

FCC Test Report

Report No.: RF161019E02

FCC ID: COFWMSGSM42

Test Model: WM-SG-SM-42

Received Date: Oct. 19, 2016

Test Date: Dec. 15, 2016 to Jan. 11, 2017

Issued Date: Feb. 10, 2017

Applicant: UNIVERSAL GLOBAL SCIENTIFIC INDUSTRIAL CO., LTD.

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Release Control Record

Issue No.	Description	Date Issued
RF161019E02	Original release	Feb. 10, 2017

1 Certificate of Conformity

Product: LPWAN module

Brand: USI

Test Model: WM-SG-SM-42

Sample Status: ENGINEERING SAMPLE

Applicant: UNIVERSAL GLOBAL SCIENTIFIC INDUSTRIAL CO., LTD.

Test Date: Dec. 15, 2016 to Jan. 11, 2017

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 EMC characteristics under the conditions specified in this report.

Prepared by :  , **Date:** Feb. 10, 2017
Claire Kuan / Specialist

Approved by :  , **Date:** Feb. 10, 2017
May Chen / Manager

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 -17.11dB at 0.16562MHz.
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 -3.2dB at 240.00MHz.
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 i-pex 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 -16.53dB at 0.16953MHz.
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 -3.1dB at 240.00MHz.
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 i-pex 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, 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 -16.53dB at 0.16953MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -3.1dB at 240.00MHz.
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 i-pex 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	1.83 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.34 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	3.47 dB
	6GHz ~ 18GHz	3.75 dB
	18GHz ~ 40GHz	3.30 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	LPWAN module	
Brand	USI	
Test Model	WM-SG-SM-42	
Sample Status	ENGINEERING SAMPLE	
Power Supply Rating	3.3Vdc from host equipment	
Modulation Type	FSK & OOK	
Transfer Rate	21.9kbps	
Operating Frequency	902.3~914.9MHz & 923.3~927.5MHz	
Number of Channel	Hybrid Mode (125kHz Bandwidth, 64 channels)	64
	Hybrid Mode (500kHz Bandwidth, 8 channels)	8
	DTS Mode (500kHz Bandwidth, 8 channels)	8
Channel Spacing	Hybrid Mode (125kHz Bandwidth, 64 channels)	0.2MHz
	Hybrid Mode (500kHz Bandwidth, 8 channels)	1.6MHz
	DTS Mode (500kHz Bandwidth, 8 channels)	1.6MHz
Output Power	Hybrid Mode (125kHz Bandwidth, 64 channels)	81.283mW
	Hybrid Mode (500kHz Bandwidth, 8 channels)	79.25mW
	DTS Mode (500kHz Bandwidth, 8 channels)	79.25mW
Antenna Type	Dipole antenna with 2.3dBi gain	
Antenna Connector	I-pex	
Accessory Device	NA	
Cable Supplied	NA	

Note:

1. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

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) & DTS Mode (500kHz Bandwidth):

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
64	903.0	66	906.2	68	909.4	70	912.6
65	904.6	67	907.8	69	911.0	71	914.2

3.2.1 Test Mode Applicability and Tested Channel Detail

Hybrid Mode (125kHz Bandwidth, 64 channels)

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

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

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, 32, 63	FSK & OOK

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, 32, 63	FSK & OOK

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 & OOK

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, 32, 63	FSK & OOK

Test Condition:

Applicable to	Environmental Conditions	Input Power (System)	Tested by
RE≥1G	23 deg. C, 64% RH	120Vac, 60Hz	Jyunchun Lin
RE<1G	24 deg. C, 60% RH	120Vac, 60Hz	Jyunchun Lin
PLC	25 deg. C, 75% RH	120Vac, 60Hz	Andy Ho
APCM	24 deg. C, 62% RH	120Vac, 60Hz	Anderson Chen

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

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
-	64 to 71	64, 67, 71	FSK & OOK

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
-	64 to 71	64, 67, 71	FSK & OOK

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
-	64 to 71	64	FSK & OOK

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
-	64 to 71	64, 67, 71	FSK & OOK

Test Condition:

Applicable to	Environmental Conditions	Input Power (System)	Tested by
RE $\geq$ 1G	23 deg. C, 64% RH	120Vac, 60Hz	Jyunchun Lin
RE<1G	24 deg. C, 60% RH	120Vac, 60Hz	Jyunchun Lin
PLC	24 deg. C, 66% RH	120Vac, 60Hz	Jyunchun Lin
APCM	24 deg. C, 62% RH	120Vac, 60Hz	Anderson Chen

DTS 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

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
-	64 to 71	64, 67, 71	FSK & OOK

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
-	64 to 71	64, 67, 71	FSK & OOK

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
-	64 to 71	64	FSK & OOK

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
-	64 to 71	64, 67, 71	FSK & OOK

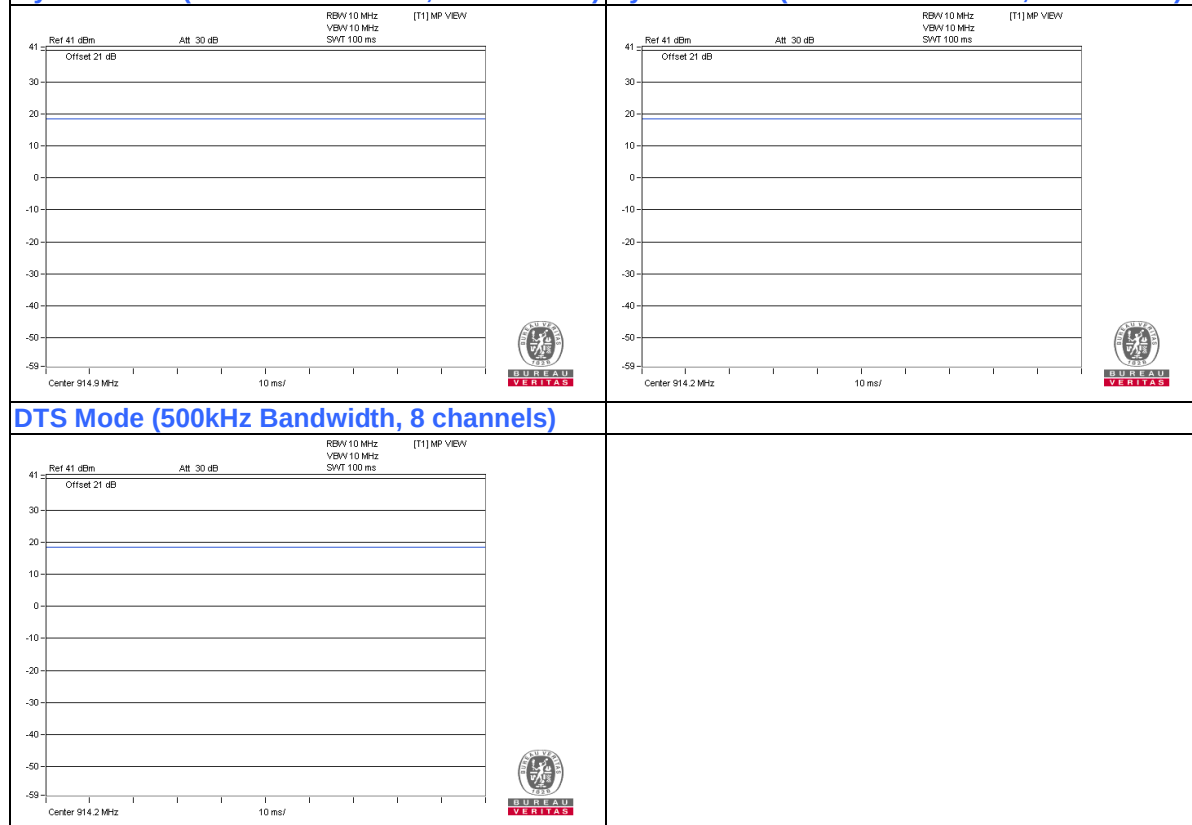
Test Condition:

Applicable to	Environmental Conditions	Input Power (System)	Tested by
RE $\geq$ 1G	23 deg. C, 64% RH	120Vac, 60Hz	Jyunchun Lin
RE<1G	24 deg. C, 60% RH	120Vac, 60Hz	Jyunchun Lin
PLC	24 deg. C, 66% RH	120Vac, 60Hz	Jyunchun Lin
APCM	24 deg. C, 62% RH	120Vac, 60Hz	Anderson Chen

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is 100 %, duty factor is not required.

Hybrid Mode (125kHz Bandwidth, 64 channels) Hybrid Mode (500kHz Bandwidth, 8 channels)



3.4 Description of Support Units

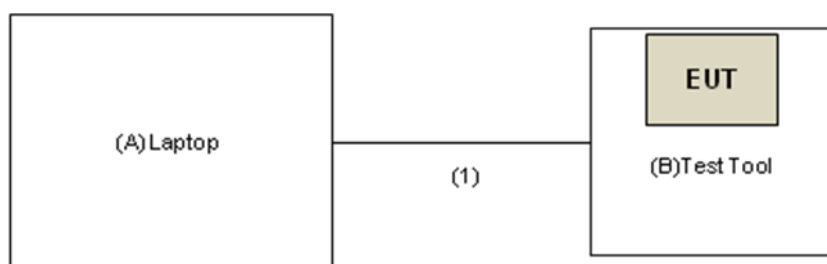
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	HP	Pavilion 14-ab023TU	5CD5340WXZ	NA	Provided by Lab
B.	Test Tool	UGSI	NA	NA	NA	Supplied by client

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	0.8	Yes	0	Provided by Lab

3.4.1 Configuration of System under Test



3.5 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)

558074 D01 DTS Meas Guidance v03r05

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

For below 1GHz test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Keysight	N9038A	MY54450088	July 20, 2016	July 19, 2017
Pre-Amplifier ^(*) EMCI	EMC001340	980142	Jan. 20, 2016	Jan. 19, 2018
Loop Antenna ^(*) Electro-Metrics	EM-6879	264	Dec. 16, 2014	Dec. 15, 2016
RF Cable	NA	LOOPCAB-001 LOOPCAB-002	Jan. 18, 2016	Jan. 17, 2017
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-01	Nov. 10, 2016	Nov. 09, 2017
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-406	Dec. 13, 2016	Dec. 12, 2017
RF Cable	8D	966-4-1 966-4-2 966-4-3	Apr. 02, 2016	Apr. 01, 2017
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-4-01	Oct. 05, 2016	Oct. 04, 2017
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208410	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP02	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 calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. The test was performed in 966 Chamber No. 4.
4. The FCC Site Registration No. is 292998
5. The CANADA Site Registration No. is 20331-2
6. Tested Date: Dec. 15, 2016

For above 1GHz test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY50010156	Aug. 18, 2016	Aug. 17, 2017
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Dec. 28, 2016	Dec. 27, 2017
Pre-Amplifier Agilent	8449B	3008A02465	Apr. 05, 2016	Apr. 04, 2017
RF Cable	EMC104-SM-SM-2000 EMC104-SM-SM-5000 EMC104-SM-SM-5000	150317 150321 150322	Mar. 30, 2016	Mar. 29, 2017
Spectrum Analyzer Keysight	N9030A	MY54490520	July 29, 2016	July 28, 2017
Pre-Amplifier EMCI	EMC184045	980143	Jan. 15, 2016	Jan. 14, 2017
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170608	Dec. 15, 2016	Dec. 14, 2017
RF Cable	SUCOFLEX 102	36432/2 36433/2	Jan. 16, 2016	Jan. 15, 2017
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	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 966 Chamber No. 3.
3. The FCC Site Registration No. is 147459
4. The CANADA Site Registration No. is 20331-1
5. Tested Date: Jan. 11, 2017

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 below 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:

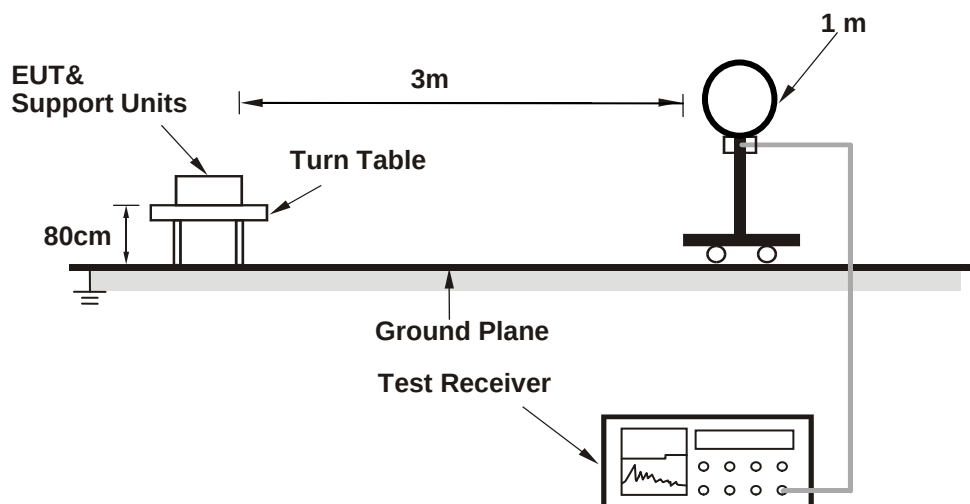
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
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

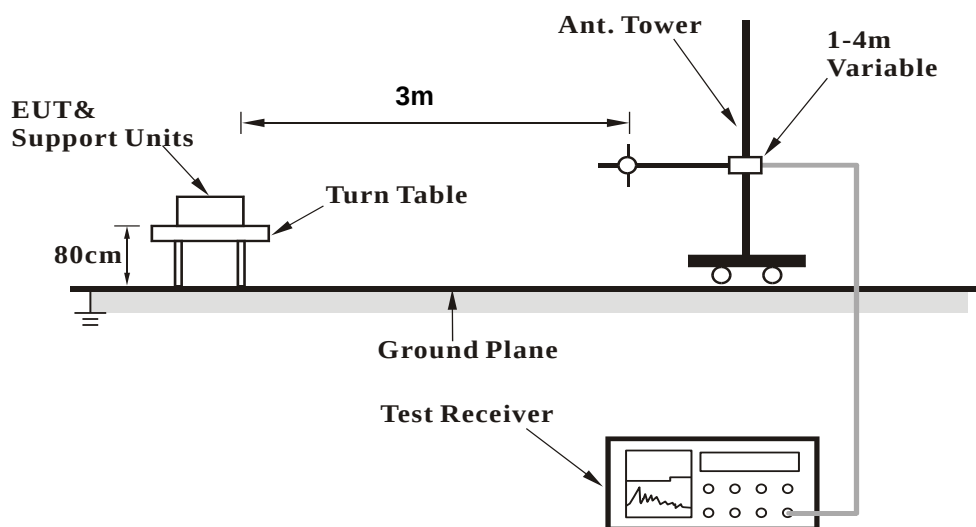
No deviation.

4.1.5 Test Setup

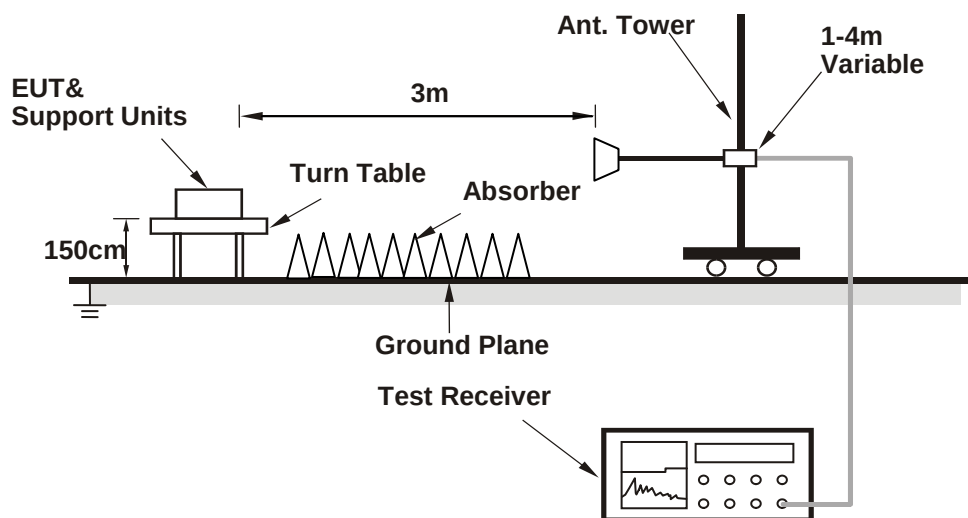
For Radiated emission below 30MHz



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

- Connected the EUT with the Laptop which is placed on table.
- Contorlling software (Hypertm.exe paste Lora cmd.txt) has been activated to set the EUT on specific status.

4.1.7 Test Results

Above 1GHz Worst-case Data:

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 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	2706.90	46.0 PK	74.0	-28.0	1.00 H	70	48.7	-2.7
2	2706.90	40.1 AV	54.0	-13.9	1.00 H	70	42.8	-2.7
3	3609.20	43.7 PK	74.0	-30.3	1.00 H	218	44.3	-0.6
4	3609.20	33.6 AV	54.0	-20.4	1.00 H	218	34.2	-0.6
5	4511.50	44.9 PK	74.0	-29.1	1.50 H	34	43.6	1.3
6	4511.50	34.4 AV	54.0	-19.6	1.50 H	34	33.1	1.3
7	5413.80	44.8 PK	74.0	-29.2	1.50 H	25	41.4	3.4
8	5413.80	33.6 AV	54.0	-20.4	1.50 H	25	30.2	3.4
9	8120.70	51.9 PK	74.0	-22.1	1.50 H	250	41.8	10.1
10	8120.70	39.3 AV	54.0	-14.7	1.50 H	250	29.2	10.1
11	9023.00	48.8 PK	74.0	-25.2	1.10 H	121	38.9	9.9
12	9023.00	39.8 AV	54.0	-14.2	1.10 H	121	29.9	9.9
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	2706.90	47.5 PK	74.0	-26.5	2.45 V	170	50.2	-2.7
2	2706.90	42.6 AV	54.0	-11.4	2.45 V	170	45.3	-2.7
3	3609.20	43.2 PK	74.0	-30.8	1.50 V	271	43.8	-0.6
4	3609.20	32.0 AV	54.0	-22.0	1.50 V	271	32.6	-0.6
5	4511.50	44.6 PK	74.0	-29.4	1.50 V	343	43.3	1.3
6	4511.50	33.8 AV	54.0	-20.2	1.50 V	343	32.5	1.3
7	5413.80	45.2 PK	74.0	-28.8	4.00 V	0	41.8	3.4
8	5413.80	34.0 AV	54.0	-20.0	4.00 V	0	30.6	3.4
9	8120.70	52.6 PK	74.0	-21.4	1.50 V	180	42.5	10.1
10	8120.70	40.4 AV	54.0	-13.6	1.50 V	180	30.3	10.1
11	9023.00	52.5 PK	74.0	-21.5	3.38 V	354	42.6	9.9
12	9023.00	48.9 AV	54.0	-5.1	3.38 V	354	39.0	9.9

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 32	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 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	2726.10	46.1 PK	74.0	-27.9	1.03 H	81	48.8	-2.7
2	2726.10	40.0 AV	54.0	-14.0	1.03 H	81	42.7	-2.7
3	3634.80	44.4 PK	74.0	-29.6	1.07 H	218	45.0	-0.6
4	3634.80	34.0 AV	54.0	-20.0	1.07 H	218	34.6	-0.6
5	4543.50	44.8 PK	74.0	-29.2	1.54 H	49	43.4	1.4
6	4543.50	34.5 AV	54.0	-19.5	1.54 H	49	33.1	1.4
7	5452.20	44.9 PK	74.0	-29.1	1.52 H	22	41.5	3.4
8	5452.20	33.5 AV	54.0	-20.5	1.52 H	22	30.1	3.4
9	8178.30	52.3 PK	74.0	-21.7	1.46 H	257	42.3	10.0
10	8178.30	39.6 AV	54.0	-14.4	1.46 H	257	29.6	10.0
11	9087.00	48.8 PK	74.0	-25.2	1.06 H	115	38.9	9.9
12	9087.00	39.8 AV	54.0	-14.2	1.06 H	115	29.9	9.9

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	2726.10	47.9 PK	74.0	-26.1	2.45 V	155	50.6	-2.7
2	2726.10	43.0 AV	54.0	-11.0	2.45 V	155	45.7	-2.7
3	3634.80	42.9 PK	74.0	-31.1	1.51 V	262	43.5	-0.6
4	3634.80	31.5 AV	54.0	-22.5	1.51 V	262	32.1	-0.6
5	4543.50	44.6 PK	74.0	-29.4	1.54 V	359	43.2	1.4
6	4543.50	34.1 AV	54.0	-19.9	1.54 V	359	32.7	1.4
7	5452.20	45.3 PK	74.0	-28.7	3.95 V	9	41.9	3.4
8	5452.20	34.0 AV	54.0	-20.0	3.95 V	9	30.6	3.4
9	8178.30	52.7 PK	74.0	-21.3	1.48 V	179	42.7	10.0
10	8178.30	40.6 AV	54.0	-13.4	1.48 V	179	30.6	10.0
11	9087.00	52.4 PK	74.0	-21.6	3.41 V	360	42.5	9.9
12	9087.00	48.6 AV	54.0	-5.4	3.41 V	360	38.7	9.9

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	Peak (PK)
FREQUENCY RANGE	1GHz ~ 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	2744.70	46.1 PK	74.0	-27.9	1.02 H	70	48.8	-2.7
2	2744.70	40.3 AV	54.0	-13.7	1.02 H	70	43.0	-2.7
3	3659.60	43.3 PK	74.0	-30.7	1.03 H	223	43.7	-0.4
4	3659.60	33.1 AV	54.0	-20.9	1.03 H	223	33.5	-0.4
5	4574.50	45.2 PK	74.0	-28.8	1.45 H	30	43.7	1.5
6	4574.50	34.9 AV	54.0	-19.1	1.45 H	30	33.4	1.5
7	8234.10	51.8 PK	74.0	-22.2	1.45 H	257	41.8	10.0
8	8234.10	39.1 AV	54.0	-14.9	1.45 H	257	29.1	10.0
9	9149.00	49.3 PK	74.0	-24.7	1.10 H	113	39.3	10.0
10	9149.00	40.0 AV	54.0	-14.0	1.10 H	113	30.0	10.0
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	2744.70	48.0 PK	74.0	-26.0	2.41 V	157	50.7	-2.7
2	2744.70	43.1 AV	54.0	-10.9	2.41 V	157	45.8	-2.7
3	3659.60	43.4 PK	74.0	-30.6	1.46 V	259	43.8	-0.4
4	3659.60	32.1 AV	54.0	-21.9	1.46 V	259	32.5	-0.4
5	4574.50	44.8 PK	74.0	-29.2	1.49 V	327	43.3	1.5
6	4574.50	33.9 AV	54.0	-20.1	1.49 V	327	32.4	1.5
7	8234.10	53.2 PK	74.0	-20.8	1.51 V	168	43.2	10.0
8	8234.10	40.8 AV	54.0	-13.2	1.51 V	168	30.8	10.0
9	9149.00	52.3 PK	74.0	-21.7	3.35 V	346	42.3	10.0
10	9149.00	48.7 AV	54.0	-5.3	3.35 V	346	38.7	10.0

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

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	66.64	28.7 QP	40.0	-11.3	2.50 H	1	38.4	-9.7
2	185.98	35.1 QP	43.5	-8.4	2.00 H	98	45.8	-10.7
3	240.00	42.7 QP	46.0	-3.3	1.00 H	360	52.6	-9.9
4	248.78	35.4 QP	46.0	-10.6	1.00 H	16	45.0	-9.6
5	480.01	38.3 QP	46.0	-7.7	2.00 H	120	41.2	-2.9
6	796.62	33.6 QP	46.0	-12.4	1.50 H	0	31.0	2.6
7	902.00	56.9 QP	79.9	-23.0	1.56 H	124	25.6	31.3
8	*902.30	109.9 QP			1.56 H	124	78.6	31.3
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	65.91	25.4 QP	40.0	-14.6	2.50 V	226	34.9	-9.5
2	216.05	29.5 QP	46.0	-16.5	1.50 V	133	41.0	-11.5
3	239.98	36.6 QP	46.0	-9.4	1.50 V	46	46.5	-9.9
4	479.98	33.9 QP	46.0	-12.1	2.00 V	106	36.8	-2.9
5	720.03	32.1 QP	46.0	-13.9	2.00 V	0	30.8	1.3
6	798.31	31.1 QP	46.0	-14.9	1.50 V	196	28.4	2.7
7	902.00	67.5 QP	90.3	-22.8	1.07 V	86	36.2	31.3
8	*902.30	120.3 QP			1.07 V	86	89.0	31.3

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.

CHANNEL	TX Channel 32	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	65.65	29.0 QP	40.0	-11.0	2.50 H	337	38.4	-9.4
2	195.75	35.9 QP	43.5	-7.6	1.50 H	77	47.4	-11.5
3	240.00	42.8 QP	46.0	-3.2	1.00 H	360	52.7	-9.9
4	279.12	34.3 QP	46.0	-11.7	1.00 H	60	42.4	-8.1
5	480.01	38.7 QP	46.0	-7.3	2.00 H	126	41.6	-2.9
6	799.40	32.1 QP	46.0	-13.9	1.00 H	360	29.4	2.7
7	*908.70	110.6 QP			1.57 H	125	79.1	31.5
8	928.00	51.0 QP	80.3	-29.3	1.58 H	124	19.3	31.7
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	65.84	25.2 QP	40.0	-14.8	2.50 V	205	34.7	-9.5
2	206.20	27.6 QP	43.5	-15.9	1.50 V	125	39.2	-11.6
3	239.98	36.7 QP	46.0	-9.3	2.00 V	40	46.6	-9.9
4	480.03	34.4 QP	46.0	-11.6	2.00 V	106	37.3	-2.9
5	597.50	31.6 QP	46.0	-14.4	1.00 V	10	31.8	-0.2
6	720.01	31.4 QP	46.0	-14.6	2.00 V	360	30.1	1.3
7	*908.70	120.1 QP			1.07 V	85	88.6	31.5
8	928.00	51.5 QP	89.8	-38.3	1.14 V	114	19.8	31.7

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.

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	66.59	28.7 QP	40.0	-11.3	2.50 H	0	38.4	-9.7
2	203.75	35.4 QP	43.5	-8.1	1.50 H	102	47.0	-11.6
3	240.00	42.8 QP	46.0	-3.2	1.50 H	360	52.7	-9.9
4	279.22	36.4 QP	46.0	-9.6	1.00 H	50	44.5	-8.1
5	480.01	38.6 QP	46.0	-7.4	2.00 H	120	41.5	-2.9
6	720.01	32.4 QP	46.0	-13.6	1.00 H	40	31.1	1.3
7	*914.90	110.3 QP			1.58 H	124	78.7	31.6
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	39.92	26.7 QP	40.0	-13.3	1.00 V	143	35.3	-8.6
2	204.67	27.6 QP	43.5	-15.9	1.50 V	182	39.2	-11.6
3	240.00	36.4 QP	46.0	-9.6	1.50 V	360	46.3	-9.9
4	480.01	34.2 QP	46.0	-11.8	2.00 V	104	37.1	-2.9
5	719.99	30.7 QP	46.0	-15.3	1.50 V	360	29.4	1.3
6	799.91	31.2 QP	46.0	-14.8	1.50 V	168	28.5	2.7
7	*914.90	119.8 QP			1.14 V	114	88.2	31.6

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. " * ": Fundamental frequency.

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.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	847124/029	Oct. 24, 2016	Oct. 23, 2017
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Oct. 26, 2016	Oct. 25, 2017
RF Cable	5D-FB	COCCAB-001	Sep. 30, 2016	Sep. 29, 2017
10 dB PAD Mini-Circuits	HAT-10+	CONATT-004	June 20, 2016	June 19, 2017
Software BVADT	BVADT_Cond_ V7.3.7.4	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. 1.
3. Tested Date: Dec. 19, 2016

4.2.3 Test Procedures

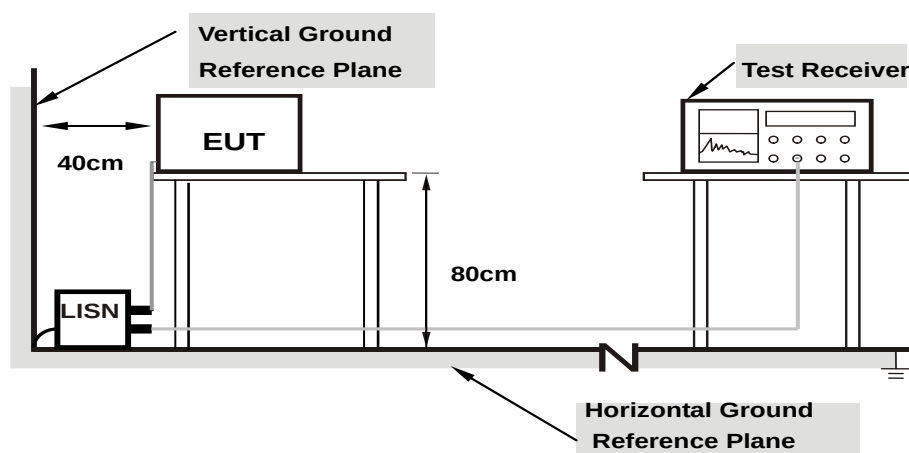
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance 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: All modes of operation were investigated and the worst-case emissions are reported.

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 Condition

Same as 4.1.6.

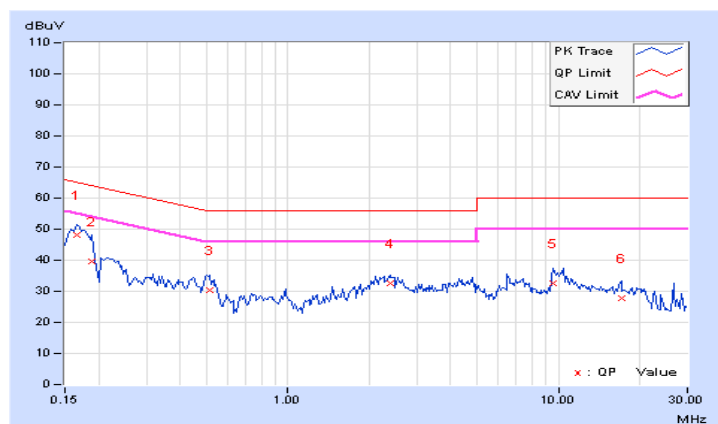
4.2.7 Test Results

Channel	TX Channel 0	Phase	Line (L)
Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz		

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	0.16562	10.19	37.88	26.21	48.07	36.40	65.18	55.18	-17.11	-18.78
2	0.18906	10.19	29.55	13.01	39.74	23.20	64.08	54.08	-24.34	-30.88
3	0.51719	10.23	20.03	14.31	30.26	24.54	56.00	46.00	-25.74	-21.46
4	2.37891	10.24	22.22	17.94	32.46	28.18	56.00	46.00	-23.54	-17.82
5	9.60938	10.53	22.11	16.81	32.64	27.34	60.00	50.00	-27.36	-22.66
6	17.09375	11.19	16.44	11.01	27.63	22.20	60.00	50.00	-32.37	-27.80

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.

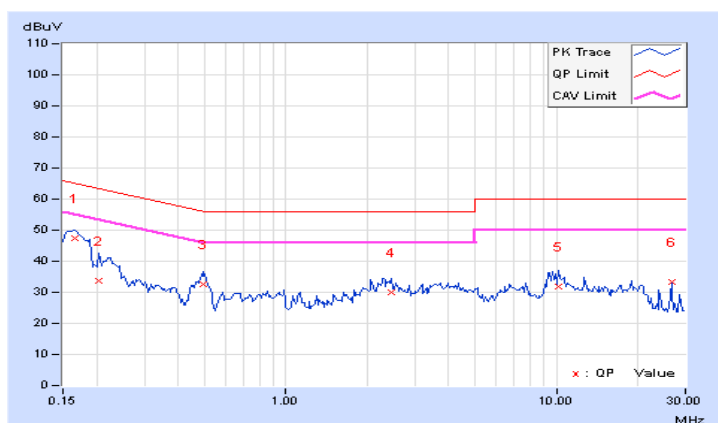


Channel	TX Channel 0	Phase	Neutral (N)
Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz		

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	0.16562	10.17	37.11	25.50	47.28	35.67	65.18	55.18	-17.90	-19.51
2	0.20469	10.16	23.65	10.80	33.81	20.96	63.42	53.42	-29.61	-32.46
3	0.49375	10.21	22.21	16.64	32.42	26.85	56.10	46.10	-23.68	-19.25
4	2.44141	10.25	19.64	14.12	29.89	24.37	56.00	46.00	-26.11	-21.63
5	10.19531	10.51	21.24	15.93	31.75	26.44	60.00	50.00	-28.25	-23.56
6	26.62500	11.07	22.20	21.34	33.27	32.41	60.00	50.00	-26.73	-17.59

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.

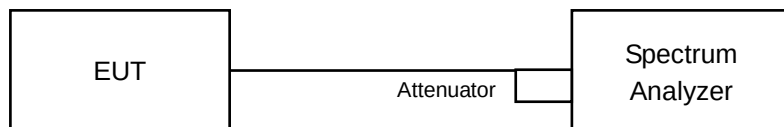


4.3 Number of Hopping Frequency Used

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

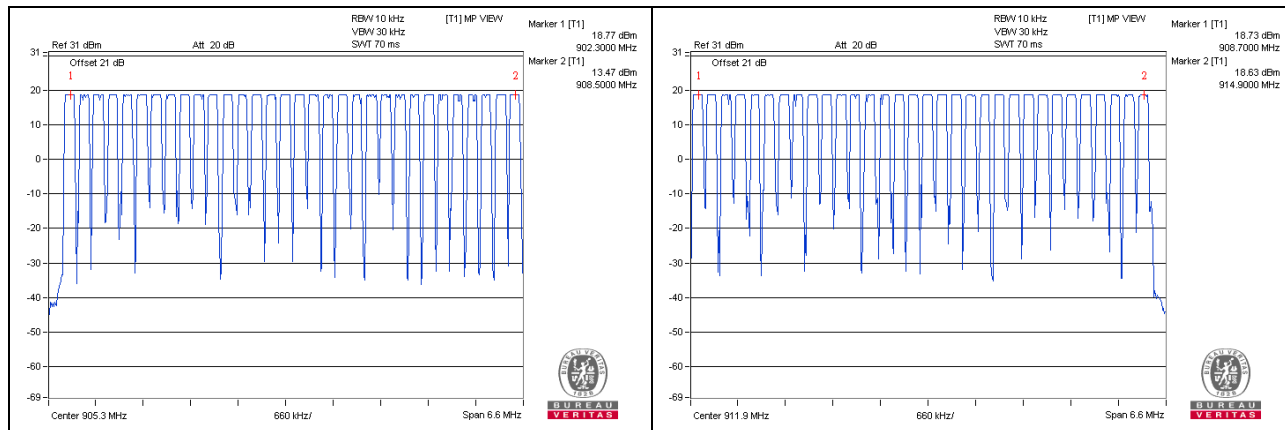
- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make 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.

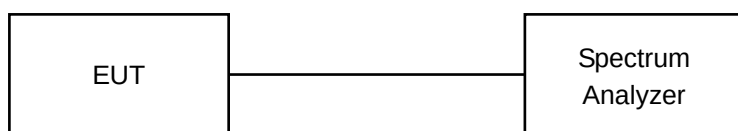


4.4 Dwell Time on Each Channel

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.

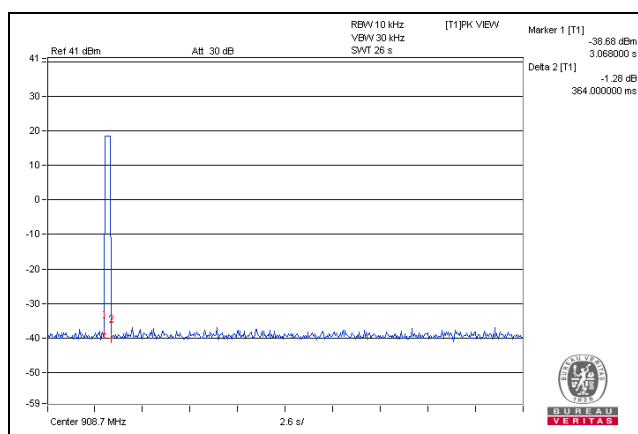
4.4.5 Deviation from Test Standard

No deviation.

4.4.6 Test Results

Mode	Number of transmission in a 25.6 (64Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
Hybrid	1 (times / 26 sec) = 1 times	364	364	400

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

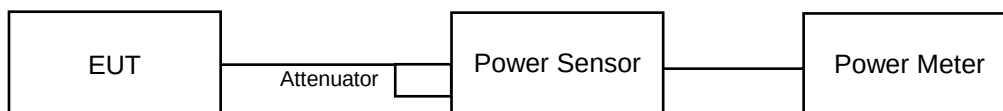


4.5 Conducted Output Power Measurement

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	81.283	19.10	30	Pass
32	908.7	78.886	18.97	30	Pass
63	914.9	77.268	18.88	30	Pass

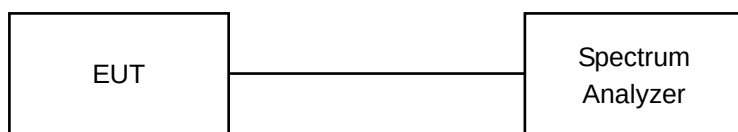
4.6 Power Spectral Density Measurement

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

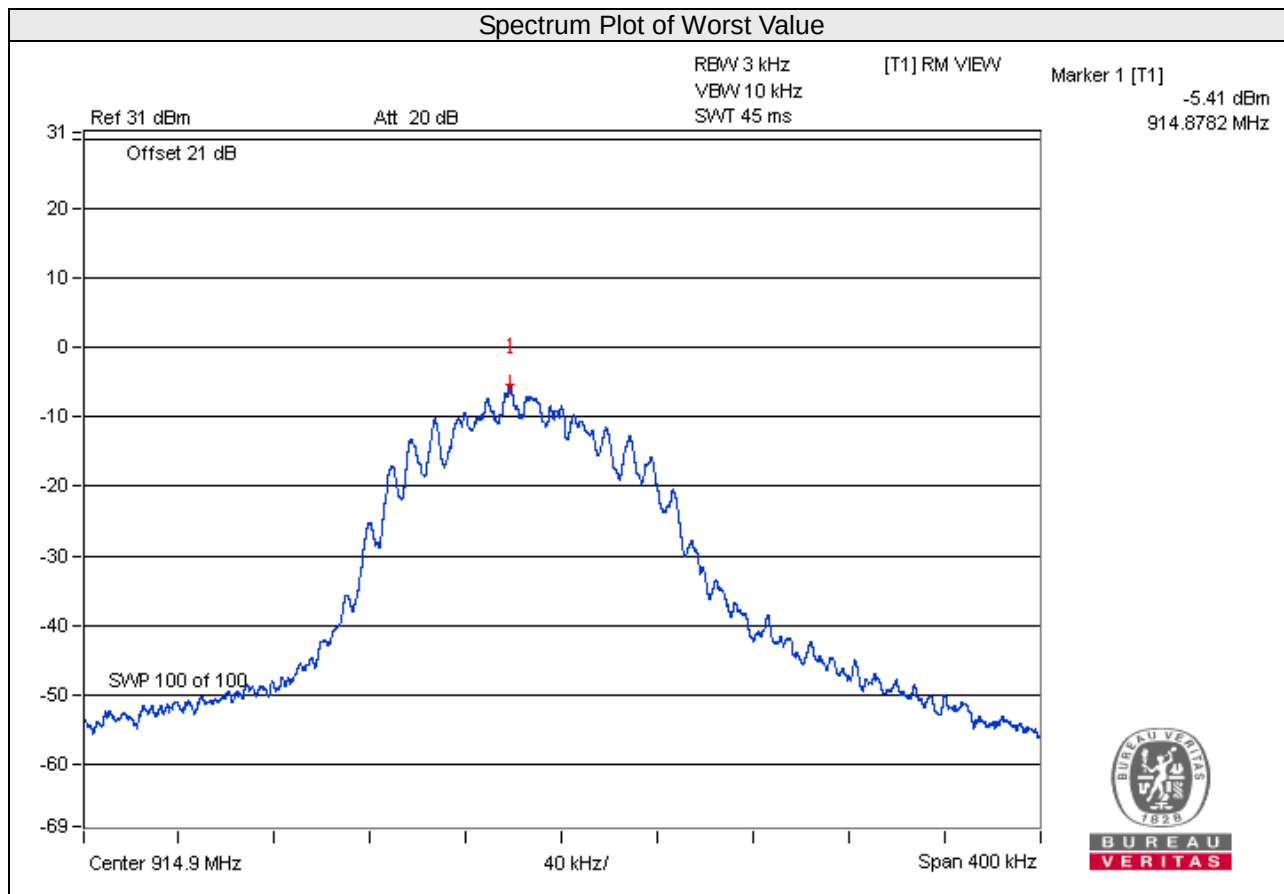
No deviation.

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)	Limit (dBm)	Pass / Fail
0	902.3	-6.75	8	Pass
32	908.7	-5.84	8	Pass
63	914.9	-5.41	8	Pass

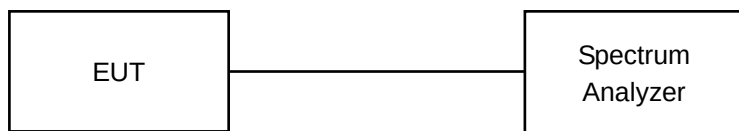


4.7 Conducted Out of Band Emission Measurement

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 = peak.
- 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 OOBE

- Set RBW = 100 kHz.
- Set VBW $\geq$ 300 kHz.
- Detector = peak.
- 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.

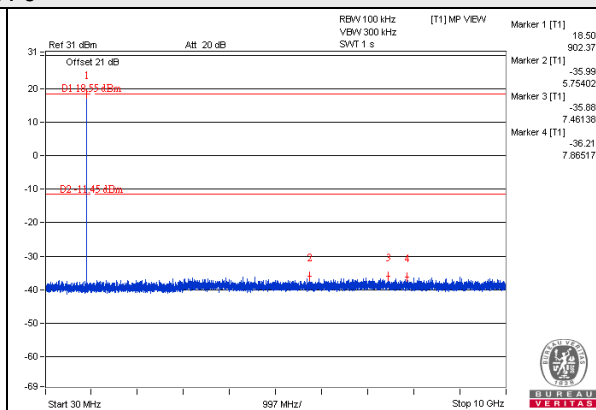
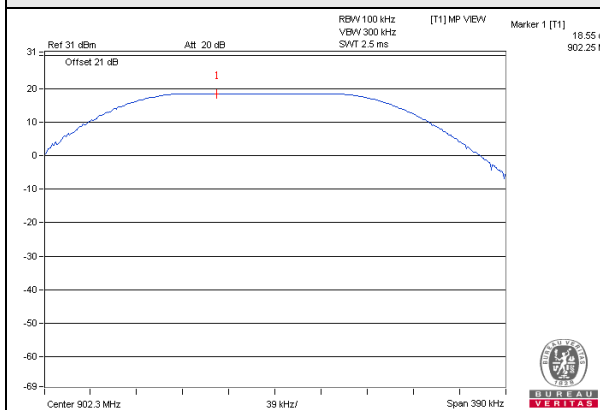
4.7.6 EUT Operating Condition

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

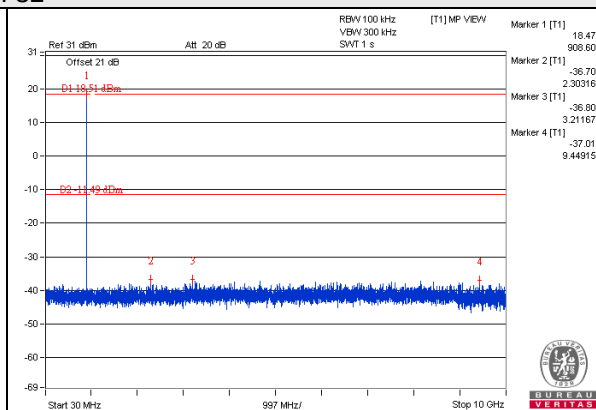
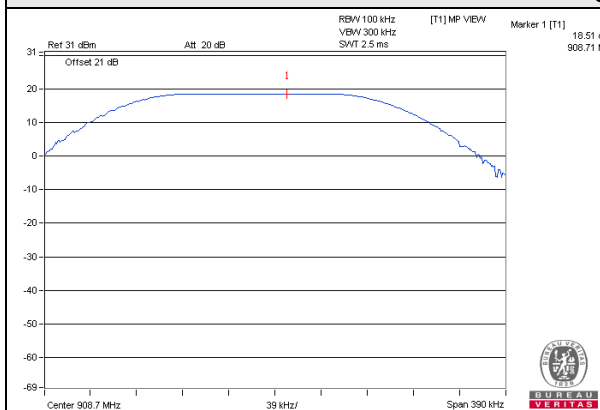
4.7.7 Test Results

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.

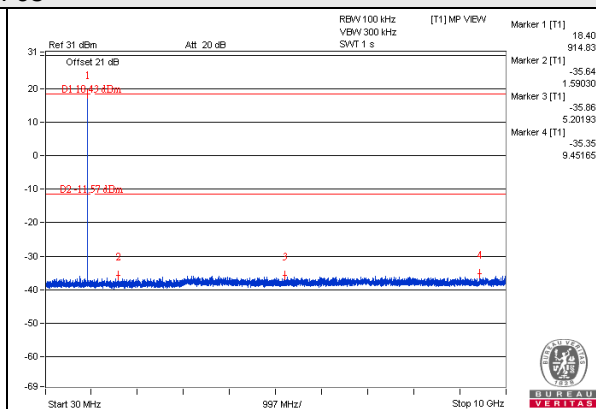
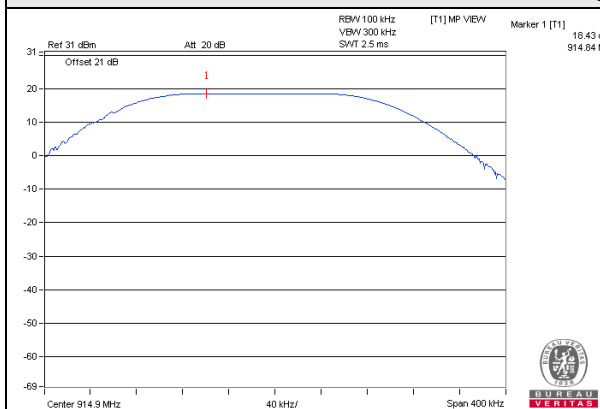
CH 0



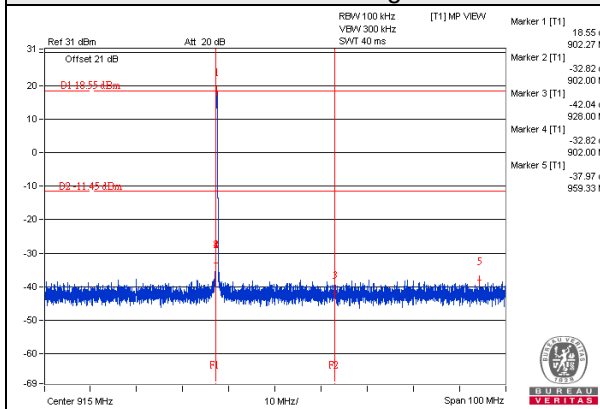
CH 32



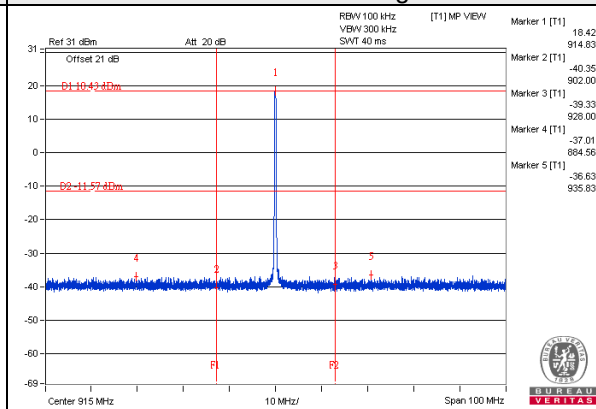
CH 63



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

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 below 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:

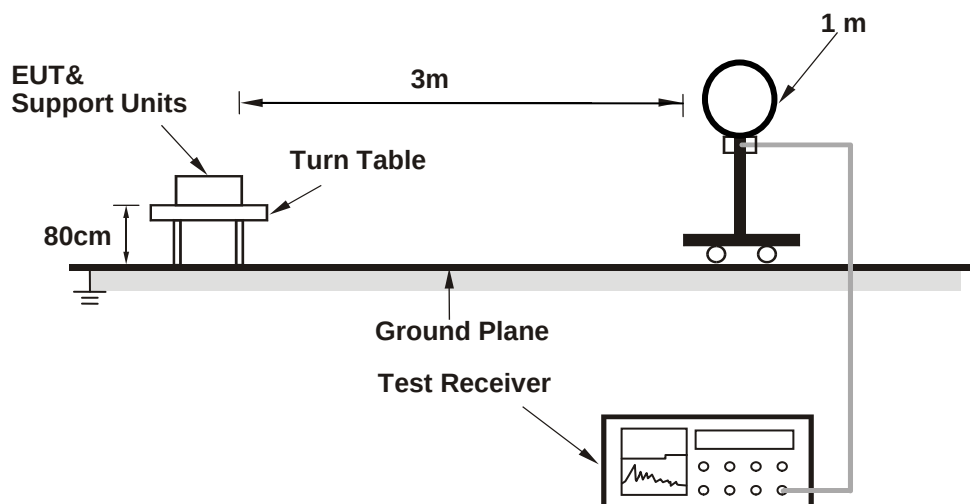
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
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.

5.1.4 Deviation from Test Standard

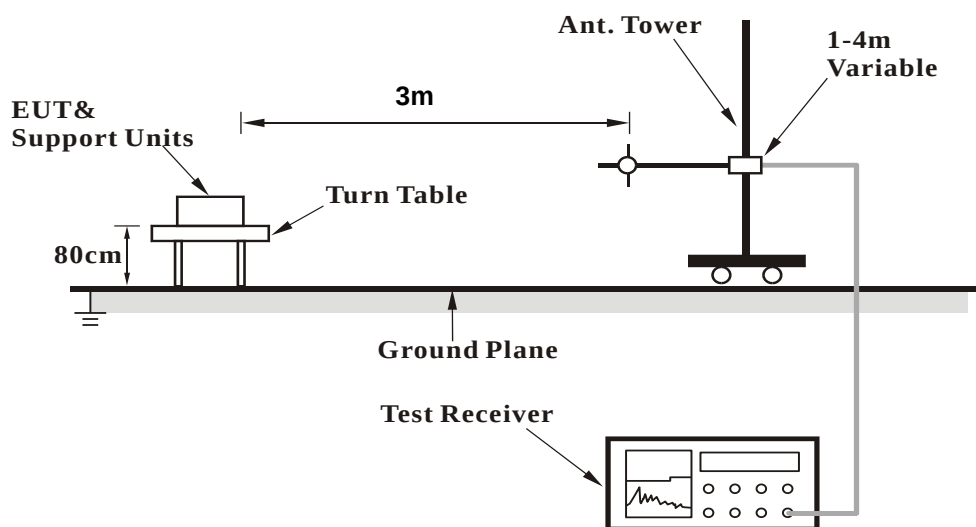
No deviation.

5.1.5 Test Setup

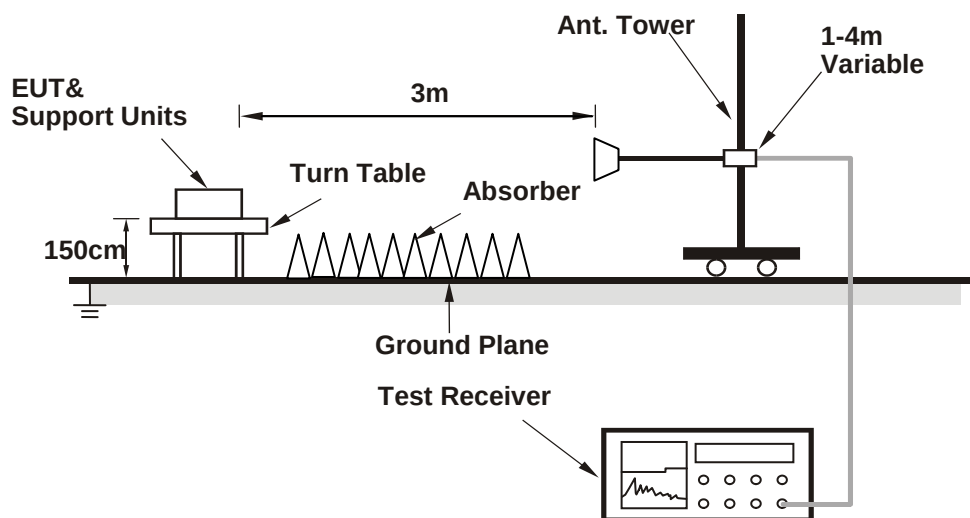
For Radiated emission below 30MHz



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).

5.1.6 EUT Operating Conditions

Same as 4.1.6.

5.1.7 Test Results

Above 1GHz Worst-case Data:

CHANNEL	TX Channel 64	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 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	2709.00	46.4 PK	74.0	-27.6	1.04 H	81	49.1	-2.7
2	2709.00	40.3 AV	54.0	-13.7	1.04 H	81	43.0	-2.7
3	3612.00	43.6 PK	74.0	-30.4	1.00 H	220	44.2	-0.6
4	3612.00	33.8 AV	54.0	-20.2	1.00 H	220	34.4	-0.6
5	4515.00	45.0 PK	74.0	-29.0	1.47 H	43	43.6	1.4
6	4515.00	34.3 AV	54.0	-19.7	1.47 H	43	32.9	1.4
7	5418.00	45.0 PK	74.0	-29.0	1.47 H	31	41.5	3.5
8	5418.00	33.6 AV	54.0	-20.4	1.47 H	31	30.1	3.5
9	8127.00	52.5 PK	74.0	-21.5	1.49 H	263	42.4	10.1
10	8127.00	39.8 AV	54.0	-14.2	1.49 H	263	29.7	10.1
11	9030.00	47.3 PK	74.0	-26.7	1.15 H	108	37.4	9.9
12	9030.00	38.5 AV	54.0	-15.5	1.15 H	108	28.6	9.9
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	2709.00	47.5 PK	74.0	-26.5	2.47 V	165	50.2	-2.7
2	2709.00	42.9 AV	54.0	-11.1	2.47 V	165	45.6	-2.7
3	3612.00	43.5 PK	74.0	-30.5	1.48 V	272	44.1	-0.6
4	3612.00	32.0 AV	54.0	-22.0	1.48 V	272	32.6	-0.6
5	4515.00	44.7 PK	74.0	-29.3	1.49 V	338	43.3	1.4
6	4515.00	34.0 AV	54.0	-20.0	1.49 V	338	32.6	1.4
7	5418.00	45.5 PK	74.0	-28.5	4.00 V	10	42.0	3.5
8	5418.00	34.4 AV	54.0	-19.6	4.00 V	10	30.9	3.5
9	8127.00	52.7 PK	74.0	-21.3	1.45 V	189	42.6	10.1
10	8127.00	40.5 AV	54.0	-13.5	1.45 V	189	30.4	10.1
11	9030.00	51.3 PK	74.0	-22.7	3.33 V	357	41.4	9.9
12	9030.00	47.7 AV	54.0	-6.3	3.33 V	357	37.8	9.9

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 67	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 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	2723.40	45.7 PK	74.0	-28.3	1.08 H	68	48.4	-2.7
2	2723.40	39.7 AV	54.0	-14.3	1.08 H	68	42.4	-2.7
3	3631.20	44.1 PK	74.0	-29.9	1.04 H	209	44.7	-0.6
4	3631.20	33.7 AV	54.0	-20.3	1.04 H	209	34.3	-0.6
5	4539.00	44.9 PK	74.0	-29.1	1.54 H	25	43.5	1.4
6	4539.00	34.2 AV	54.0	-19.8	1.54 H	25	32.8	1.4
7	5446.80	45.5 PK	74.0	-28.5	1.50 H	38	42.1	3.4
8	5446.80	34.0 AV	54.0	-20.0	1.50 H	38	30.6	3.4
9	8170.20	51.8 PK	74.0	-22.2	1.46 H	240	41.8	10.0
10	8170.20	39.4 AV	54.0	-14.6	1.46 H	240	29.4	10.0
11	9078.00	47.7 PK	74.0	-26.3	1.10 H	106	37.8	9.9
12	9078.00	38.9 AV	54.0	-15.1	1.10 H	106	29.0	9.9

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	2723.40	47.4 PK	74.0	-26.6	2.47 V	183	50.1	-2.7
2	2723.40	42.4 AV	54.0	-11.6	2.47 V	183	45.1	-2.7
3	3631.20	43.1 PK	74.0	-30.9	1.47 V	285	43.7	-0.6
4	3631.20	31.8 AV	54.0	-22.2	1.47 V	285	32.4	-0.6
5	4539.00	44.8 PK	74.0	-29.2	1.47 V	331	43.4	1.4
6	4539.00	34.3 AV	54.0	-19.7	1.47 V	331	32.9	1.4
7	5446.80	45.0 PK	74.0	-29.0	4.00 V	14	41.6	3.4
8	5446.80	33.9 AV	54.0	-20.1	4.00 V	14	30.5	3.4
9	8170.20	52.1 PK	74.0	-21.9	1.48 V	173	42.1	10.0
10	8170.20	40.0 AV	54.0	-14.0	1.48 V	173	30.0	10.0
11	9078.00	51.6 PK	74.0	-22.4	3.40 V	351	41.7	9.9
12	9078.00	47.9 AV	54.0	-6.1	3.40 V	351	38.0	9.9

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 71	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 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	2742.60	46.7 PK	74.0	-27.3	1.05 H	55	49.3	-2.6
2	2742.60	40.6 AV	54.0	-13.4	1.05 H	55	43.2	-2.6
3	3656.80	43.8 PK	74.0	-30.2	1.07 H	208	44.2	-0.4
4	3656.80	34.0 AV	54.0	-20.0	1.07 H	208	34.4	-0.4
5	4571.00	44.7 PK	74.0	-29.3	1.53 H	18	43.2	1.5
6	4571.00	33.9 AV	54.0	-20.1	1.53 H	18	32.4	1.5
7	8227.80	51.4 PK	74.0	-22.6	1.53 H	263	41.4	10.0
8	8227.80	38.9 AV	54.0	-15.1	1.53 H	263	28.9	10.0
9	9142.00	47.1 PK	74.0	-26.9	1.10 H	125	37.1	10.0
10	9142.00	38.2 AV	54.0	-15.8	1.10 H	125	28.2	10.0
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	2742.60	47.1 PK	74.0	-26.9	2.43 V	166	49.7	-2.6
2	2742.60	42.2 AV	54.0	-11.8	2.43 V	166	44.8	-2.6
3	3656.80	42.9 PK	74.0	-31.1	1.48 V	274	43.3	-0.4
4	3656.80	31.9 AV	54.0	-22.1	1.48 V	274	32.3	-0.4
5	4571.00	45.4 PK	74.0	-28.6	1.51 V	339	43.9	1.5
6	4571.00	34.3 AV	54.0	-19.7	1.51 V	339	32.8	1.5
7	8227.80	52.7 PK	74.0	-21.3	1.48 V	169	42.7	10.0
8	8227.80	40.7 AV	54.0	-13.3	1.48 V	169	30.7	10.0
9	9142.00	51.2 PK	74.0	-22.8	3.34 V	355	41.2	10.0
10	9142.00	47.3 AV	54.0	-6.7	3.34 V	355	37.3	10.0

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

Below 1GHz worst-case data:

CHANNEL	TX Channel 64	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	65.77	28.5 QP	40.0	-11.5	2.00 H	0	37.9	-9.4
2	201.59	36.1 QP	43.5	-7.4	1.50 H	111	47.8	-11.7
3	240.00	42.9 QP	46.0	-3.1	1.00 H	1	52.8	-9.9
4	279.19	33.5 QP	46.0	-12.5	1.00 H	44	41.6	-8.1
5	480.01	38.3 QP	46.0	-7.7	2.00 H	120	41.2	-2.9
6	796.81	33.7 QP	46.0	-12.3	1.00 H	1	31.1	2.6
7	902.00	50.2 QP	79.9	-29.7	1.56 H	124	18.9	31.3
8	*903.00	109.9 QP			1.56 H	124	78.6	31.3
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	66.47	24.8 QP	40.0	-15.2	2.50 V	258	34.4	-9.6
2	205.04	28.3 QP	43.5	-15.2	1.50 V	260	39.9	-11.6
3	239.98	36.9 QP	46.0	-9.1	1.50 V	40	46.8	-9.9
4	480.01	34.1 QP	46.0	-11.9	2.00 V	104	37.0	-2.9
5	615.18	29.7 QP	46.0	-16.3	1.00 V	340	29.6	0.1
6	720.01	31.0 QP	46.0	-15.0	2.00 V	360	29.7	1.3
7	902.00	54.5 QP	90.5	-36.0	1.11 V	112	23.2	31.3
8	*903.00	120.5 QP			1.11 V	112	89.2	31.3

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.

CHANNEL	TX Channel 67	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	66.21	28.1 QP	40.0	-11.9	2.00 H	351	37.6	-9.5
2	198.63	37.2 QP	43.5	-6.3	1.50 H	105	48.8	-11.6
3	240.01	42.8 QP	46.0	-3.2	1.00 H	16	52.7	-9.9
4	279.53	34.9 QP	46.0	-11.1	1.00 H	47	43.0	-8.1
5	480.01	38.3 QP	46.0	-7.7	2.00 H	125	41.2	-2.9
6	959.99	37.2 QP	46.0	-8.8	1.50 H	304	32.4	4.8
7	*907.80	110.3 QP			1.56 H	125	78.8	31.5
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	66.04	24.8 QP	40.0	-15.2	2.50 V	240	34.3	-9.5
2	180.01	27.7 QP	43.5	-15.8	1.00 V	278	37.7	-10.0
3	240.00	36.2 QP	46.0	-9.8	2.00 V	360	46.1	-9.9
4	480.01	34.0 QP	46.0	-12.0	2.00 V	102	36.9	-2.9
5	597.50	30.2 QP	46.0	-15.8	1.00 V	9	30.4	-0.2
6	796.74	32.3 QP	46.0	-13.7	1.00 V	56	29.7	2.6
7	*907.80	120.3 QP			1.11 V	114	88.8	31.5

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.

CHANNEL	TX Channel 71	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	66.33	28.3 QP	40.0	-11.7	2.50 H	336	37.9	-9.6
2	179.99	34.5 QP	43.5	-9.0	2.00 H	99	44.5	-10.0
3	240.00	42.9 QP	46.0	-3.1	1.50 H	9	52.8	-9.9
4	279.61	34.6 QP	46.0	-11.4	1.00 H	34	42.6	-8.0
5	399.84	31.0 QP	46.0	-15.0	2.00 H	82	36.1	-5.1
6	480.01	38.8 QP	46.0	-7.2	2.00 H	124	41.7	-2.9
7	*914.20	110.1 QP			1.57 H	125	78.5	31.6
8	928.00	51.0 QP	80.1	-29.1	1.57 H	125	19.3	31.7
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	66.62	25.9 QP	40.0	-14.1	2.50 V	249	35.6	-9.7
2	205.25	28.1 QP	43.5	-15.4	1.00 V	243	39.7	-11.6
3	239.98	37.0 QP	46.0	-9.0	1.50 V	45	46.9	-9.9
4	480.01	33.7 QP	46.0	-12.3	2.00 V	108	36.6	-2.9
5	720.01	31.0 QP	46.0	-15.0	2.00 V	11	29.7	1.3
6	799.28	31.7 QP	46.0	-14.3	1.00 V	43	29.0	2.7
7	*914.20	119.6 QP			1.11 V	113	88.0	31.6
8	928.00	51.5 QP	89.6	-38.1	1.11 V	113	19.8	31.7

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.

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

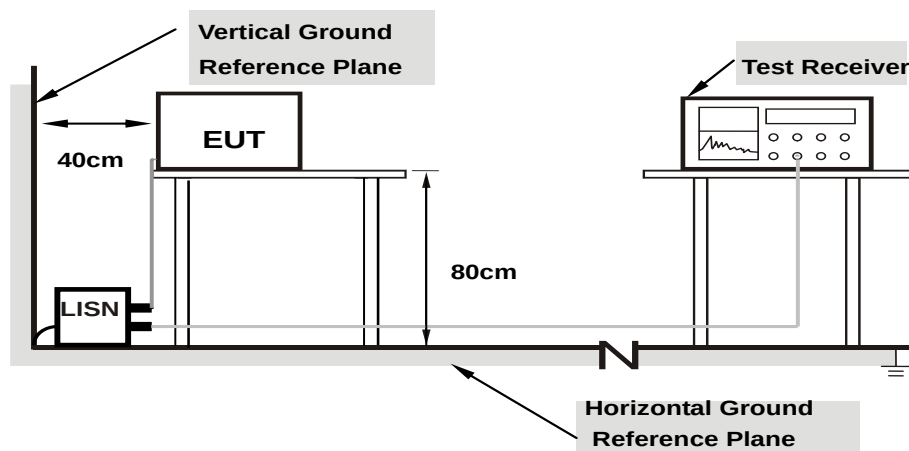
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance 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: All modes of operation were investigated and the worst-case emissions are reported.

5.2.4 Deviation from Test Standard

No deviation.

5.2.5 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).

5.2.6 EUT Operating Condition

Same as 4.1.6.

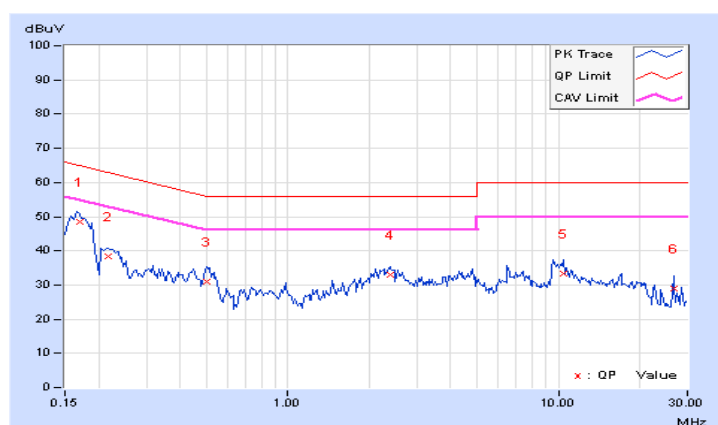
5.2.7 Test Results

Channel	TX Channel 64	Phase	Line (L)
Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz		

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	0.16953	10.19	38.26	26.78	48.45	36.97	64.98	54.98	-16.53	-18.01
2	0.21641	10.19	28.32	24.15	38.51	34.34	62.96	52.96	-24.45	-18.62
3	0.50156	10.23	20.63	14.89	30.86	25.12	56.00	46.00	-25.14	-20.88
4	2.37891	10.24	22.69	18.18	32.93	28.42	56.00	46.00	-23.07	-17.58
5	10.42578	10.59	22.63	17.15	33.22	27.74	60.00	50.00	-26.78	-22.26
6	26.62500	11.44	17.38	12.09	28.82	23.53	60.00	50.00	-31.18	-26.47

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.

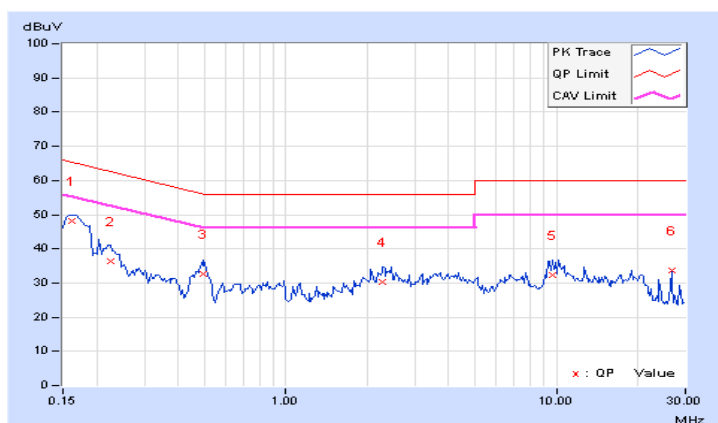


Channel	TX Channel 64	Phase	Neutral (N)
Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz		

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	0.16172	10.18	37.85	26.11	48.03	36.29	65.38	55.38	-17.35	-19.09
2	0.22422	10.17	26.31	12.35	36.48	22.52	62.66	52.66	-26.18	-30.14
3	0.49400	10.21	22.52	16.91	32.73	27.12	56.10	46.10	-23.37	-18.98
4	2.27344	10.26	20.01	14.85	30.27	25.11	56.00	46.00	-25.73	-20.89
5	9.62891	10.47	21.75	16.26	32.22	26.73	60.00	50.00	-27.78	-23.27
6	26.62500	11.07	22.53	21.71	33.60	32.78	60.00	50.00	-26.40	-17.22

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.

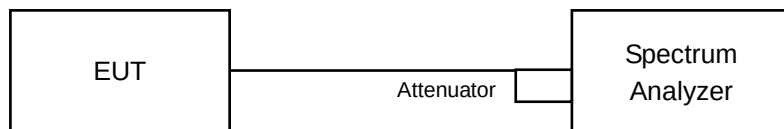


5.3 Number of Hopping Frequency Used

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

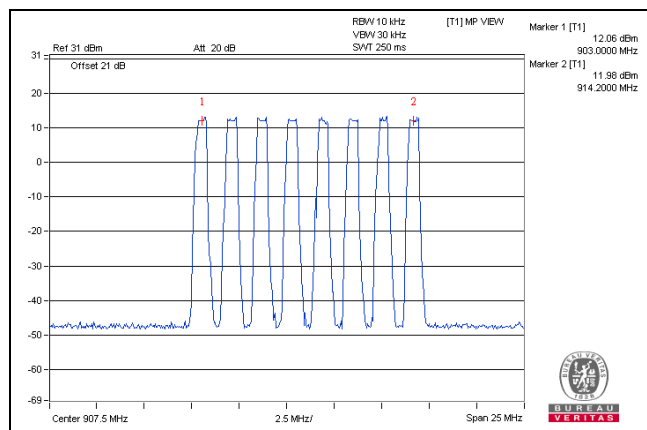
- Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make 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.

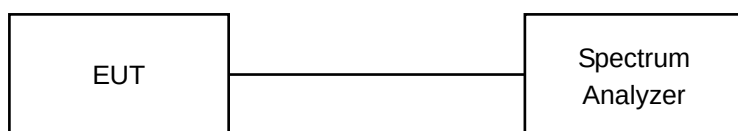


5.4 Dwell Time on Each Channel

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.

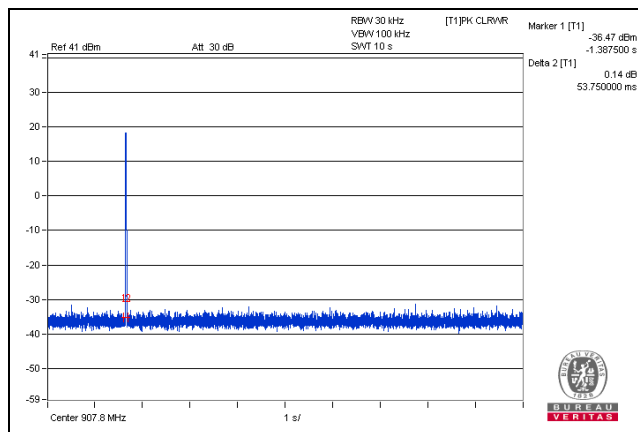
5.4.5 Deviation from Test Standard

No deviation.

5.4.6 Test Results

Number of transmission in a 3.2 (8Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
1 (times / 10 sec) = 1 times	53.75	53.75	400

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

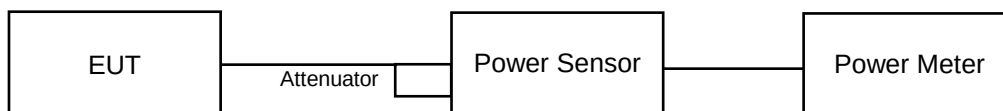


5.5 Conducted Output Power Measurement

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
64	903	79.25	18.99	30	Pass
67	907.8	78.524	18.95	30	Pass
71	914.2	77.446	18.89	30	Pass

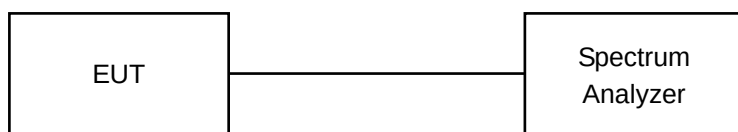
5.6 Power Spectral Density Measurement

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 $\geq 2 \times \text{span/RBW}$.
- 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

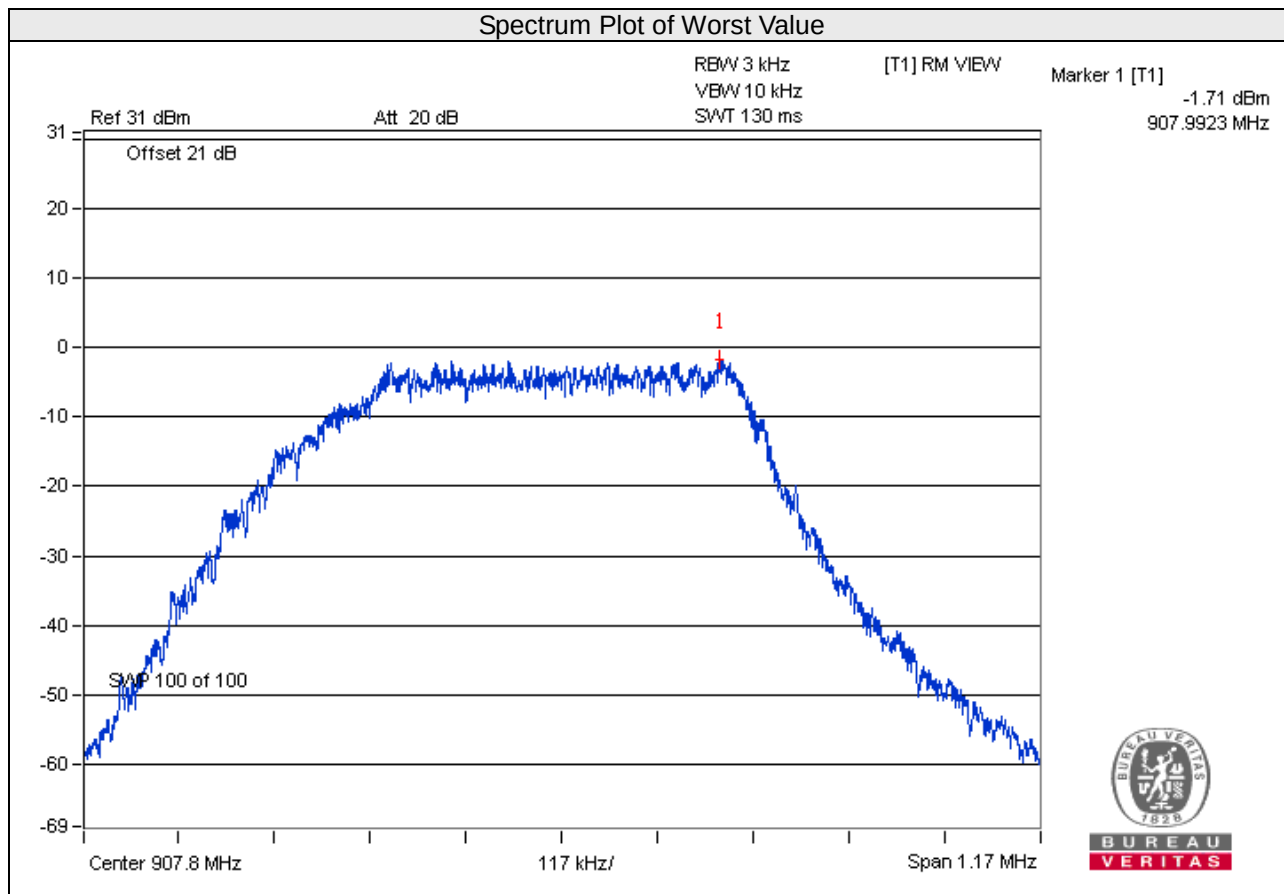
No deviation.

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)	Limit (dBm)	Pass / Fail
64	903.0	-1.76	8	Pass
67	907.8	-1.71	8	Pass
71	914.2	-2.46	8	Pass

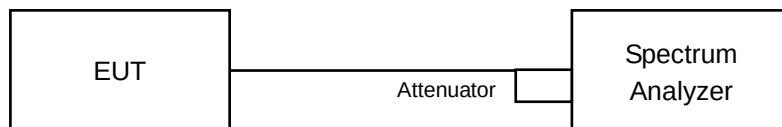


5.7 Conducted Out of Band Emission Measurement

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 = peak.
- 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 OOBE

- Set RBW = 100 kHz.
- Set VBW $\geq$ 300 kHz.
- Detector = peak.
- 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.

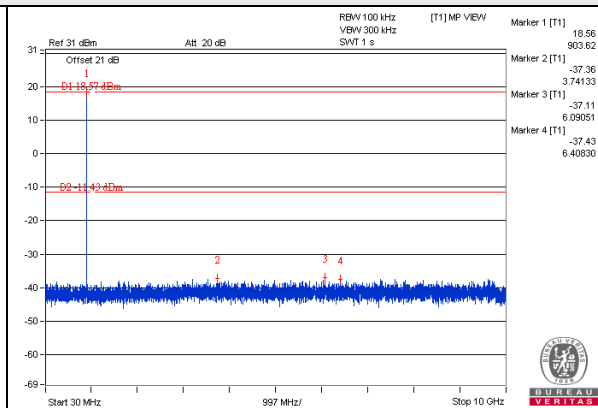
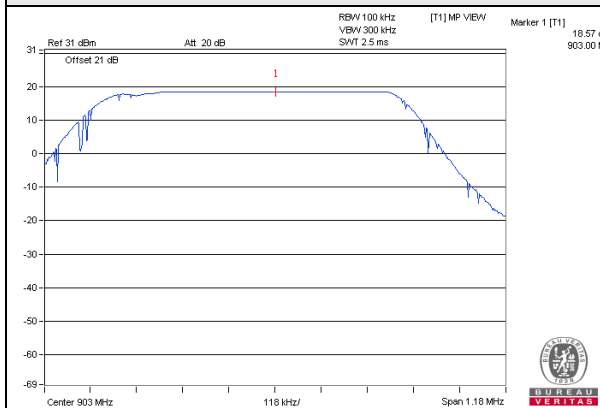
5.7.6 EUT Operating Condition

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

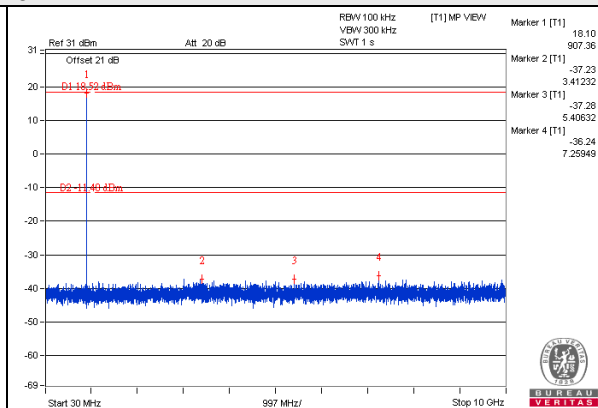
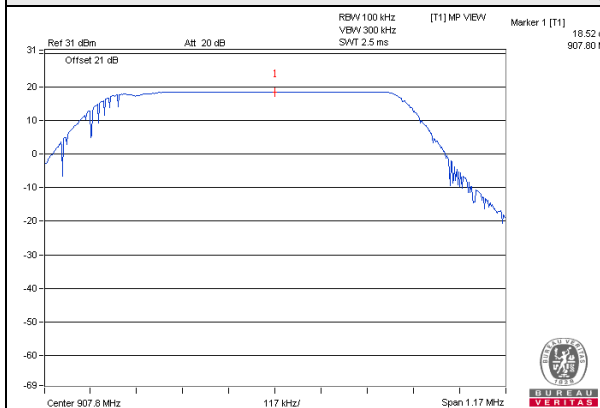
5.7.7 Test Results

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.

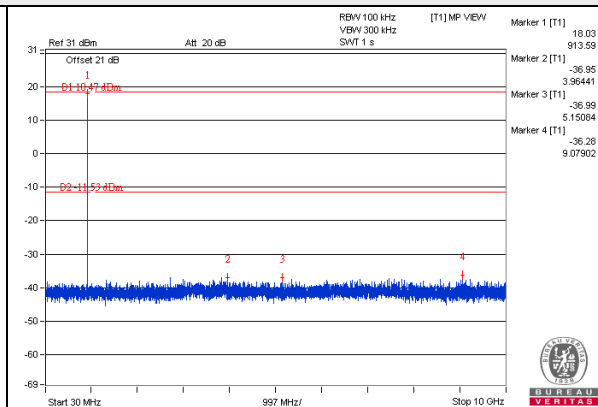
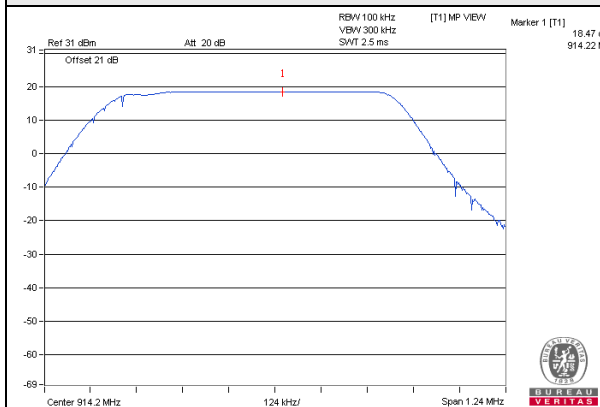
CH 64



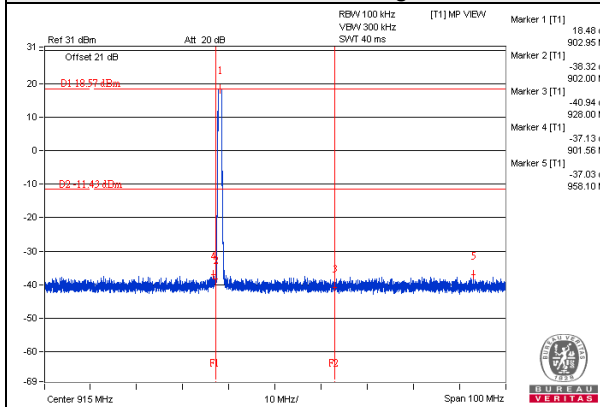
CH 67



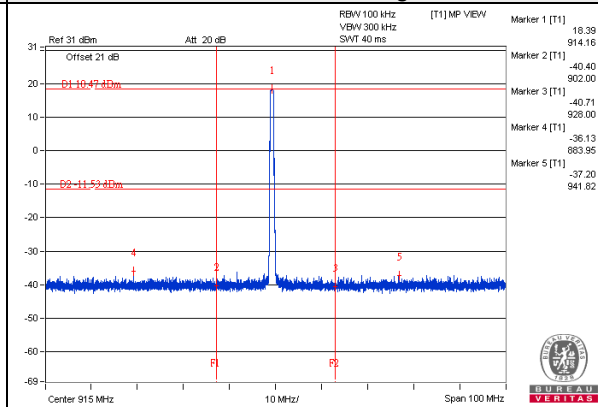
CH 71



CH 64 Band edge



CH 71 Band edge



6 Test Types and Results – DTS Mode (500kHz Bandwidth, 8 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 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.

6.1.2 Test Instruments

Same as 4.1.2.

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. 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:

2. 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 below 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:

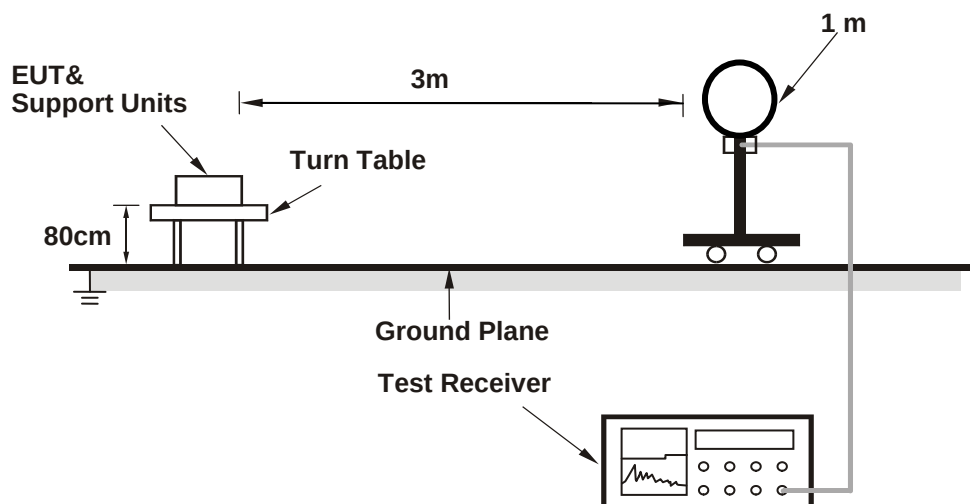
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
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.

6.1.4 Deviation from Test Standard

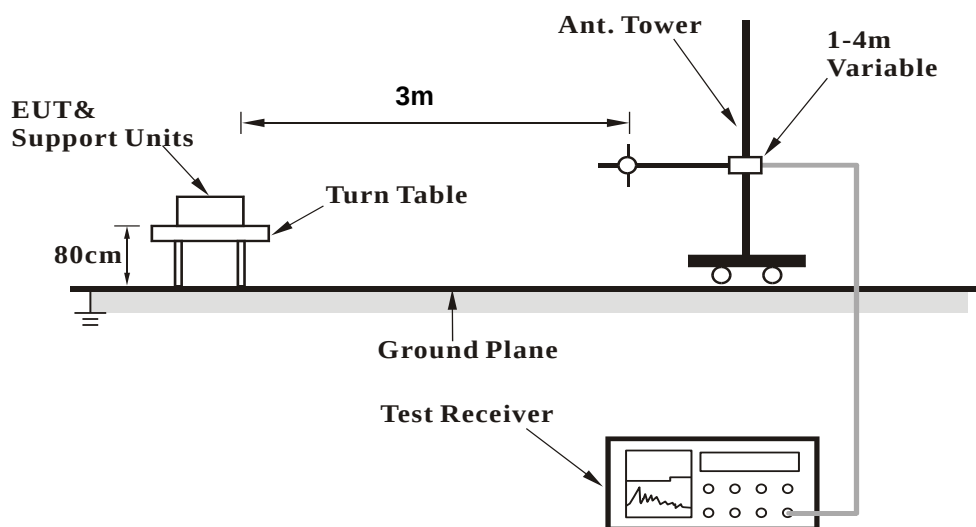
No deviation.

6.1.5 Test Setup

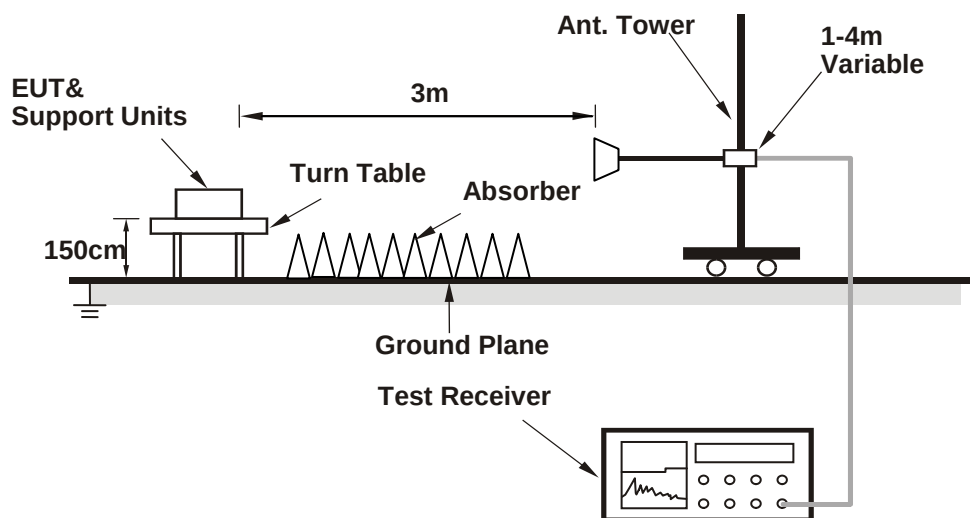
For Radiated emission below 30MHz



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

Same as 4.1.6.

6.1.7 Test Results

Above 1GHz Worst-case Data:

CHANNEL	TX Channel 64	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 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	2709.00	46.4 PK	74.0	-27.6	1.04 H	81	49.1	-2.7
2	2709.00	40.3 AV	54.0	-13.7	1.04 H	81	43.0	-2.7
3	3612.00	43.6 PK	74.0	-30.4	1.00 H	220	44.2	-0.6
4	3612.00	33.8 AV	54.0	-20.2	1.00 H	220	34.4	-0.6
5	4515.00	45.0 PK	74.0	-29.0	1.47 H	43	43.6	1.4
6	4515.00	34.3 AV	54.0	-19.7	1.47 H	43	32.9	1.4
7	5418.00	45.0 PK	74.0	-29.0	1.47 H	31	41.5	3.5
8	5418.00	33.6 AV	54.0	-20.4	1.47 H	31	30.1	3.5
9	8127.00	52.5 PK	74.0	-21.5	1.49 H	263	42.4	10.1
10	8127.00	39.8 AV	54.0	-14.2	1.49 H	263	29.7	10.1
11	9030.00	47.3 PK	74.0	-26.7	1.15 H	108	37.4	9.9
12	9030.00	38.5 AV	54.0	-15.5	1.15 H	108	28.6	9.9
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	2709.00	47.5 PK	74.0	-26.5	2.47 V	165	50.2	-2.7
2	2709.00	42.9 AV	54.0	-11.1	2.47 V	165	45.6	-2.7
3	3612.00	43.5 PK	74.0	-30.5	1.48 V	272	44.1	-0.6
4	3612.00	32.0 AV	54.0	-22.0	1.48 V	272	32.6	-0.6
5	4515.00	44.7 PK	74.0	-29.3	1.49 V	338	43.3	1.4
6	4515.00	34.0 AV	54.0	-20.0	1.49 V	338	32.6	1.4
7	5418.00	45.5 PK	74.0	-28.5	4.00 V	10	42.0	3.5
8	5418.00	34.4 AV	54.0	-19.6	4.00 V	10	30.9	3.5
9	8127.00	52.7 PK	74.0	-21.3	1.45 V	189	42.6	10.1
10	8127.00	40.5 AV	54.0	-13.5	1.45 V	189	30.4	10.1
11	9030.00	51.3 PK	74.0	-22.7	3.33 V	357	41.4	9.9
12	9030.00	47.7 AV	54.0	-6.3	3.33 V	357	37.8	9.9

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 67	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 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	2723.40	45.7 PK	74.0	-28.3	1.08 H	68	48.4	-2.7
2	2723.40	39.7 AV	54.0	-14.3	1.08 H	68	42.4	-2.7
3	3631.20	44.1 PK	74.0	-29.9	1.04 H	209	44.7	-0.6
4	3631.20	33.7 AV	54.0	-20.3	1.04 H	209	34.3	-0.6
5	4539.00	44.9 PK	74.0	-29.1	1.54 H	25	43.5	1.4
6	4539.00	34.2 AV	54.0	-19.8	1.54 H	25	32.8	1.4
7	5446.80	45.5 PK	74.0	-28.5	1.50 H	38	42.1	3.4
8	5446.80	34.0 AV	54.0	-20.0	1.50 H	38	30.6	3.4
9	8170.20	51.8 PK	74.0	-22.2	1.46 H	240	41.8	10.0
10	8170.20	39.4 AV	54.0	-14.6	1.46 H	240	29.4	10.0
11	9078.00	47.7 PK	74.0	-26.3	1.10 H	106	37.8	9.9
12	9078.00	38.9 AV	54.0	-15.1	1.10 H	106	29.0	9.9

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	2723.40	47.4 PK	74.0	-26.6	2.47 V	183	50.1	-2.7
2	2723.40	42.4 AV	54.0	-11.6	2.47 V	183	45.1	-2.7
3	3631.20	43.1 PK	74.0	-30.9	1.47 V	285	43.7	-0.6
4	3631.20	31.8 AV	54.0	-22.2	1.47 V	285	32.4	-0.6
5	4539.00	44.8 PK	74.0	-29.2	1.47 V	331	43.4	1.4
6	4539.00	34.3 AV	54.0	-19.7	1.47 V	331	32.9	1.4
7	5446.80	45.0 PK	74.0	-29.0	4.00 V	14	41.6	3.4
8	5446.80	33.9 AV	54.0	-20.1	4.00 V	14	30.5	3.4
9	8170.20	52.1 PK	74.0	-21.9	1.48 V	173	42.1	10.0
10	8170.20	40.0 AV	54.0	-14.0	1.48 V	173	30.0	10.0
11	9078.00	51.6 PK	74.0	-22.4	3.40 V	351	41.7	9.9
12	9078.00	47.9 AV	54.0	-6.1	3.40 V	351	38.0	9.9

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 71	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 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	2742.60	46.7 PK	74.0	-27.3	1.05 H	55	49.3	-2.6
2	2742.60	40.6 AV	54.0	-13.4	1.05 H	55	43.2	-2.6
3	3656.80	43.8 PK	74.0	-30.2	1.07 H	208	44.2	-0.4
4	3656.80	34.0 AV	54.0	-20.0	1.07 H	208	34.4	-0.4
5	4571.00	44.7 PK	74.0	-29.3	1.53 H	18	43.2	1.5
6	4571.00	33.9 AV	54.0	-20.1	1.53 H	18	32.4	1.5
7	8227.80	51.4 PK	74.0	-22.6	1.53 H	263	41.4	10.0
8	8227.80	38.9 AV	54.0	-15.1	1.53 H	263	28.9	10.0
9	9142.00	47.1 PK	74.0	-26.9	1.10 H	125	37.1	10.0
10	9142.00	38.2 AV	54.0	-15.8	1.10 H	125	28.2	10.0
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	2742.60	47.1 PK	74.0	-26.9	2.43 V	166	49.7	-2.6
2	2742.60	42.2 AV	54.0	-11.8	2.43 V	166	44.8	-2.6
3	3656.80	42.9 PK	74.0	-31.1	1.48 V	274	43.3	-0.4
4	3656.80	31.9 AV	54.0	-22.1	1.48 V	274	32.3	-0.4
5	4571.00	45.4 PK	74.0	-28.6	1.51 V	339	43.9	1.5
6	4571.00	34.3 AV	54.0	-19.7	1.51 V	339	32.8	1.5
7	8227.80	52.7 PK	74.0	-21.3	1.48 V	169	42.7	10.0
8	8227.80	40.7 AV	54.0	-13.3	1.48 V	169	30.7	10.0
9	9142.00	51.2 PK	74.0	-22.8	3.34 V	355	41.2	10.0
10	9142.00	47.3 AV	54.0	-6.7	3.34 V	355	37.3	10.0

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

Below 1GHz worst-case data:

CHANNEL	TX Channel 64	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	65.77	28.5 QP	40.0	-11.5	2.00 H	0	37.9	-9.4
2	201.59	36.1 QP	43.5	-7.4	1.50 H	111	47.8	-11.7
3	240.00	42.9 QP	46.0	-3.1	1.00 H	1	52.8	-9.9
4	279.19	33.5 QP	46.0	-12.5	1.00 H	44	41.6	-8.1
5	480.01	38.3 QP	46.0	-7.7	2.00 H	120	41.2	-2.9
6	796.81	33.7 QP	46.0	-12.3	1.00 H	1	31.1	2.6
7	902.00	50.2 QP	79.9	-29.7	1.56 H	124	18.9	31.3
8	*903.00	109.9 QP			1.56 H	124	78.6	31.3
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	66.47	24.8 QP	40.0	-15.2	2.50 V	258	34.4	-9.6
2	205.04	28.3 QP	43.5	-15.2	1.50 V	260	39.9	-11.6
3	239.98	36.9 QP	46.0	-9.1	1.50 V	40	46.8	-9.9
4	480.01	34.1 QP	46.0	-11.9	2.00 V	104	37.0	-2.9
5	615.18	29.7 QP	46.0	-16.3	1.00 V	340	29.6	0.1
6	720.01	31.0 QP	46.0	-15.0	2.00 V	360	29.7	1.3
7	902.00	54.5 QP	90.5	-36.0	1.11 V	112	23.2	31.3
8	*903.00	120.5 QP			1.11 V	112	89.2	31.3

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.

CHANNEL	TX Channel 67	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	66.21	28.1 QP	40.0	-11.9	2.00 H	351	37.6	-9.5
2	198.63	37.2 QP	43.5	-6.3	1.50 H	105	48.8	-11.6
3	240.01	42.8 QP	46.0	-3.2	1.00 H	16	52.7	-9.9
4	279.53	34.9 QP	46.0	-11.1	1.00 H	47	43.0	-8.1
5	480.01	38.3 QP	46.0	-7.7	2.00 H	125	41.2	-2.9
6	959.99	37.2 QP	46.0	-8.8	1.50 H	304	32.4	4.8
7	*907.80	110.3 QP			1.56 H	125	78.8	31.5
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	66.04	24.8 QP	40.0	-15.2	2.50 V	240	34.3	-9.5
2	180.01	27.7 QP	43.5	-15.8	1.00 V	278	37.7	-10.0
3	240.00	36.2 QP	46.0	-9.8	2.00 V	360	46.1	-9.9
4	480.01	34.0 QP	46.0	-12.0	2.00 V	102	36.9	-2.9
5	597.50	30.2 QP	46.0	-15.8	1.00 V	9	30.4	-0.2
6	796.74	32.3 QP	46.0	-13.7	1.00 V	56	29.7	2.6
7	*907.80	120.3 QP			1.11 V	114	88.8	31.5

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.

CHANNEL	TX Channel 71	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	66.33	28.3 QP	40.0	-11.7	2.50 H	336	37.9	-9.6
2	179.99	34.5 QP	43.5	-9.0	2.00 H	99	44.5	-10.0
3	240.00	42.9 QP	46.0	-3.1	1.50 H	9	52.8	-9.9
4	279.61	34.6 QP	46.0	-11.4	1.00 H	34	42.6	-8.0
5	399.84	31.0 QP	46.0	-15.0	2.00 H	82	36.1	-5.1
6	480.01	38.8 QP	46.0	-7.2	2.00 H	124	41.7	-2.9
7	*914.20	110.1 QP			1.57 H	125	78.5	31.6
8	928.00	51.0 QP	80.1	-29.1	1.57 H	125	19.3	31.7
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	66.62	25.9 QP	40.0	-14.1	2.50 V	249	35.6	-9.7
2	205.25	28.1 QP	43.5	-15.4	1.00 V	243	39.7	-11.6
3	239.98	37.0 QP	46.0	-9.0	1.50 V	45	46.9	-9.9
4	480.01	33.7 QP	46.0	-12.3	2.00 V	108	36.6	-2.9
5	720.01	31.0 QP	46.0	-15.0	2.00 V	11	29.7	1.3
6	799.28	31.7 QP	46.0	-14.3	1.00 V	43	29.0	2.7
7	*914.20	119.6 QP			1.11 V	113	88.0	31.6
8	928.00	51.5 QP	89.6	-38.1	1.11 V	113	19.8	31.7

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.

6.2 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

Same as 4.2.2.

6.2.3 Test Procedures

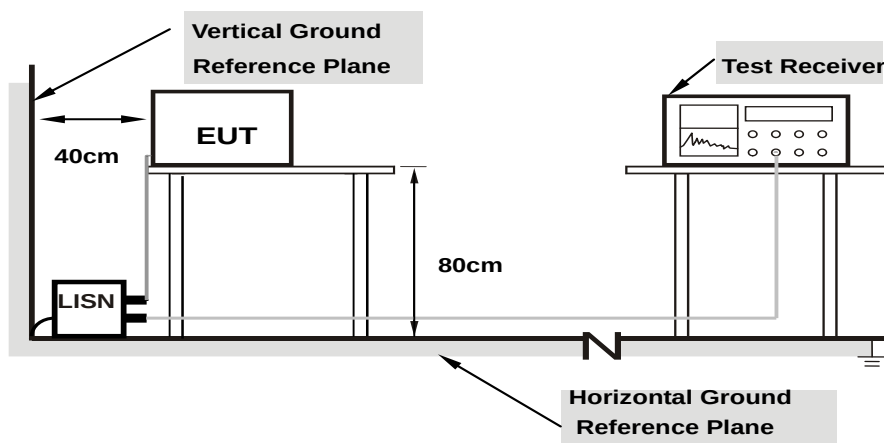
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance 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: All modes of operation were investigated and the worst-case emissions are reported.

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.

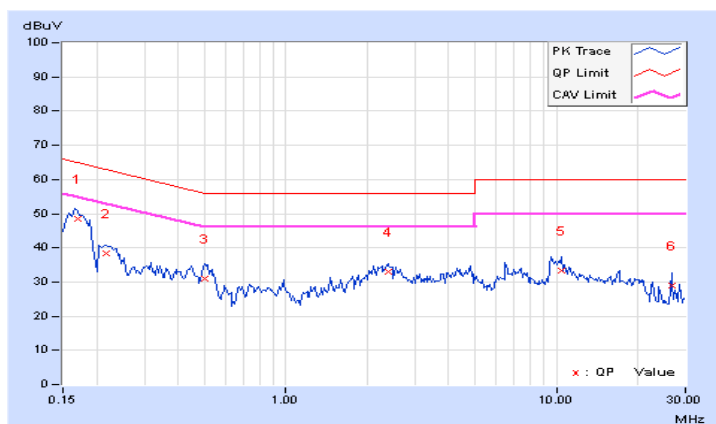
6.2.7 Test Results

Channel	TX Channel 64	Phase	Line (L)
Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz		

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	0.16953	10.19	38.26	26.78	48.45	36.97	64.98	54.98	-16.53	-18.01
2	0.21641	10.19	28.32	24.15	38.51	34.34	62.96	52.96	-24.45	-18.62
3	0.50156	10.23	20.63	14.89	30.86	25.12	56.00	46.00	-25.14	-20.88
4	2.37891	10.24	22.69	18.18	32.93	28.42	56.00	46.00	-23.07	-17.58
5	10.42578	10.59	22.63	17.15	33.22	27.74	60.00	50.00	-26.78	-22.26
6	26.62500	11.44	17.38	12.09	28.82	23.53	60.00	50.00	-31.18	-26.47

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.

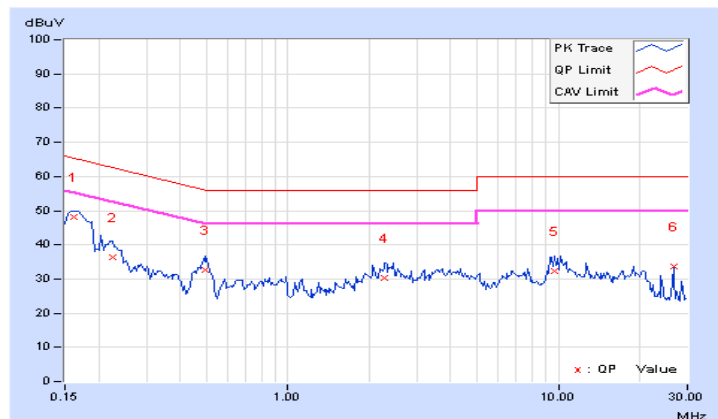


Channel	TX Channel 64	Phase	Neutral (N)
Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz		

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	0.16172	10.18	37.85	26.11	48.03	36.29	65.38	55.38	-17.35	-19.09
2	0.22422	10.17	26.31	12.35	36.48	22.52	62.66	52.66	-26.18	-30.14
3	0.49400	10.21	22.52	16.91	32.73	27.12	56.10	46.10	-23.37	-18.98
4	2.27344	10.26	20.01	14.85	30.27	25.11	56.00	46.00	-25.73	-20.89
5	9.62891	10.47	21.75	16.26	32.22	26.73	60.00	50.00	-27.78	-23.27
6	26.62500	11.07	22.53	21.71	33.60	32.78	60.00	50.00	-26.40	-17.22

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.

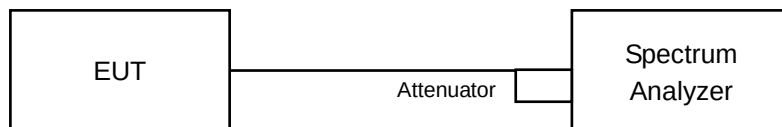


6.3 6dB Bandwidth Measurement

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 = Peak.
- 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

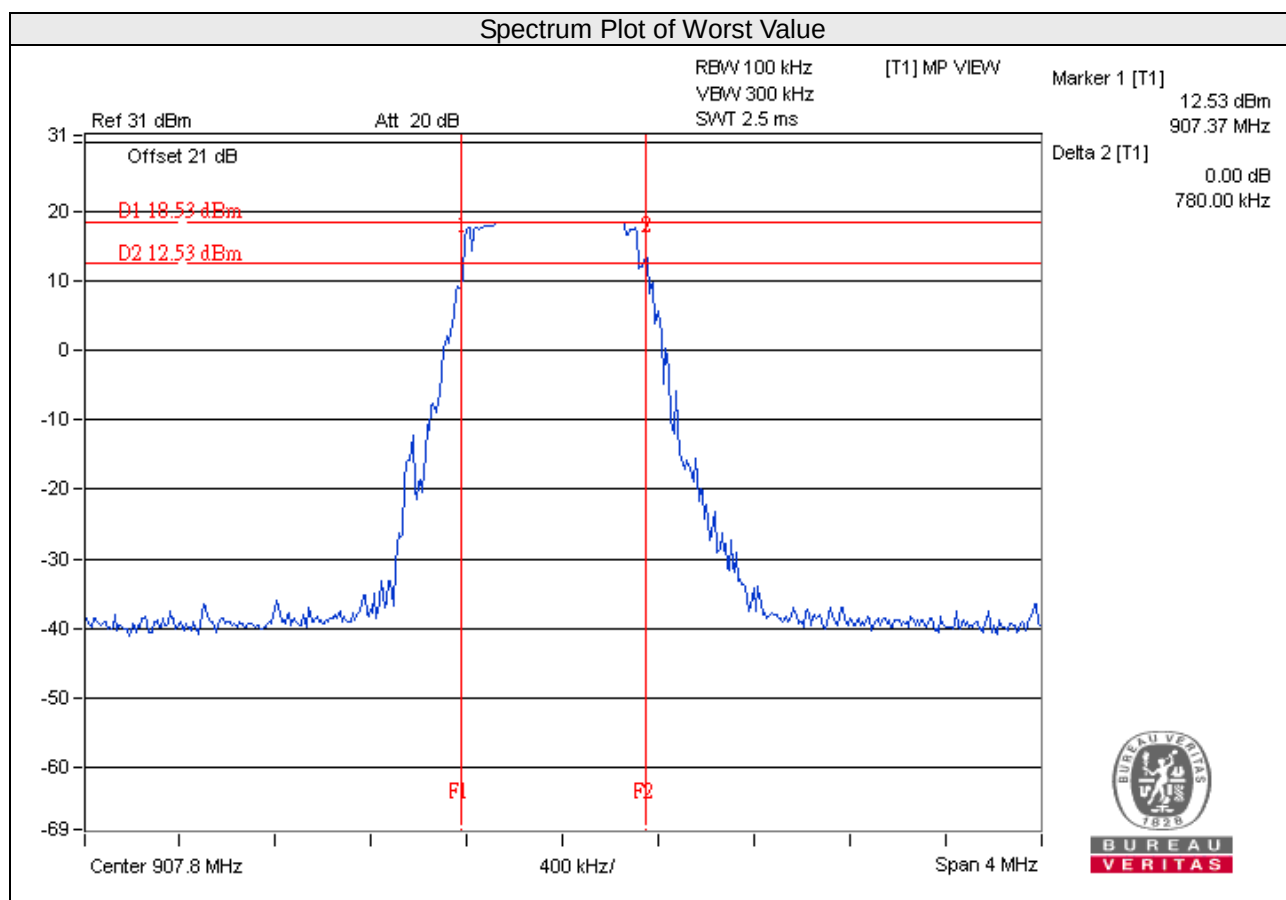
No deviation.

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
64	903.0	0.79	0.5	Pass
67	907.8	0.78	0.5	Pass
71	914.2	0.83	0.5	Pass

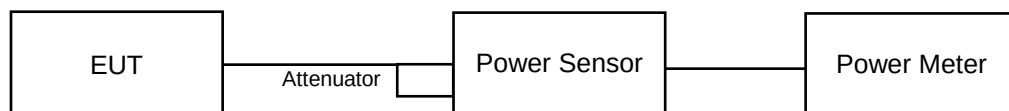


6.4 Conducted Output Power Measurement

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 Procedures

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.

6.4.5 Deviation from Test Standard

No deviation.

6.4.6 EUT Operating Conditions

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

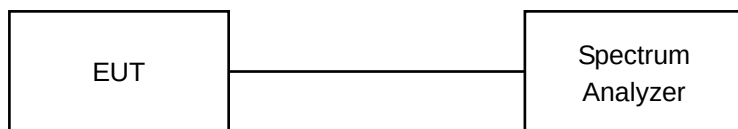
Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
64	903	79.25	18.99	30	Pass
67	907.8	78.524	18.95	30	Pass
71	914.2	77.446	18.89	30	Pass

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

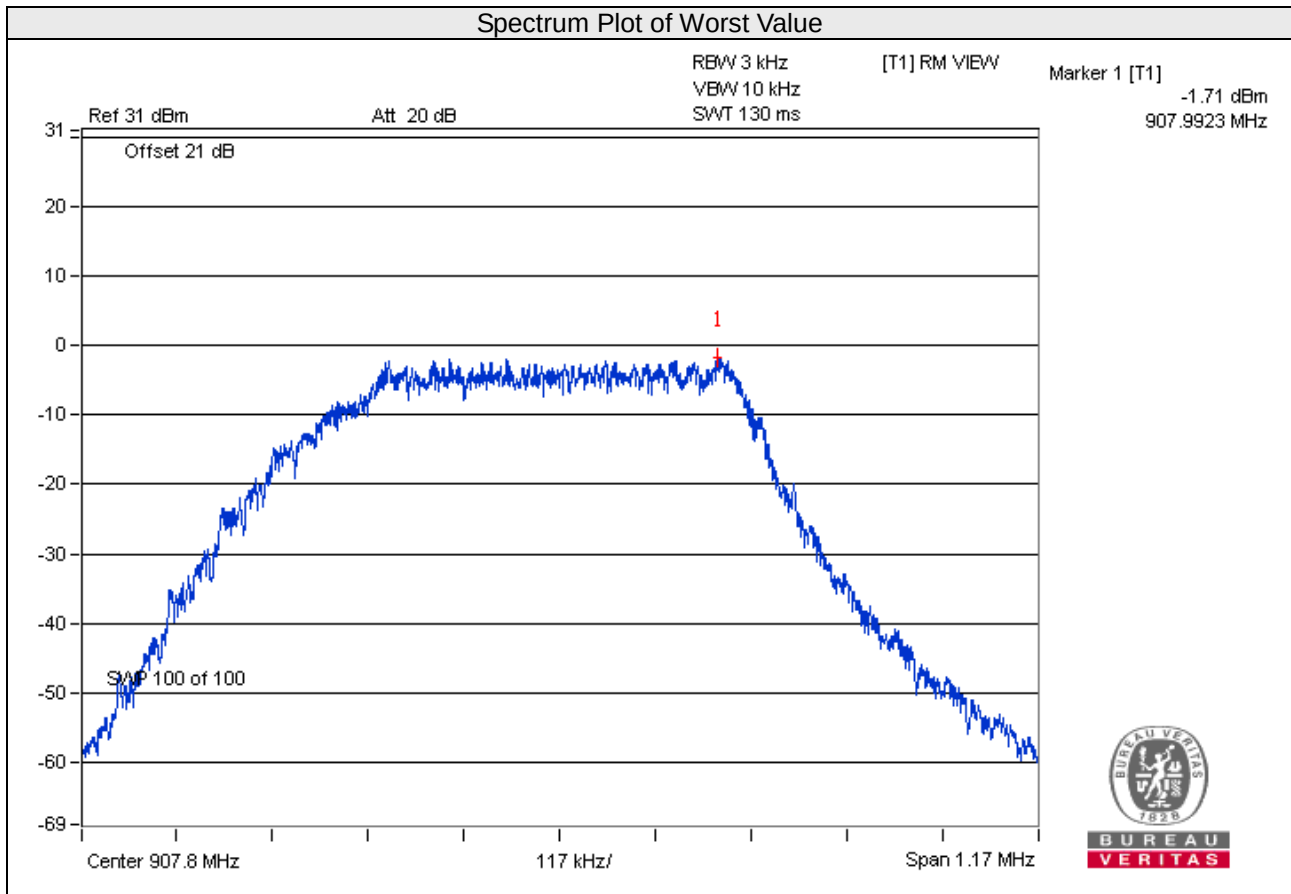
No deviation.

6.5.6 EUT Operating Condition

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

6.5.7 Test Results

Channel	Freq. (MHz)	PSD (dBm)	Limit (dBm)	Pass / Fail
64	903.0	-1.76	8	Pass
67	907.8	-1.71	8	Pass
71	914.2	-2.46	8	Pass

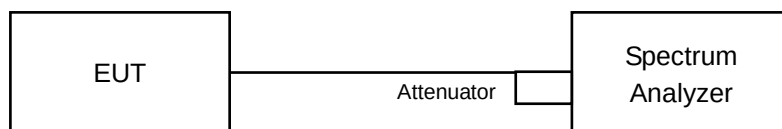


6.6 Conducted Out of Band Emission Measurement

6.6.1 Limits of Conducted Out of Band Emission Measurement

Below -30dB 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

- Set the RBW = 100 kHz.
- Set the VBW $\geq$ 300 kHz.
- Detector = peak.
- 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 OOBE

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

6.6.5 Deviation from Test Standard

No deviation.

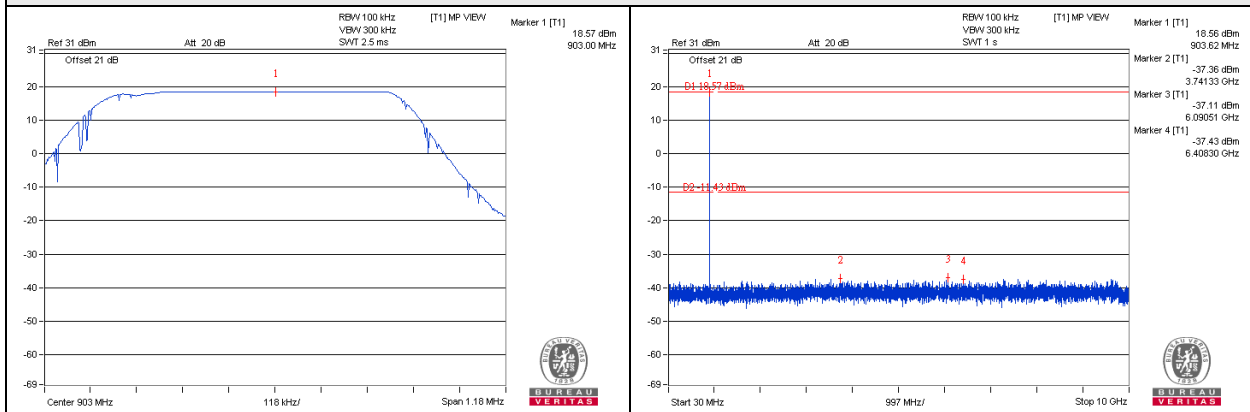
6.6.6 EUT Operating Condition

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

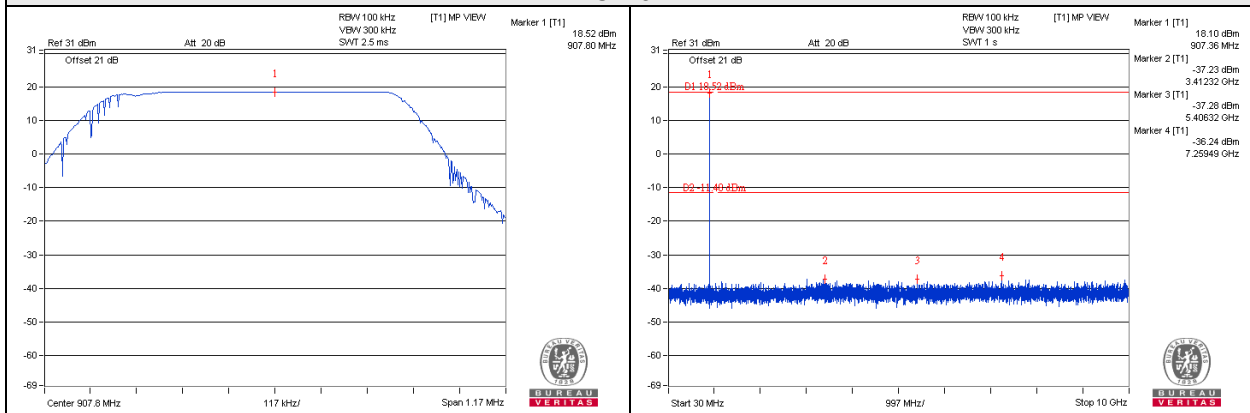
6.6.7 Test Results

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

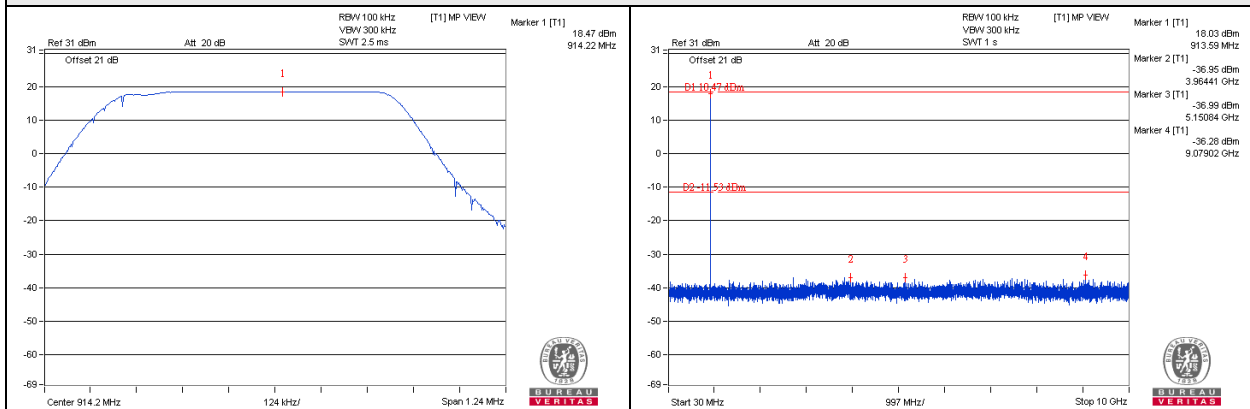
CH 64



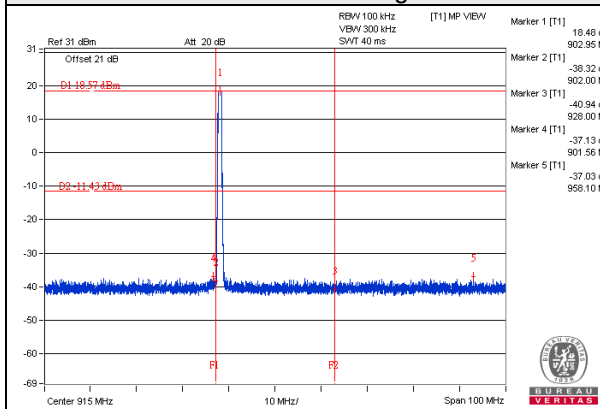
CH 67



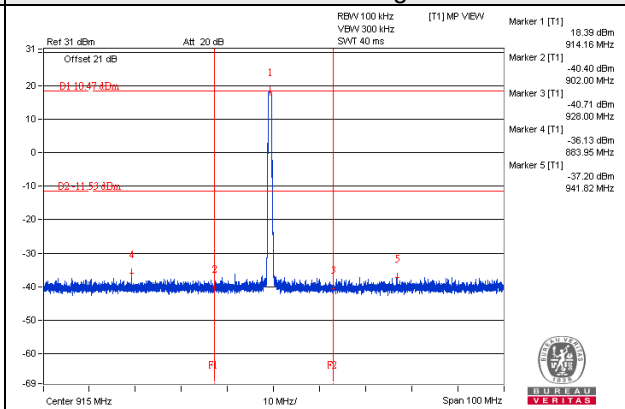
CH 71



CH 64 Band edge



CH 71 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 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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