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

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

5.2.2 Test Instruments

Same as 4.2.2.

5.2.3 Test Procedures

Same as 4.2.3.

5.2.4 Deviation from Test Standard

No deviation.

5.2.5 Test Setup

Same as 4.2.5.

5.2.6 EUT Operating Conditions

Same as 4.1.6.

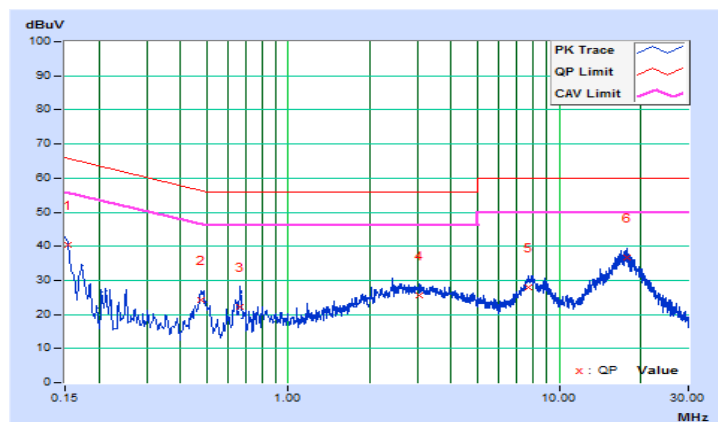
5.2.7 Test Results

Channel	TX Channel 0	Phase	Line (L)
Detector Function	Quasi-Peak (QP) / Average (AV)		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	10.45	30.05	14.41	40.50	24.86	65.79	55.79	-25.29	-30.93
2	0.47844	10.51	13.59	3.45	24.10	13.96	56.37	46.37	-32.27	-32.41
3	0.66605	10.50	11.80	1.61	22.30	12.11	56.00	46.00	-33.70	-33.89
4	3.04340	10.59	15.09	10.13	25.68	20.72	56.00	46.00	-30.32	-25.28
5	7.74713	10.82	17.04	11.13	27.86	21.95	60.00	50.00	-32.14	-28.05
6	17.86230	11.32	25.39	21.56	36.71	32.88	60.00	50.00	-23.29	-17.12

Remarks:

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

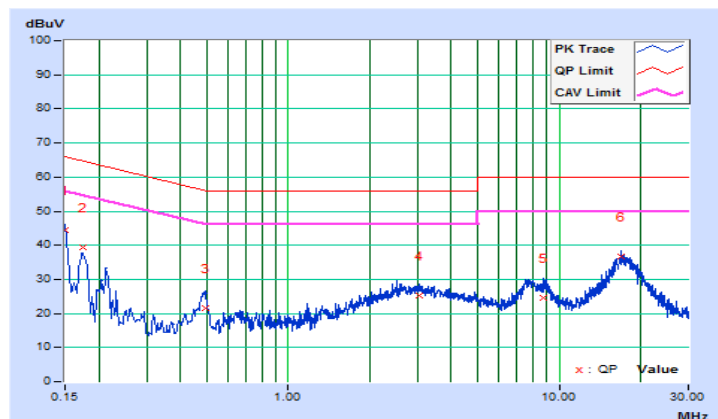


Channel	TX Channel 0	Phase	Neutral (N)
Detector Function	Quasi-Peak (QP) / Average (AV)		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.20	34.24	21.62	44.44	31.82	66.00	56.00	-21.56	-24.18
2	0.17374	10.21	29.19	16.56	39.40	26.77	64.78	54.78	-25.38	-28.01
3	0.49799	10.24	11.31	2.97	21.55	13.21	56.03	46.03	-34.48	-32.82
4	3.03558	10.36	15.01	10.29	25.37	20.65	56.00	46.00	-30.63	-25.35
5	8.70117	10.61	13.87	7.81	24.48	18.42	60.00	50.00	-35.52	-31.58
6	16.94736	10.94	25.62	22.02	36.56	32.96	60.00	50.00	-23.44	-17.04

Remarks:

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

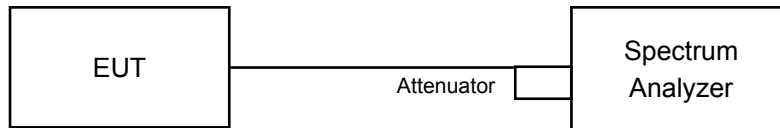


5.3 Number of Hopping Frequency Used

5.3.1 Limits of Hopping Frequency Used Measurement

There is no minimum number of hopping channels associated with this type of hybrid system.

5.3.2 Test Setup



5.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

5.3.4 Test Procedure

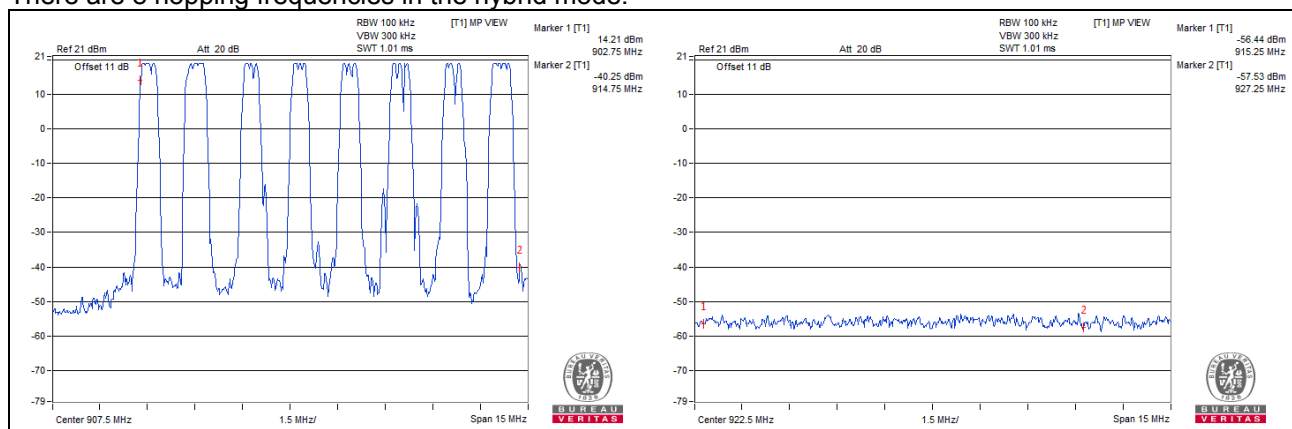
- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
- Set the SA on View mode and then plot the result on SA screen.
- Repeat above procedures until all frequencies measured were complete.

5.3.5 Deviation from Test Standard

No deviation.

5.3.6 Test Results

There are 8 hopping frequencies in the hybrid mode.

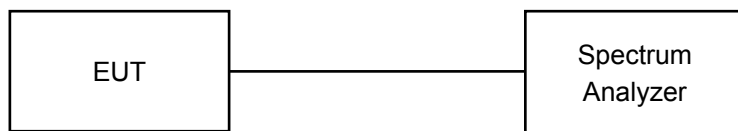


5.4 Dwell Time on Each Channel

5.4.1 Limits of Dwell Time on Each Channel Measurement

A hybrid system must comply with a 0.4 second/channel maximum dwell time when the hopping function is turned on.

5.4.2 Test Setup



5.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

5.4.4 Test Procedures

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

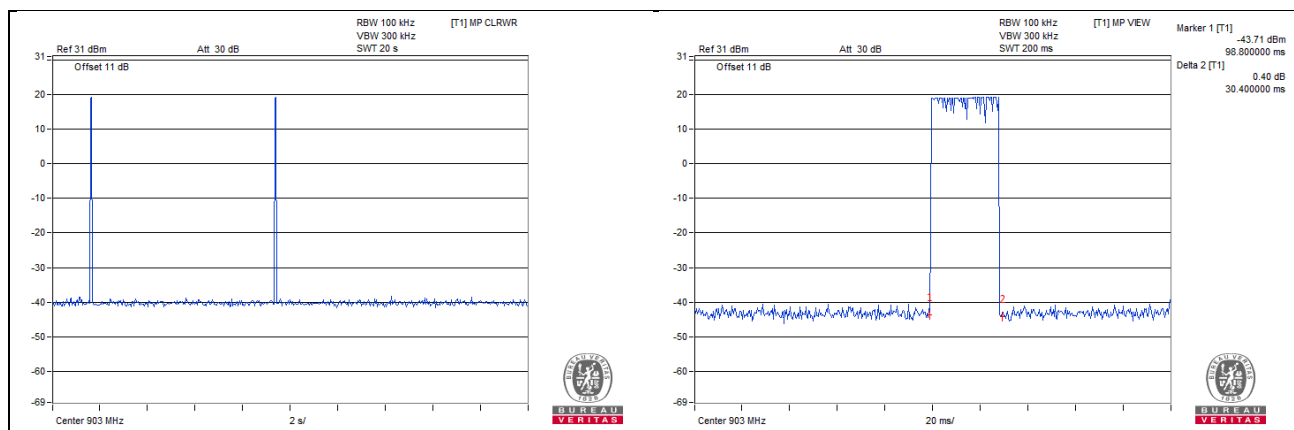
5.4.5 Deviation from Test Standard

No deviation.

5.4.6 Test Results

Number of transmission in a time period	Length of transmission time (msec)	Result (msec)	Limit (msec)
2 time	30.4	60.8	400

Note: Test plots of the transmitting time slot are shown on following.

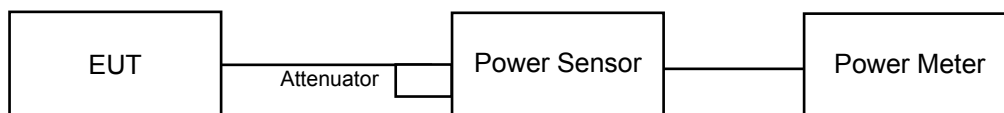


5.5 Conducted Output Power Measurement

5.5.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 902-928 MHz bands: 1 Watt (30dBm)

5.5.2 Test Setup



5.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

5.5.4 Test Procedure

An average power sensor was used on the output port of the EUT. A power meter was used to read the response of the average power sensor. Record the power level.

5.5.5 Deviation from Test Standard

No deviation.

5.5.6 EUT Operating Condition

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

5.5.7 Test Results

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)	Power Limit (dBm)	Pass / Fail
0	903.0	85.507	19.32	30.00	Pass
4	909.4	83.753	19.23	30.00	Pass
7	914.2	82.985	19.19	30.00	Pass

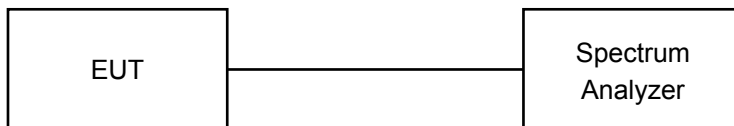
5.6 Power Spectral Density Measurement

5.6.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm.

A hybrid system must comply with the power density standard of 8 dBm in any 3 kHz band when the frequency hopping function is turned off

5.6.2 Test Setup



5.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

5.6.4 Test Procedure

- Set instrument center frequency to DTS channel center frequency.
- Set span to at least 1.5 times the OBW.
- Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set VBW $\geq 3 \times \text{RBW}$.
- Detector = power averaging (RMS) or sample detector (when RMS not available).
- Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span}/\text{RBW}$.
- Sweep time = auto couple.
- Employ trace averaging (RMS) mode over a minimum of 100 traces.
- Use the peak marker function to determine the maximum amplitude level.

5.6.5 Deviation from Test Standard

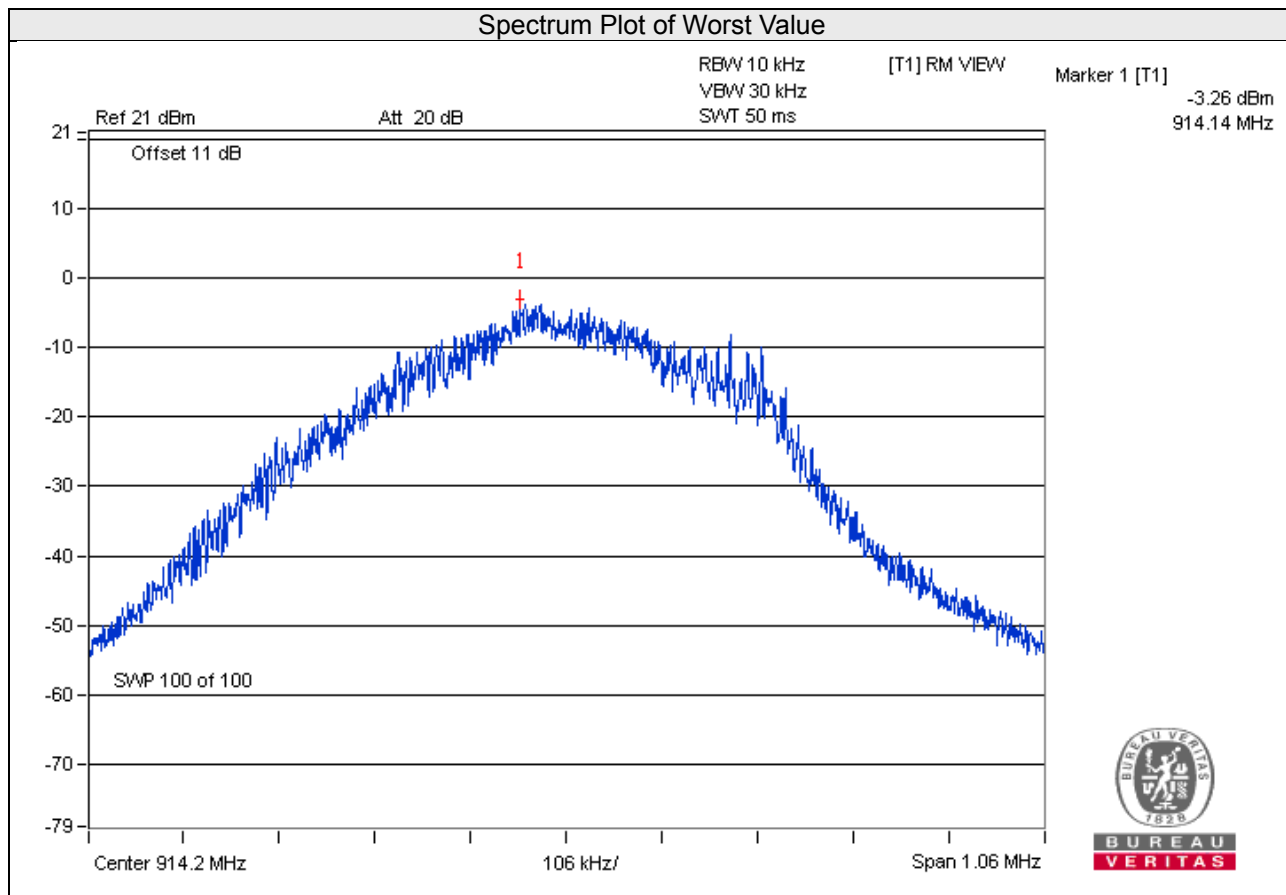
No deviation.

5.6.6 EUT Operating Condition

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

5.6.7 Test Results

Channel	Freq. (MHz)	PSD (dBm/10kHz)	Limit (dBm/3kHz)	Pass / Fail
0	903.0	-4.33	8.00	Pass
4	909.4	-4.39	8.00	Pass
7	914.2	-3.26	8.00	Pass

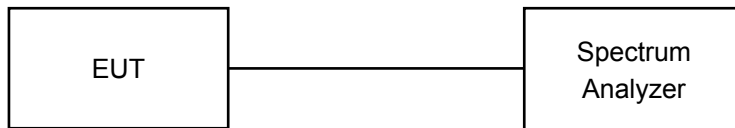


5.7 Conducted Out of Band Emission Measurement

5.7.1 Limits of Conducted Out Of Band Emission Measurement

Below 30dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

5.7.2 Test Setup



5.7.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

5.7.4 Test Procedure

MEASUREMENT PROCEDURE REF

- Set the RBW = 100 kHz.
- Set the VBW $\geq$ 300 kHz.
- Detector = average.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOB

- Set RBW = 100 kHz.
- Set VBW $\geq$ 300 kHz.
- Detector = average.
- Sweep = auto couple.
- Trace Mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

5.7.5 Deviation from Test Standard

No deviation.

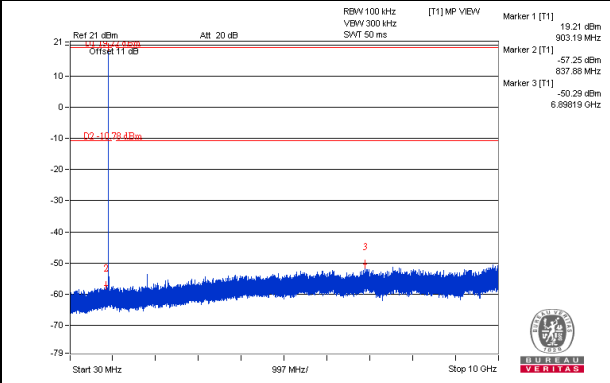
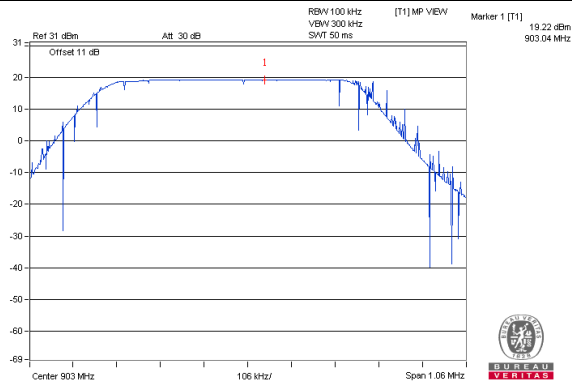
5.7.6 EUT Operating Condition

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

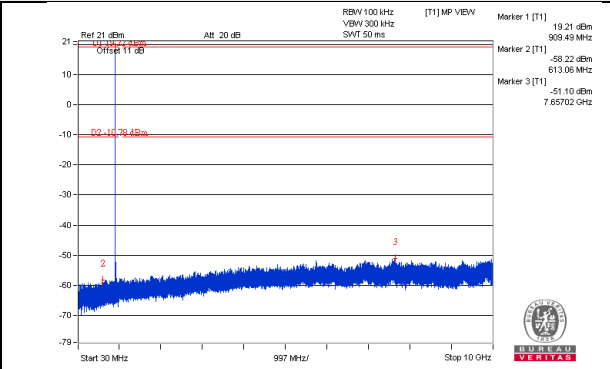
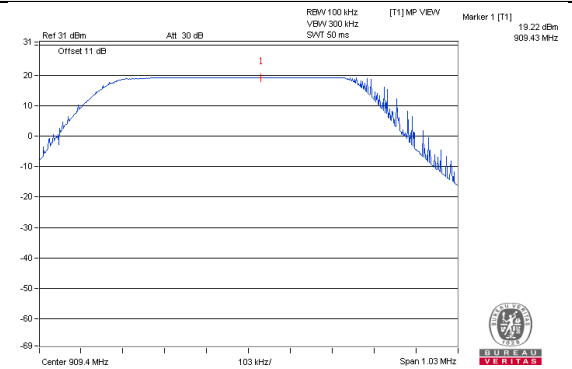
5.7.7 Test Results

The spectrum plots are attached on the following images. D1 line indicates the highest level, D2 line indicates the 30dB offset below D1. It shows compliance with the requirement.

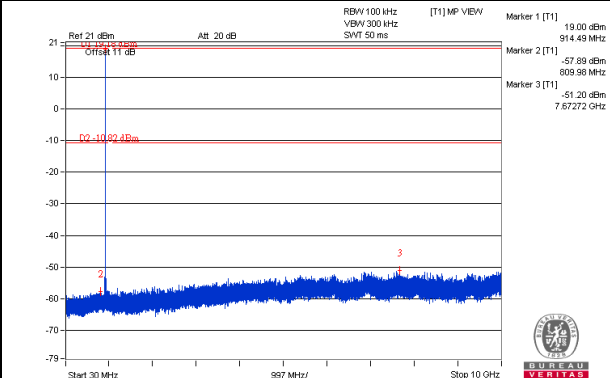
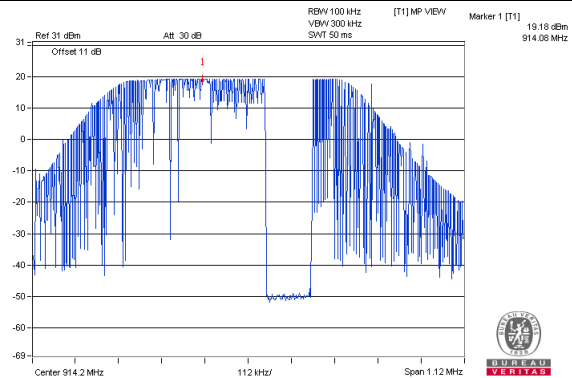
CH 0



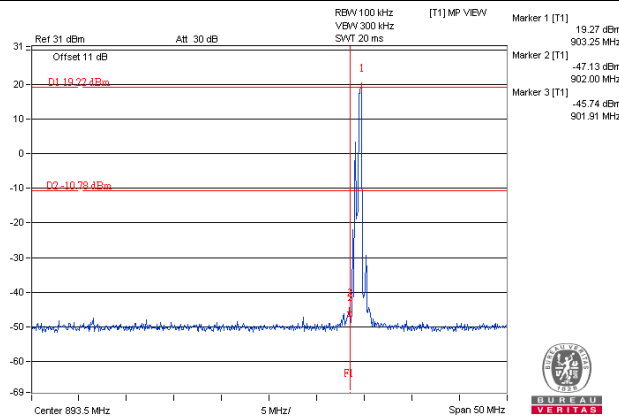
CH 4



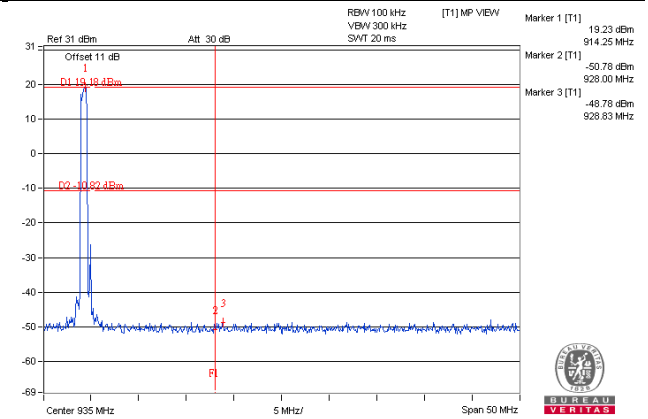
CH 7



CH 0 Band edge



CH 7 Band edge



6 Test Types and Results (DTS Mode (500kHz Bandwidth, 42 channels))

6.1 Radiated Emission and Bandedge Measurement

6.1.1 Limits of Radiated Emission and Bandedge Measurement

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:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, 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.

6.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100424	Oct. 17, 2017	Oct. 16, 2018
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100040	Aug. 18, 2017	Aug. 17, 2018
BILOG Antenna SCHWARZBECK	VULB9168	9168-155	Dec. 11, 2017	Dec. 10, 2018
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-1170	Dec. 13, 2017	Dec. 12, 2018
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Dec. 01, 2017	Nov. 30, 2018
Loop Antenna EMCI	EM-6879	269	Aug. 11, 2017	Aug. 10, 2018
Preamplifier Agilent (Below 1GHz)	8447D	2944A10631	Aug. 08, 2017	Aug. 07, 2018
Preamplifier Agilent (Above 1GHz)	8449B	3008A01922	Sep. 15, 2017	Sep. 14, 2018
RF signal cable HUBER+SUHNER	SUCOFLEX 104	MY 13380+295012/04	Aug. 08, 2017	Aug. 07, 2018
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH4-03 (250724)	Aug. 08, 2017	Aug. 07, 2018
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	010303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021703	NA	NA
Turn Table BV ADT	TT100	TT93021703	NA	NA
Turn Table Controller BV ADT	SC100	SC93021703	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
High Speed Peak Power Meter	ML2495A	0824012	Aug. 18, 2017	Aug. 17, 2018
Power Sensor	MA2411B	0738171	Aug. 18, 2017	Aug. 17, 2018

- Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 4.
3. The FCC Designation Number is TW0003. The number will be varied with the Lab location and scope as attached.
4. The IC Site Registration No. is IC 7450F-4.

6.1.3 Test Procedures

For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

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

For Radiated emission above 30MHz

- g. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- h. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- i. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- j. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- k. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- l. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

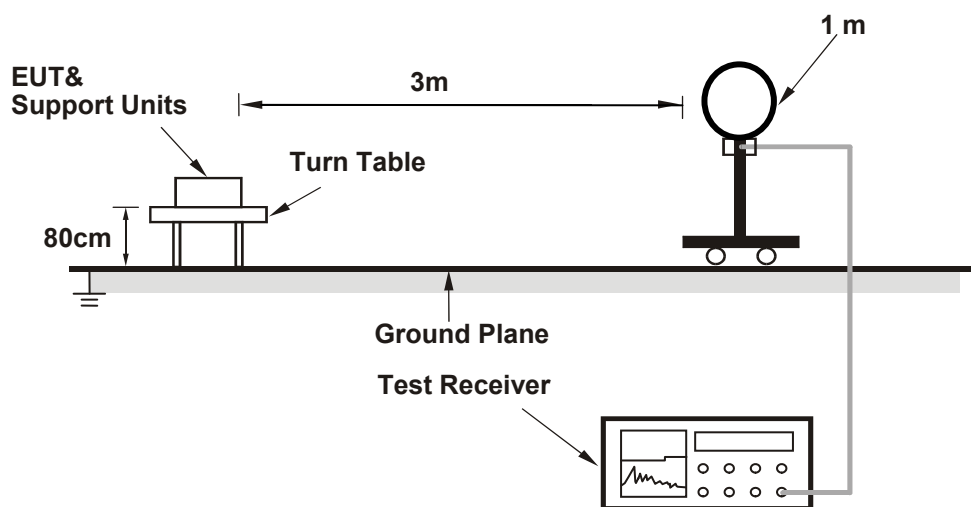
5. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
6. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

6.1.4 Deviation from Test Standard

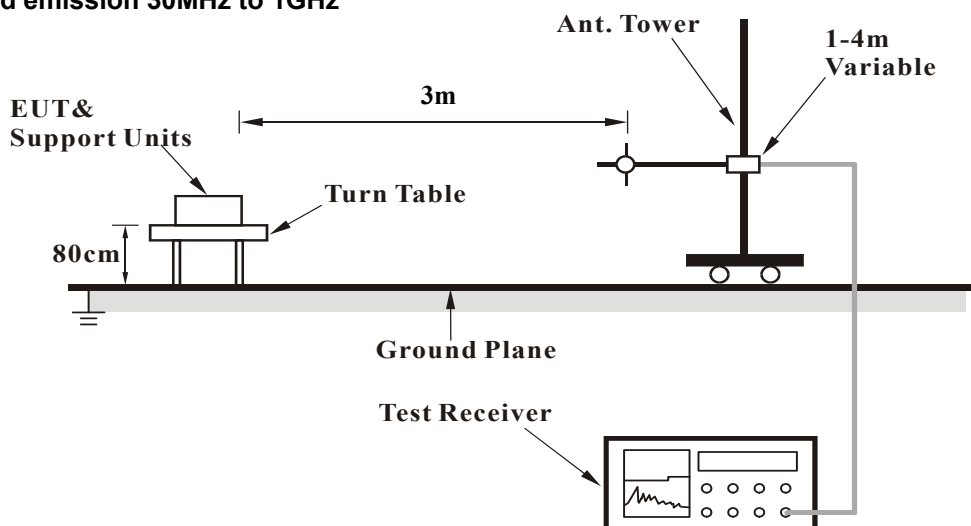
No deviation.

6.1.5 Test Setup

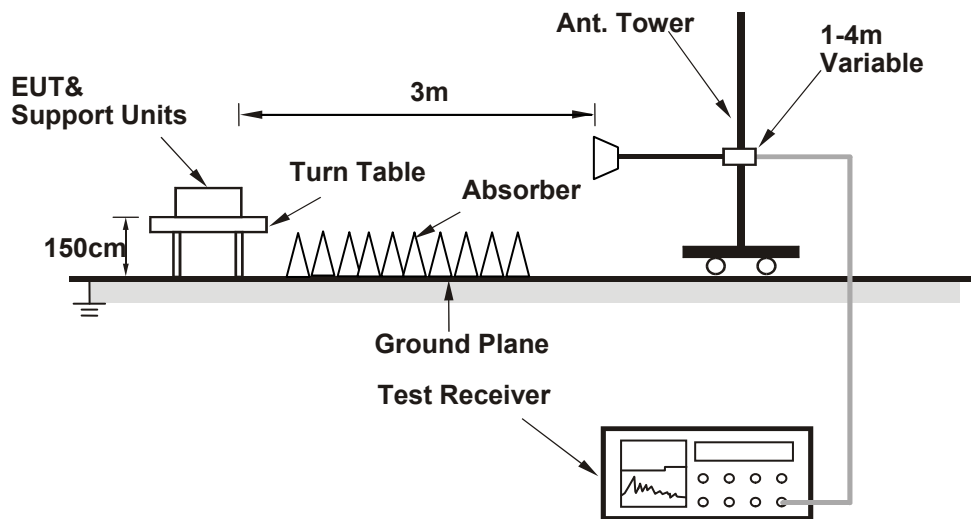
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

6.1.6 EUT Operating Conditions

- b. Set the EUT under transmission condition continuously at specific channel frequency.

6.1.7 Test Results

Above 1GHz Data:

CHANNEL	TX Channel 1	DETECTOR	Peak (PK)
FREQUENCY RANGE	30MHz ~ 10GHz	FUNCTION	Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#902.00	59.5 PK	93.8	-34.3	1.49 H	18	31.2	28.3
2	#902.00	48.7 AV	88.9	-40.2	1.49 H	18	20.4	28.3
3	*902.90	113.8 PK			1.58 H	9	85.5	28.3
4	*902.90	108.9 AV			1.58 H	9	80.6	28.3
5	#1805.80	62.5 PK	93.8	-31.3	1.48 H	37	70.7	-8.2
6	#1805.80	56.4 AV	88.9	-32.5	1.48 H	37	64.6	-8.2
7	2708.70	45.6 PK	74.0	-28.4	1.18 H	33	49.5	-3.9
8	2708.70	38.8 AV	54.0	-15.2	1.18 H	33	42.7	-3.9
9	3611.60	42.4 PK	74.0	-31.6	1.39 H	221	44.1	-1.7
10	3611.60	30.1 AV	54.0	-23.9	1.39 H	221	31.8	-1.7
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#902.00	63.0 PK	96.5	-33.5	1.02 V	218	34.7	28.3
2	#902.00	50.7 AV	91.7	-41.0	1.02 V	218	22.4	28.3
3	*902.90	116.5 PK			1.01 V	236	88.2	28.3
4	*902.90	111.7 AV			1.01 V	236	83.4	28.3
5	#1805.80	60.1 PK	96.5	-36.4	1.00 V	250	68.3	-8.2
6	#1805.80	56.4 AV	91.7	-35.3	1.00 V	250	64.6	-8.2
7	2708.70	47.4 PK	74.0	-26.6	1.56 V	110	51.3	-3.9
8	2708.70	42.9 AV	54.0	-11.1	1.56 V	110	46.8	-3.9
9	3611.60	42.8 PK	74.0	-31.2	1.15 V	226	44.5	-1.7
10	3611.60	30.0 AV	54.0	-24.0	1.15 V	226	31.7	-1.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

CHANNEL	TX Channel 21	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	30MHz ~ 10GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*914.90	115.2 PK			1.56 H	63	86.6	28.6
2	*914.90	110.4 AV			1.56 H	63	81.8	28.6
3	#1829.80	59.2 PK	95.2	-36.0	1.33 H	163	67.3	-8.1
4	#1829.80	57.5 AV	90.4	-32.9	1.33 H	163	65.6	-8.1
5	2744.70	45.8 PK	74.0	-28.2	1.14 H	199	49.5	-3.7
6	2744.70	39.1 AV	54.0	-14.9	1.14 H	199	42.8	-3.7
7	3659.60	42.9 PK	74.0	-31.1	1.55 H	219	44.6	-1.7
8	3659.60	30.1 AV	54.0	-23.9	1.55 H	219	31.8	-1.7
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*914.90	117.6 PK			1.15 V	112	89.0	28.6
2	*914.90	112.7 AV			1.15 V	112	84.1	28.6
3	#1829.80	58.8 PK	97.6	-38.8	1.00 V	249	66.9	-8.1
4	#1829.80	57.1 AV	92.7	-35.6	1.00 V	249	65.2	-8.1
5	2744.70	45.6 PK	74.0	-28.4	1.53 V	194	49.3	-3.7
6	2744.70	39.7 AV	54.0	-14.3	1.53 V	194	43.4	-3.7
7	3659.60	43.4 PK	74.0	-30.6	1.53 V	320	45.1	-1.7
8	3659.60	30.0 AV	54.0	-24.0	1.53 V	320	31.7	-1.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

CHANNEL	TX Channel 42	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	30MHz ~ 10GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*927.50	115.7 PK			1.44 H	66	87.1	28.6
2	*927.50	110.8 AV			1.44 H	66	82.2	28.6
3	#928.00	87.3 PK	95.7	-8.4	1.38 H	72	58.7	28.6
4	#928.00	74.6 AV	90.8	-16.2	1.38 H	72	46.0	28.6
5	#1855.00	59.1 PK	95.7	-36.6	1.12 H	40	67.0	-7.9
6	#1855.00	55.1 AV	90.8	-35.7	1.12 H	40	63.0	-7.9
7	2782.50	46.0 PK	74.0	-28.0	1.20 H	250	49.7	-3.7
8	2782.50	39.6 AV	54.0	-14.4	1.20 H	250	43.3	-3.7
9	3710.00	43.4 PK	74.0	-30.6	1.32 H	122	44.9	-1.5
10	3710.00	30.1 AV	54.0	-23.9	1.32 H	122	31.6	-1.5
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*927.50	117.5 PK			1.14 V	112	88.9	28.6
2	*927.50	112.6 AV			1.14 V	112	84.0	28.6
3	#928.00	88.3 PK	97.5	-9.2	1.10 V	119	59.7	28.6
4	#928.00	76.5 AV	92.6	-16.1	1.10 V	119	47.9	28.6
5	#1855.00	57.8 PK	97.5	-39.7	1.00 V	252	65.7	-7.9
6	#1855.00	55.8 AV	92.6	-36.8	1.00 V	252	63.7	-7.9
7	2782.50	49.3 PK	74.0	-24.7	1.58 V	309	53.0	-3.7
8	2782.50	43.9 AV	54.0	-10.1	1.58 V	309	47.6	-3.7
9	3710.00	43.8 PK	74.0	-30.2	1.25 V	100	45.3	-1.5
10	3710.00	31.3 AV	54.0	-22.7	1.25 V	100	32.8	-1.5

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

Below 1GHz Data:

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	142.44	38.4 QP	43.5	-5.1	1.99 H	7	52.4	-14.0
2	165.73	38.6 QP	43.5	-4.9	1.49 H	159	52.3	-13.7
3	249.17	36.7 QP	46.0	-9.3	1.49 H	87	50.8	-14.1
4	336.48	34.5 QP	46.0	-11.5	1.00 H	82	45.8	-11.3
5	431.56	33.4 QP	46.0	-12.6	1.99 H	109	42.8	-9.4
6	664.41	28.5 QP	46.0	-17.5	1.49 H	13	33.1	-4.6
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	57.07	35.3 QP	40.0	-4.7	1.51 V	350	49.5	-14.2
2	111.40	34.7 QP	43.5	-8.8	1.51 V	140	51.6	-16.9
3	142.44	34.8 QP	43.5	-8.7	1.00 V	102	48.8	-14.0
4	165.73	32.2 QP	43.5	-11.3	1.00 V	268	45.9	-13.7
5	336.48	28.7 QP	46.0	-17.3	1.51 V	7	40.0	-11.3
6	666.35	28.9 QP	46.0	-17.1	1.51 V	208	33.5	-4.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

CHANNEL	TX Channel 21	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	165.73	36.8 QP	43.5	-6.7	1.00 H	138	50.5	-13.7
2	231.70	36.3 QP	46.0	-9.7	1.50 H	195	52.0	-15.7
3	293.79	31.6 QP	46.0	-14.4	1.00 H	185	43.9	-12.3
4	336.48	32.3 QP	46.0	-13.7	1.50 H	73	43.6	-11.3
5	365.59	29.8 QP	46.0	-16.2	2.00 H	104	40.7	-10.9
6	817.70	31.6 QP	46.0	-14.4	1.00 H	235	33.0	-1.4
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	66.77	27.8 QP	40.0	-12.2	1.50 V	259	42.9	-15.1
2	99.75	34.6 QP	43.5	-8.9	1.00 V	269	53.1	-18.5
3	165.73	32.1 QP	43.5	-11.4	1.50 V	4	45.8	-13.7
4	336.48	27.8 QP	46.0	-18.2	1.00 V	31	39.1	-11.3
5	489.77	24.5 QP	46.0	-21.5	2.00 V	183	33.1	-8.6
6	864.27	30.1 QP	46.0	-15.9	1.00 V	247	30.9	-0.8

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

CHANNEL	TX Channel 42	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	165.73	37.3 QP	43.5	-6.2	1.50 H	135	51.0	-13.7
2	231.70	35.8 QP	46.0	-10.2	1.00 H	67	51.5	-15.7
3	336.48	32.8 QP	46.0	-13.2	1.00 H	89	44.1	-11.3
4	365.59	30.9 QP	46.0	-15.1	1.50 H	95	41.8	-10.9
5	813.82	30.7 QP	46.0	-15.3	1.50 H	235	32.1	-1.4
6	864.27	30.8 QP	46.0	-15.2	1.00 H	6	31.6	-0.8
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	99.75	34.8 QP	43.5	-8.7	1.50 V	261	53.3	-18.5
2	165.73	32.4 QP	43.5	-11.1	1.00 V	359	46.1	-13.7
3	249.17	30.8 QP	46.0	-15.2	1.50 V	339	44.9	-14.1
4	336.48	29.8 QP	46.0	-16.2	1.00 V	2	41.1	-11.3
5	431.56	27.1 QP	46.0	-18.9	1.00 V	192	36.5	-9.4
6	745.91	31.8 QP	46.0	-14.2	2.00 V	189	34.5	-2.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

6.2 Conducted Emission Measurement

6.2.1 Limits of Conducted Emission Measurement

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

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

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

6.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Nov. 23, 2017	Nov. 22, 2018
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond1-01	Sep. 05, 2017	Sep. 04, 2018
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Mar. 06, 2018	Mar. 05, 2019
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 15, 2017	Aug. 14, 2018
Software ADT	BV ADT_Conf_ V7.3.7.4	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in HwaYa Shielded Room 1.

3. The VCCI Site Registration No. is C-2040.

6.2.3 Test Procedures

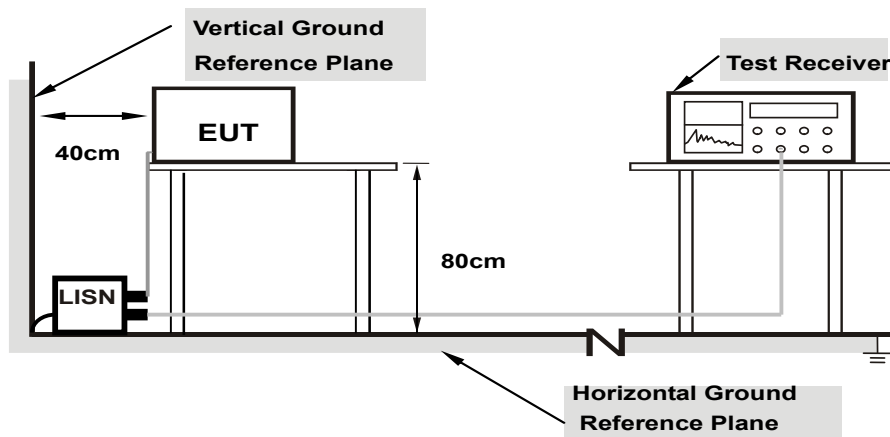
- d. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- e. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- f. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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

6.2.4 Deviation from Test Standard

No deviation.

6.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

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

6.2.6 EUT Operating Conditions

Same as 4.1.6.

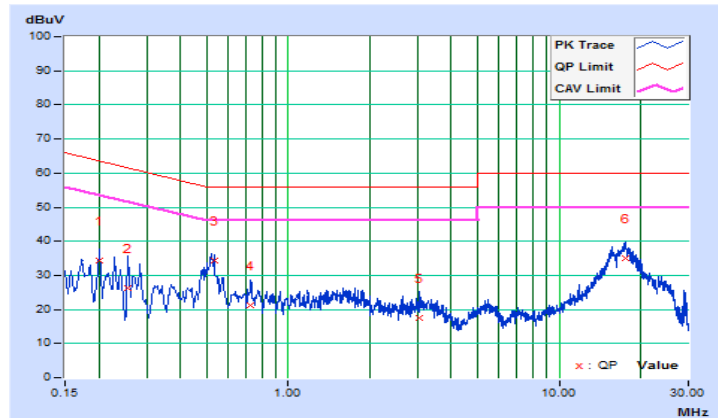
6.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	TX Channel 1		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.20084	10.10	24.23	8.24	34.33	18.34	63.58	53.58	-29.25	-35.24
2	0.25557	10.11	16.22	4.44	26.33	14.55	61.57	51.57	-35.24	-37.02
3	0.53318	10.12	24.33	19.60	34.45	29.72	56.00	46.00	-21.55	-16.28
4	0.72868	10.13	11.06	5.55	21.19	15.68	56.00	46.00	-34.81	-30.32
5	3.05904	10.24	7.11	1.84	17.35	12.08	56.00	46.00	-38.65	-33.92
6	17.68635	11.07	23.91	17.58	34.98	28.65	60.00	50.00	-25.02	-21.35

Remarks:

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

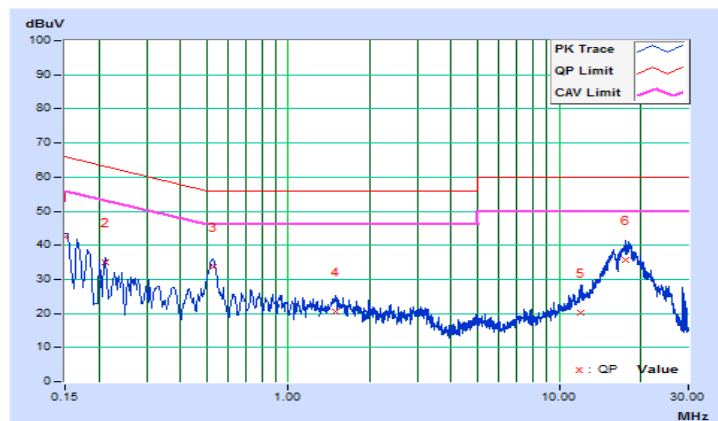


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	TX Channel 1		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.10	32.31	16.94	42.41	27.04	66.00	56.00	-23.59	-28.96
2	0.21256	10.10	24.78	9.44	34.88	19.54	63.10	53.10	-28.22	-33.56
3	0.52544	10.12	23.57	17.36	33.69	27.48	56.00	46.00	-22.31	-18.52
4	1.50350	10.15	10.42	5.90	20.57	16.05	56.00	46.00	-35.43	-29.95
5	12.07550	10.61	9.47	4.07	20.08	14.68	60.00	50.00	-39.92	-35.32
6	17.57296	10.84	24.82	18.35	35.66	29.19	60.00	50.00	-24.34	-20.81

Remarks:

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

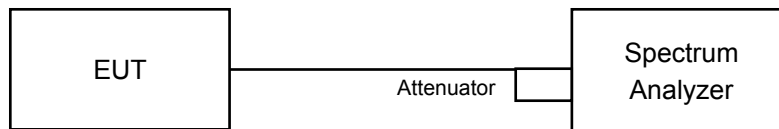


6.3 6dB Bandwidth Measurement

6.3.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

6.3.2 Test Setup



6.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

6.3.4 Test Procedure

- Set resolution bandwidth (RBW) = 100kHz
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = average.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

6.3.5 Deviation from Test Standard

No deviation.

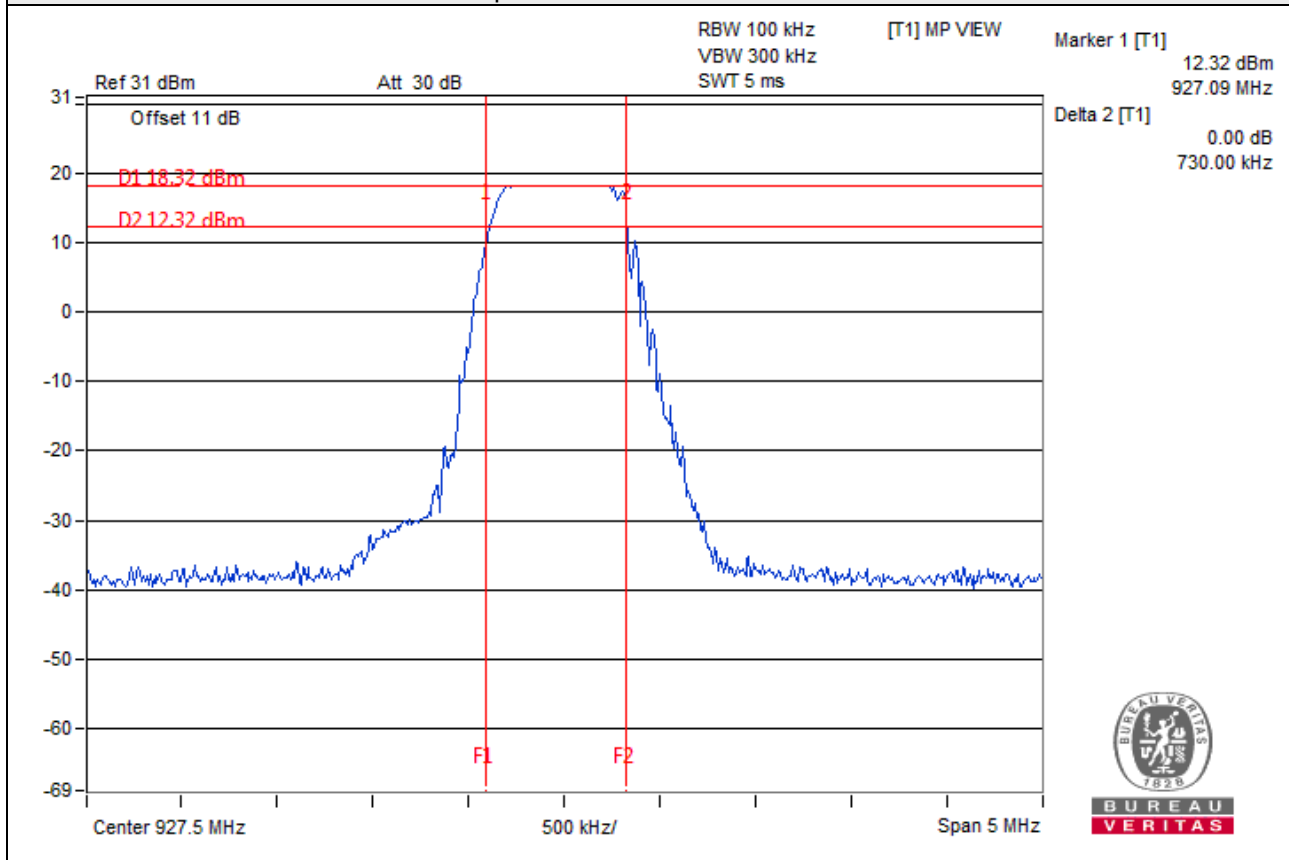
6.3.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

6.3.7 Test Result

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	902.9	0.69	0.5	Pass
21	914.9	0.69	0.5	Pass
42	927.5	0.73	0.5	Pass

Spectrum Plot of Worst Value

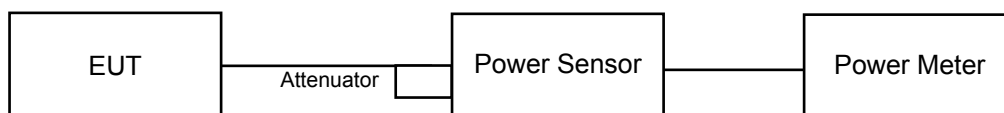


6.4 Conducted Output Power Measurement

6.4.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 902-928 MHz bands: 1 Watt (30dBm)

6.4.2 Test Setup



6.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

6.4.4 Test Procedure

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

6.4.5 Deviation from Test Standard

No deviation.

6.4.6 EUT Operating Condition

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

6.4.7 Test Results

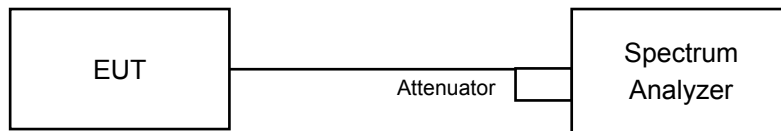
Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Power Limit (dBm)	Pass / Fail
1	902.9	57.943	17.63	30.00	Pass
21	914.9	58.749	17.69	30.00	Pass
42	927.5	57.677	17.61	30.00	Pass

6.5 Power Spectral Density Measurement

6.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm.

6.5.2 Test Setup



6.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

6.5.4 Test Procedure

- Set instrument center frequency to DTS channel center frequency.
- Set span to at least 1.5 times the OBW.
- Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set VBW $\geq 3 \times \text{RBW}$.
- Detector = power averaging (RMS) or sample detector (when RMS not available).
- Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span/RBW}$.
- Sweep time = auto couple.
- Employ trace averaging (RMS) mode over a minimum of 100 traces.
- Use the peak marker function to determine the maximum amplitude level.

6.5.5 Deviation from Test Standard

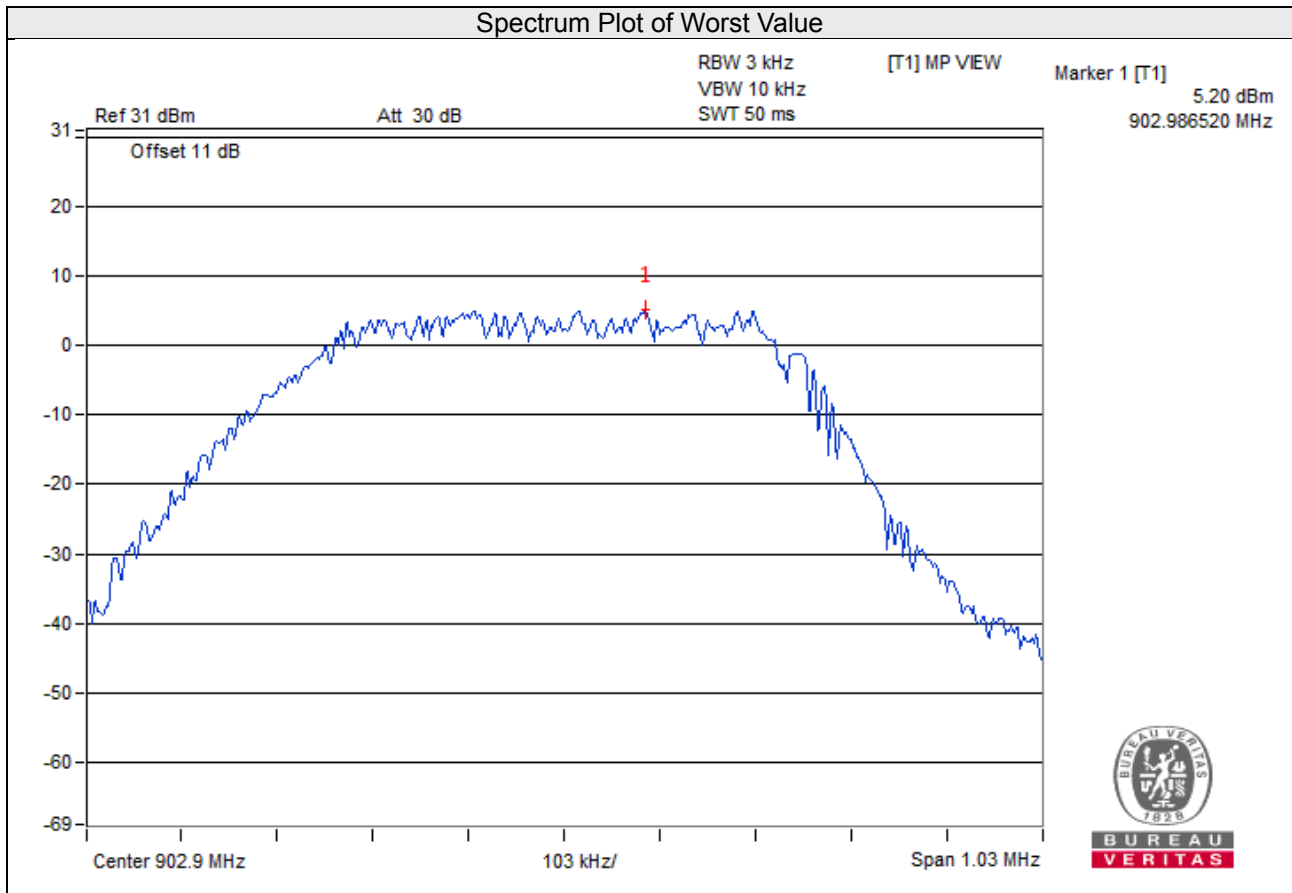
No deviation.

6.5.6 EUT Operating Condition

Same as Item 4.3.6

6.5.7 Test Results

Channel	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass / Fail
1	902.9	5.20	8.00	Pass
21	914.9	5.18	8.00	Pass
42	927.5	5.17	8.00	Pass

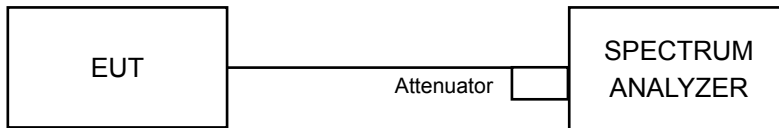


6.6 Conducted Out of Band Emission Measurement

6.6.1 Limits of Conducted Out Of Band Emission Measurement

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

6.6.2 Test Setup



6.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

6.6.4 Test Procedure

MEASUREMENT PROCEDURE REF

- h. Set the RBW = 100 kHz.
- i. Set the VBW $\geq$ 300 kHz.
- j. Detector = average.
- k. Sweep time = auto couple.
- l. Trace mode = max hold.
- m. Allow trace to fully stabilize.
- n. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOBE

- h. Set RBW = 100 kHz.
- i. Set VBW $\geq$ 300 kHz.
- j. Detector = average.
- k. Sweep = auto couple.
- l. Trace Mode = max hold.
- m. Allow trace to fully stabilize.
- n. Use the peak marker function to determine the maximum amplitude level.

6.6.5 Deviation from Test Standard

No deviation.

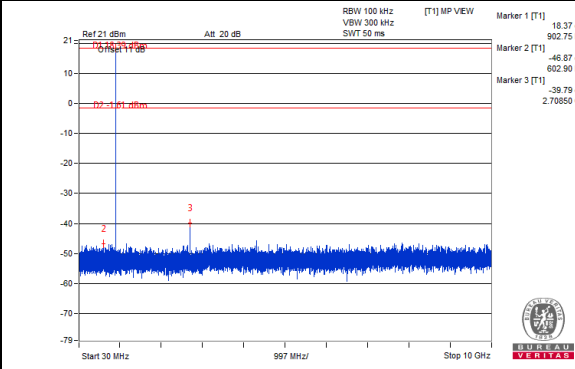
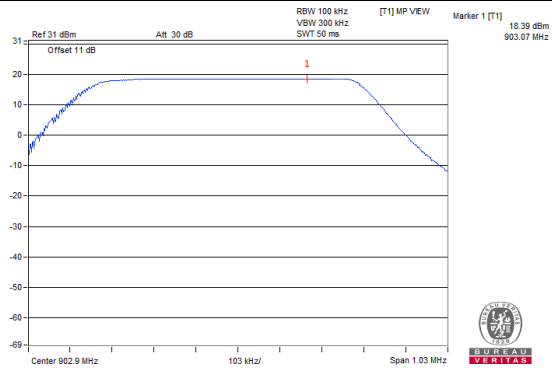
6.6.6 EUT Operating Condition

Same as Item 4.3.6

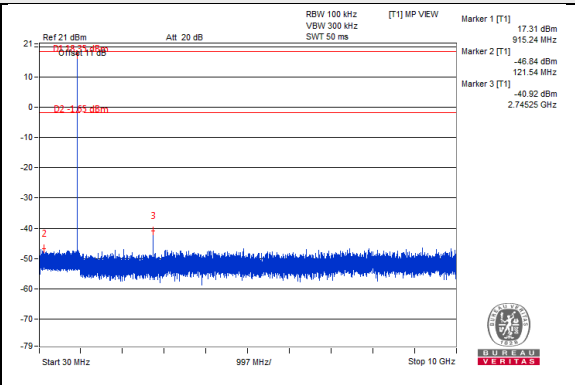
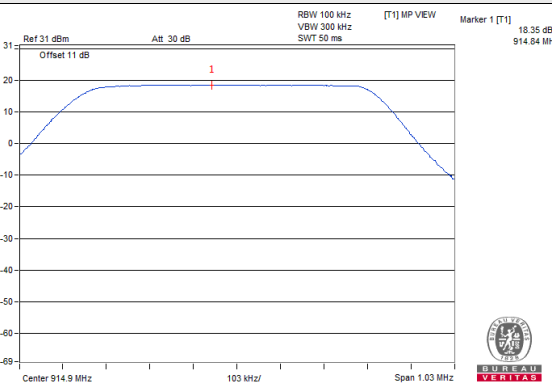
6.6.7 Test Results

The spectrum plots are attached on the following images. D1 line indicates the highest level, D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

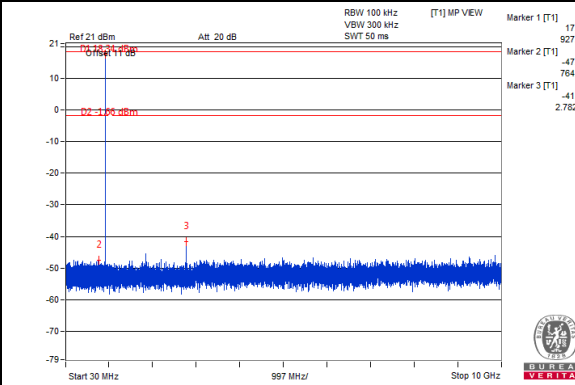
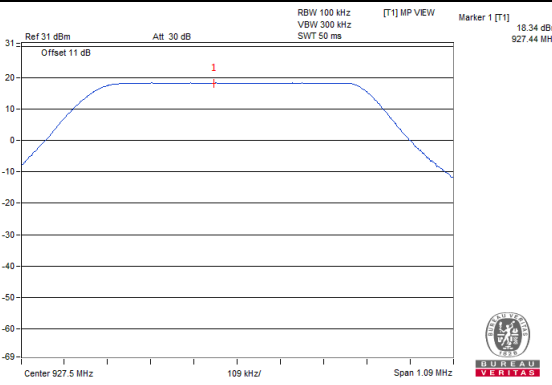
CH 1



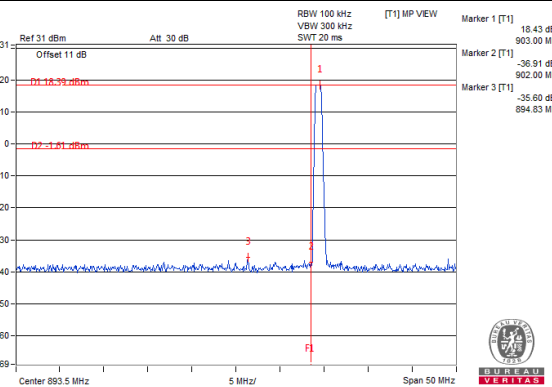
CH 21



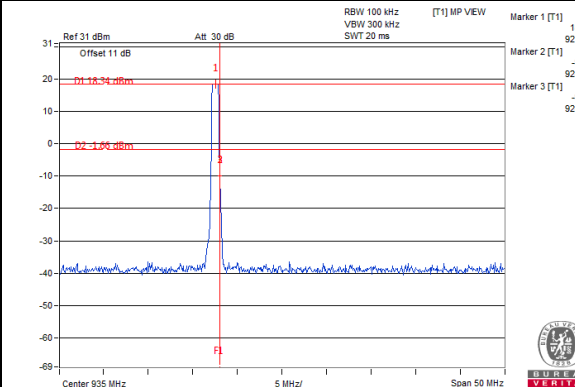
CH 42



CH 1 Band edge



CH 42 Band edge



7 Pictures of Test Arrangements

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

Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

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