FCC TEST REPORT
(BLUETOOTH)

Report No.:	RF160504W010-1
FCC ID:	2ADOBF20
Test Model:	Hisense F20
Received Date:	May 04, 2016
Test Date:	May 05, 2016 ~ Jun. 02, 2016
Issued Date:	Jun. 03, 2016
Applicant:	Hisense International Co., Ltd.
Address:	Floor 22, Hisense Tower, 17 Donghai Xi Road, Qingdao, 266071, China
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lab Address:	No. 47-2, 14th Ling, Chia Cau Vil., Lin Kou Dist., New Taipei City, Taiwan (R.O.C.)
Test Location:	No. 19, Hwa Ya 2nd Rd., Wen Hwa Tsuen, Kwei Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C.

This report should not be used by the client to claim product certification, approval, or endorsement by TAF or any government agencies.

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF160504W010-1	Original release	Jun. 03, 2016

1 Certificate of Conformity

Product:	Mobile phone
Brand:	Hisense
Test Model:	Hisense F20
Sample Status:	Identical Prototype
Applicant:	Hisense International Co., Ltd.
Test Date:	May 05, 2016 ~ Jun. 02, 2016
Standards:	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:** Jun. 03, 2016

Amyee Qian / Engineer

Approved by : _____ , **Date:** Jun. 03, 2016

William Chung / Manager

2 Summary of Test Results

FCC Part 15, Subpart C (SECTION 15.247) (BT EDR)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is 20.98dB at 1.820000MHz.
15.247(a)(1)(iii)	Number of Hopping Frequency Used	PASS	Meet the requirement of limit.
15.247(a)(1)(iii)	Dwell Time on Each Channel	PASS	Meet the requirement of limit.
15.247(a)(1)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	PASS	Meet the requirement of limit.
15.247(b)	Maximum Peak Output Power	PASS	Meet the requirement of limit.
15.205 & 209	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -3.09dB at 37.76MHz.
15.247(d)	Band Edge Measurement	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

NOTE: If The Frequency Hopping System operating in 2400-2483.5MHz band and the output power less than 125mW. The hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of hopping channel whichever is greater.

FCC Part 15, Subpart C (SECTION 15.247) (BT LE 4.0)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is 20.98dB at 1.820000MHz.
15.205 & 209	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -2.51dB at 43.58MHz.
15.247(d)	Band Edge Measurement	PASS	Meet the requirement of limit.
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	No antenna connector is used.

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	Expended Uncertainty (k=2) (±)
Conducted Emissions at mains ports	9kHz ~ 30MHz	2.44 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	2.93 dB
	200MHz ~1000MHz	2.95 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.26 dB
	18GHz ~ 40GHz	1.94 dB

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

3 General Information

3.1 General Description of EUT

Product	Mobile phone	
Brand	Hisense	
Test Model	Hisense F20	
Power Supply Rating	5.0Vdc (adapter or host equipment) 3.8Vdc (battery)	
Modulation Technology	**BT EDR**	FHSS
	BT LE 4.0	DTS
Modulation Type	**BT EDR**	GFSK, 8DPSK, π/4 DQPSK
	BT LE 4.0	GFSK
Transfer Rate	**BT EDR**	1/2/3 Mbps
	BT LE 4.0	1Mbps
Operating Frequency	2402MHz ~ 2480MHz	
Number of Channel	**BT EDR**	79
	BT LE 4.0	40
Output Power	**BT EDR**	15.241mW
	BT LE 4.0	1.726mW
Antenna Type	PIFA Antenna with 1.4dBi gain	
Accessory Device	Refer to note as below	
Data Cable Supplied	USB cable: shielded, detachable, 0.8m Earphone cable: Unshielded, detachable,0.8m	

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.
2. The EUT was powered by the following adapter:

ADAPTER	
BRAND:	Hisense
MODEL:	A31-501000
INPUT:	AC 100-240V, 150mA
OUTPUT:	DC 5V, 1000mA

3. The EUT matched the following USB Cable and Earphone.

USB CABLE	
BRAND:	SHENZHEN FKY-QY HARDWARE ELECTRONIC CO.,LTD
MODEL:	FKYM1-2828L08BKR/FKYM1-2828L08WHR
SIGNAL LINE:	0.8 METER

EARPHONE	
BRAND:	NEW LEADER
MODEL:	NLD-EM116T-055S NLD-EM116T-056S
SIGNAL LINE:	0.8 METER

4. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

3.2 Description of Test Modes

79 channels are provided for BT-EDR mode:

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

40 channels are provided for BT LE 4.0 mode:

CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

3.2.1 Test Mode Applicability and Tested Channel Detail

BT EDR

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

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

NOTE:
1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.
2. "-" means no effect.

Radiated Emission Test (Above 1GHz):

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

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	0, 39, 78	FHSS	GFSK	DH5

Radiated Emission Test (Below 1GHz):

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

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	78	FHSS	GFSK	DH5

Power Line Conducted Emission Test:

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

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	78	FHSS	8DPSK	DH5

Antenna Port Conducted Measurement:

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

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	0, 39, 78	FHSS	GFSK	DH5
-	0 to 78	0, 39, 78	FHSS	8DPSK	DH5

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	25deg. C, 65%RH	120Vac, 60Hz	Alex Chen
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	Alex Chen
PLC	25deg. C, 68%RH	120Vac, 60Hz	Yuqiang Yin
APCM	21deg. C, 60%RH	120Vac, 60Hz	Wenliang Wu

BT LE 4.0

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

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

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane**.
NOTE: "-"means no effect.

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 CONFIGUURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
-	0 to 39	0, 19, 39	GFSK	1

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 CONFIGUURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
-	0 to 39	0	GFSK	1

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 CONFIGUURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
-	0 to 39	0	GFSK	1

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 CONFIGUURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
-	0 to 39	0, 19, 39	GFSK	1

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	25deg. C, 65%RH	120Vac, 60Hz	Alex Chen
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	Alex Chen
PLC	25deg. C, 68%RH	120Vac, 60Hz	Yuqiang Yin
APCM	21deg. C, 60%RH	120Vac, 60Hz	Wenliang Wu

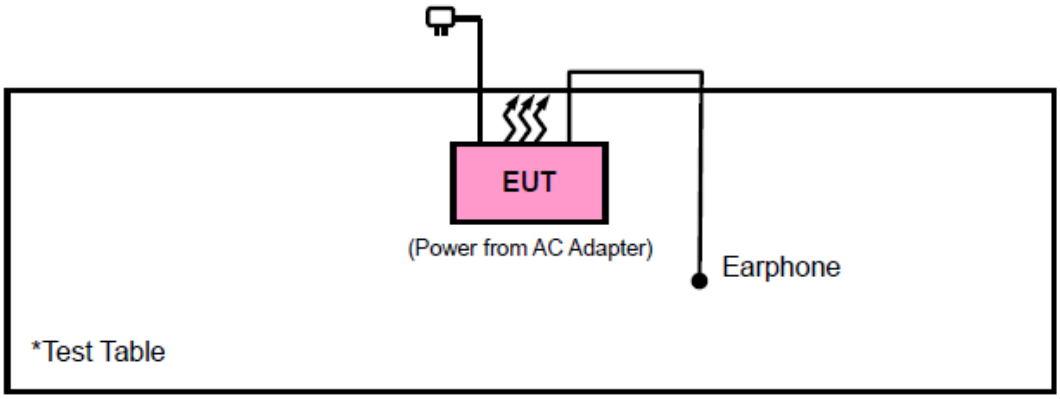
3.3 Description of Support Units

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

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	DC source	LONG WEI	PS-6403D	010934269	N/A
2	PC	HP	A6608CN	3CR83825X3	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	DC Line: Unshielded, Detachable 1.0m
2	AC Line: Unshielded, Detachable 1.5m

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards

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

FCC Part 15, Subpart C (15.247)
FCC Public Notice DA 00-705
558074 D01 DTS Meas Guidance v03r05
ANSI C63.10-2013

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

NOTE: The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DOC). The test report has been issued separately.

4 Test Types and Results(For BT EDR)

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 20dB below the highest level of the desired power:

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

NOTE:

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

4.1.2 Test Instruments

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR7	101494	Apr. 05,16	Apr. 04,17
Bilog Antenna	Teseq	CBL 6111D	30643	Jul. 16, 15	Jul. 15, 16
Horn Antenna (1GHz -18GHz)	ETS -Lindgren	3117	00062558	May 30, 14	May 29, 17
Amplifier	Burgeon	BPA-530	100220	Apr. 05,16	Apr. 04,17
Pre-Amplifier (18GHz-40GHz)	EMCI	EMC 184045	980102	Nov. 20,15	Nov. 19,17
Pre-Amplifier	HP	8449B	3008A00409	Apr. 25,15	Apr. 24,17
GPS Generator+ Antenna	TOJOIN	GNSS-5000A	E1-010119	Aug. 08, 14	Aug. 07, 16
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	NSEMC003	Mar. 12,16	Mar. 11,18
Test Software	ADT	ADT_Radiated _V7.6.15.9.2	N/A	N/A	N/A

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 loop antenna is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. The test was performed in HwaYa Chamber 4.
4. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
5. The FCC Site Registration No. is 460141.
6. The IC Site Registration No. is IC7450F-4.

4.1.3 Test Procedures

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 detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.

Note:

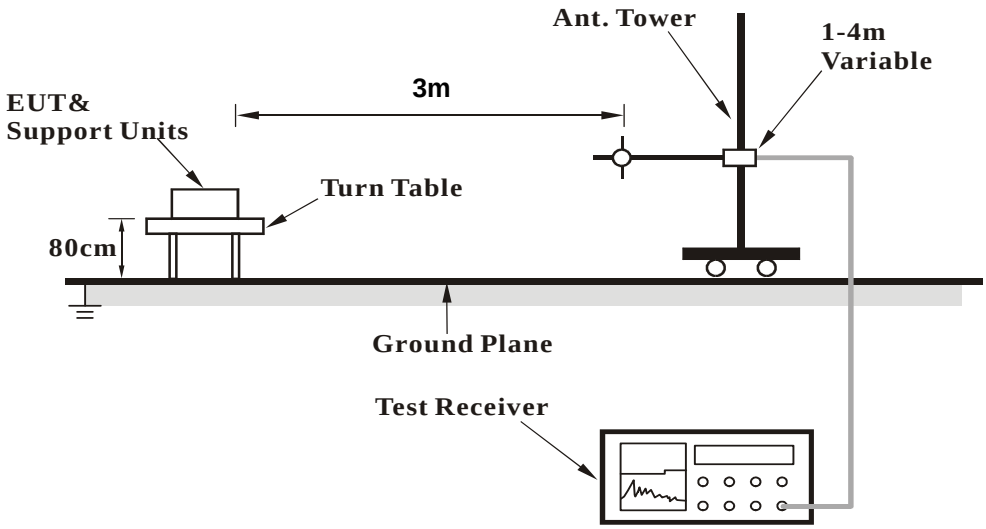
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. For Average measurement, due to the DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to: 20log(3.125 / 100)= -30.1 dB, therefore Average value = peak reading + 20log(duty cycle).
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

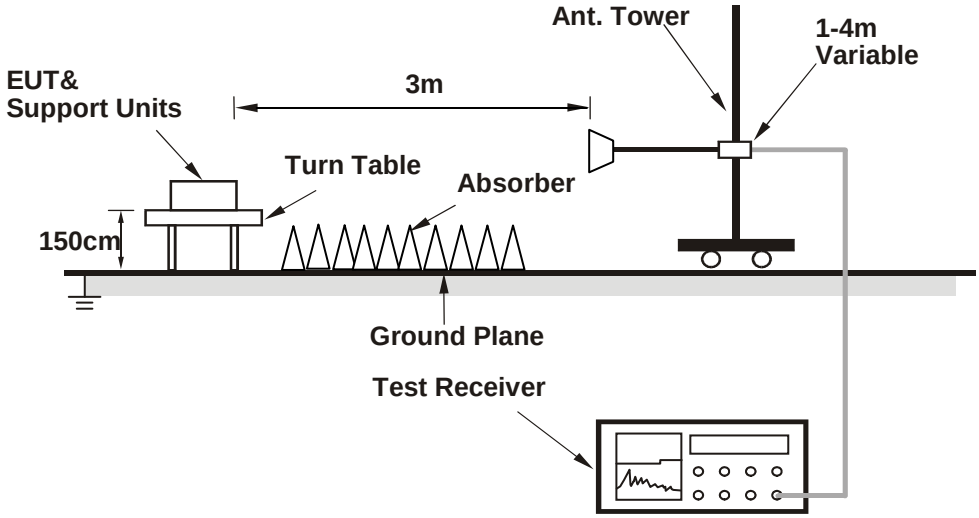
No deviation.

4.1.5 Test Set Up

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



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

4.1.6 EUT Operating Conditions

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

4.1.7 Test Results

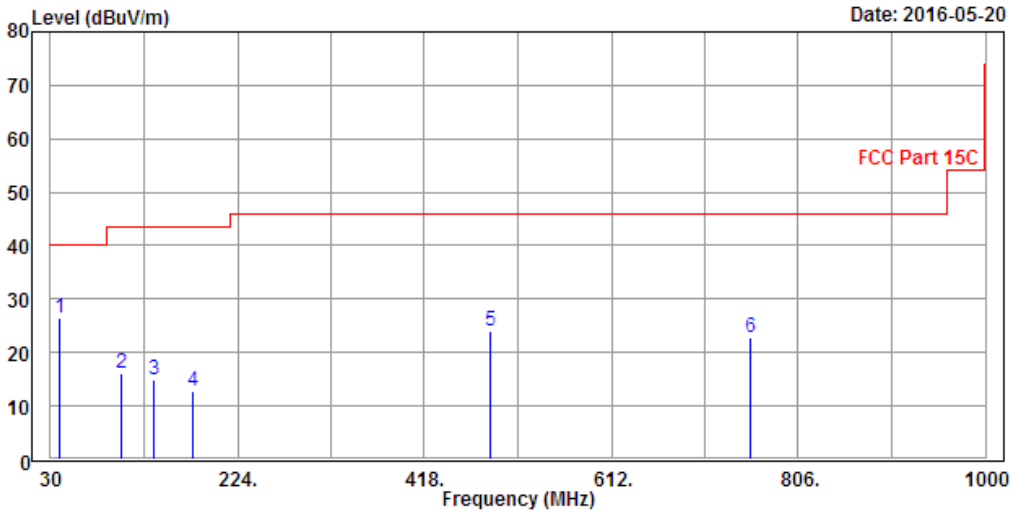
BELOW 1GHz WORST-CASE DATA:

CHANNEL	TX Channel 0	**DETECTOR FUNCTION**	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
Freq. (MHz)	**Emission level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Antenna Height (cm)**	**Table Angle (degree)**	**Remark**
38.73	26.61	50.73	40.00	-13.39	11.08	-35.20	200	213	QP
102.75	16.23	42.84	43.50	-27.27	7.90	-34.51	200	278	QP
136.70	14.95	41.27	43.50	-28.55	7.87	-34.19	200	138	QP
178.41	12.80	36.83	43.50	-30.70	9.92	-33.95	200	112	QP
486.87	23.97	38.95	46.00	-22.03	18.24	-33.22	200	65	QP
755.56	22.96	32.70	46.00	-23.04	23.04	-32.78	200	308	QP

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

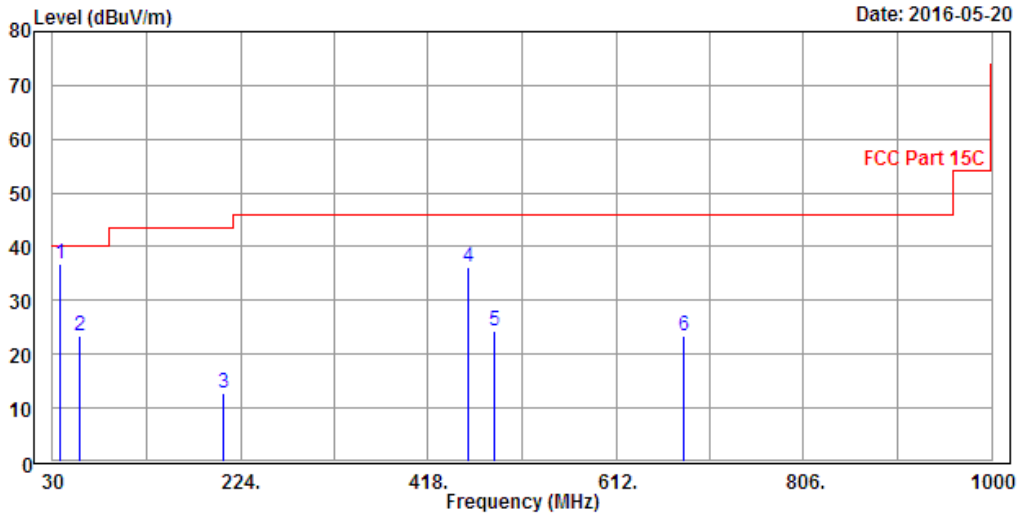


CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M									
Freq. (MHz)	Emission level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Antenna Height (cm)	Table Angle (degree)	Remark
37.76	36.91	60.38	40.00	-3.09	11.75	-35.22	101	202	QP
57.16	23.51	52.00	40.00	-16.49	6.43	-34.92	101	168	QP
205.57	12.72	36.22	43.50	-30.78	10.36	-33.86	101	324	QP
459.71	36.13	51.43	46.00	-9.87	17.92	-33.22	101	247	QP
486.87	24.42	39.40	46.00	-21.58	18.24	-33.22	101	128	QP
681.84	23.44	33.68	46.00	-22.56	22.59	-32.83	101	32	QP

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



ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

		Freq	Level	Read Level	Limit Line	Over Limit	Ant Factor	Cable Loss	APos	TPos	Remark
		MHz	dBuV/m	dBuV	dBuV/m	dB	dB/m	dB	cm	deg	
1	PP	38.730	26.61	50.73	40.00	-13.39	11.08	-35.20	200	213	Peak
2		102.750	16.23	42.84	43.50	-27.27	7.90	-34.51	200	278	Peak
3		136.700	14.95	41.27	43.50	-28.55	7.87	-34.19	200	138	Peak
4		178.410	12.80	36.83	43.50	-30.70	9.92	-33.95	200	112	Peak
5		486.870	23.97	38.95	46.00	-22.03	18.24	-33.22	200	65	Peak
6		755.560	22.96	32.70	46.00	-23.04	23.04	-32.78	200	308	Peak

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

		Freq	Level	Read Level	Limit Line	Over Limit	Ant Factor	Cable Loss	APos	TPos	Remark
		MHz	dBuV/m	dBuV	dBuV/m	dB	dB/m	dB	cm	deg	
1	PP	37.760	36.91	60.38	40.00	-3.09	11.75	-35.22	101	202	Peak
2		57.160	23.51	52.00	40.00	-16.49	6.43	-34.92	101	168	Peak
3		205.570	12.72	36.22	43.50	-30.78	10.36	-33.86	101	324	Peak
4		459.710	36.13	51.43	46.00	-9.87	17.92	-33.22	101	247	Peak
5		486.870	24.42	39.40	46.00	-21.58	18.24	-33.22	101	128	Peak
6		681.840	23.44	33.68	46.00	-22.56	22.59	-32.83	101	32	Peak

REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
   Margin value = Emission level – Limit value.

ABOVE 1GHz WORST-CASE DATA:

GFSK DH5

CHANNEL	TX Channel 0	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
FREQ. (MHz)	**EMISSION LEVEL (dBuV/m)**	**READ LEVEL (dBuV)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA HEIGHT (cm)**	**TABLE ANGLE (Degree)**	**CORRECTION FACTOR (dB/m)**	**REMARK**
2390	37.65	45.52	-16.35	54.00	100	240	-7.87	Average
2390	48.11	55.98	-25.89	74.00	100	240	-7.87	Peak
2402	99.10	106.94			100	240	-7.84	Average
2402	106.60	114.44			100	240	-7.84	Peak
4804	43.92	45.96	-10.08	54.00	100	102	-2.04	Average
4804	52.42	54.46	-21.58	74.00	100	102	-2.04	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
FREQ. (MHz)	**EMISSION LEVEL (dBuV/m)**	**READ LEVEL (dBuV)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA HEIGHT (cm)**	**TABLE ANGLE (Degree)**	**CORRECTION FACTOR (dB/m)**	**REMARK**
2390	38.28	46.15	-15.72	54.00	100	20	-7.87	Average
2390	49.44	57.31	-24.56	74.00	100	20	-7.87	Peak
2402	93.12	100.96			100	20	-7.84	Average
2402	99.78	107.62			100	20	-7.84	Peak
4804	44.48	46.52	-9.52	54.00	100	86	-2.04	Average
4804	51.48	53.52	-22.52	74.00	100	86	-2.04	Peak

REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
   Margin value = Emission level – Limit value.
2. 2402MHz: Fundamental frequency.

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	CORRECTION FACTOR (dB/m)	REMARK
2441	94.00	101.73			100	170	-7.73	Average
2441	101.07	108.80			100	170	-7.73	Peak
4882	48.24	50.02	-5.76	54.00	175	212	-1.78	Average
4882	56.18	57.96	-17.82	74.00	175	212	-1.78	Peak
7323	44.22	41.46	-9.78	54.00	100	78	2.76	Average
7323	56.63	53.87	-17.37	74.00	100	78	2.76	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	CORRECTION FACTOR (dB/m)	REMARK
2441	102.17	109.90			100	235	-7.73	Average
2441	107.93	115.66			100	235	-7.73	Peak
4882	48.71	50.49	-5.29	54.00	150	285	-1.78	Average
4882	55.71	57.49	-18.29	74.00	150	285	-1.78	Peak
7323	45.29	42.53	-8.71	54.00	100	188	2.76	Average
7323	55.91	53.15	-18.09	74.00	100	188	2.76	Peak

REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
   Margin value = Emission level – Limit value.
2. 2441MHz: Fundamental frequency.

CHANNEL	TX Channel 78	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	CORRECTION FACTOR (dB/m)	REMARK
2480	99.14	106.75			100	242	-7.61	Average
2480	106.32	113.93			100	242	-7.61	Peak
2483.5	38.78	46.38	-15.22	54.00	100	242	-7.60	Average
2483.5	48.27	55.87	-25.73	74.00	100	242	-7.60	Peak
4960	49.42	50.94	-4.58	54.00	100	102	-1.52	Average
4960	56.77	58.29	-17.23	74.00	100	102	-1.52	Peak
7440	45.17	42.21	-8.83	54.00	100	128	2.96	Average
7440	55.14	52.18	-18.86	74.00	100	128	2.96	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	CORRECTION FACTOR (dB/m)	REMARK
2480	92.84	100.45			100	178	-7.61	Average
2480	100.31	107.92			100	178	-7.61	Peak
2483.5	38.05	45.65	-15.95	54.00	100	178	-7.60	Average
2483.5	48.82	56.42	-25.18	74.00	100	178	-7.60	Peak
4960	50.02	51.54	-3.98	54.00	180	198	-1.52	Average
4960	57.70	59.22	-16.30	74.00	180	198	-1.52	Peak
7440	45.14	42.18	-8.86	54.00	100	256	2.96	Average
7440	56.18	53.22	-17.82	74.00	100	256	2.96	Peak

REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
   Margin value = Emission level – Limit value.
2. 2480MHz: 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.

3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

4.2.2 Test Instruments

Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Next Cal.**
EMI Test Receiver	Rohde&Schwarz	ESCS30	100340	May 11,15	May 10,17
Artificial Mains Network	Rohde&Schwarz	ENV216	101173	Mar. 04,16	Mar. 03,17
Artificial Mains Network	Rohde&Schwarz	ESH3-Z5	100317	Apr. 05,16	Apr. 04,17
Voltage probe	SCHWARZBECK	TK 9421	TK 9421-176	Jan. 08,16	Jan. 07,17
Test software	ADT	ADT_Cond_V7.3.7	N/A	N/A	N/A

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

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

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

4.2.3 Test Procedures

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

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

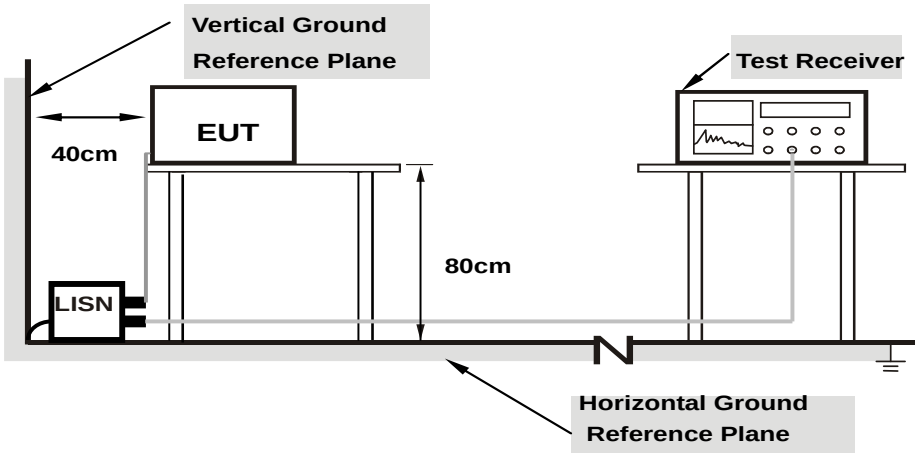
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: 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.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

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.

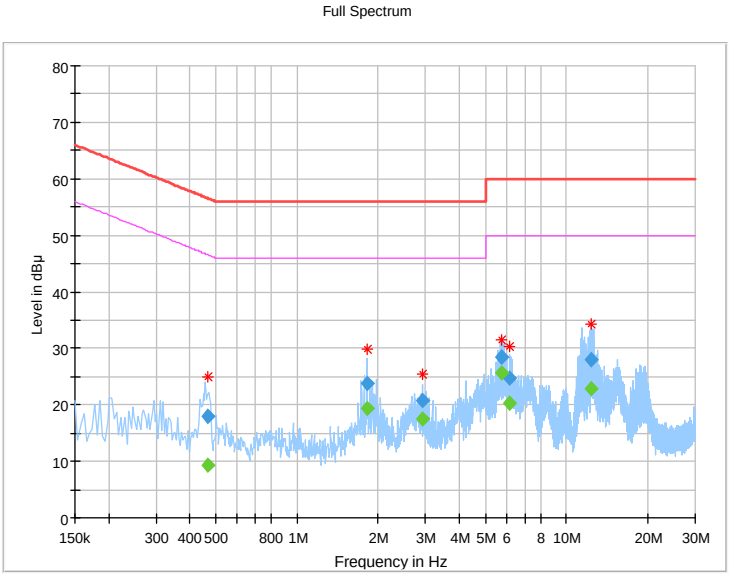
4.2.7 Test Results

CONDUCTED WORST-CASE DATA

TEST VOLTAGE	DC 5V From Adapter Input 230 Vac, 50 Hz	**6dB BANDWIDTH**	9 kHz
ENVIRONMENTAL CONDITIONS	24deg. C, 55RH	**TESTED BY**	Eric

Frequency (MHz)	QuasiPeak (dB¦ìV)	CAverage (dB¦ìV)	Limit (dB¦ìV)	Margin (dB)	Line	Filter	Corr. (dB)
0.468000	---	9.40	46.55	37.15	L	ON	9.7
0.468000	17.99	---	56.55	38.56	L	ON	9.7
1.820000	---	19.38	46.00	26.62	L	ON	9.7
1.820000	23.71	---	56.00	32.29	L	ON	9.7
2.924000	---	17.44	46.00	28.56	L	ON	9.7
2.924000	20.76	---	56.00	35.24	L	ON	9.7
5.772000	---	25.74	50.00	24.26	L	ON	9.8
5.772000	28.41	---	60.00	31.59	L	ON	9.8
6.152000	---	20.38	50.00	29.62	L	ON	9.8
6.152000	24.83	---	60.00	35.17	L	ON	9.8
12.376000	---	22.94	50.00	27.06	L	ON	9.9
12.376000	28.09	---	60.00	31.91	L	ON	9.9

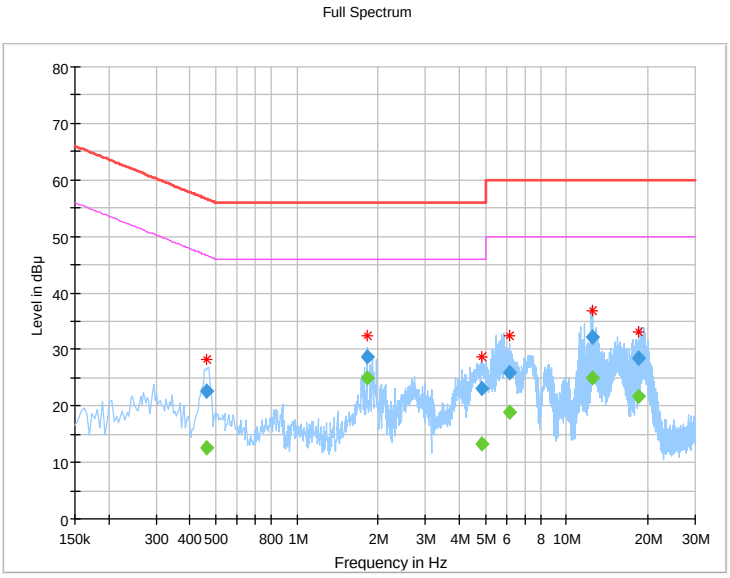
REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.



TEST VOLTAGE	DC 5V From Adapter Input 230 Vac, 50 Hz	**6dB BANDWIDTH**	9 kHz
ENVIRONMENTAL CONDITIONS	24deg. C, 55RH	**TESTED BY**	Eric

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.464000	---	12.53	46.62	34.09	N	ON	10.1
0.464000	22.69	---	56.62	33.93	N	ON	10.1
1.820000	**---**	**25.02**	**46.00**	**20.98**	**N**	**ON**	**9.8**
1.820000	28.75	---	56.00	27.25	N	ON	9.8
4.860000	---	13.38	46.00	32.62	N	ON	9.8
4.860000	23.00	---	56.00	33.00	N	ON	9.8
6.148000	---	18.91	50.00	31.09	N	ON	9.8
6.148000	25.82	---	60.00	34.18	N	ON	9.8
12.444000	---	24.99	50.00	25.01	N	ON	9.9
12.444000	32.22	---	60.00	27.78	N	ON	9.9
18.512000	---	21.78	50.00	28.22	N	ON	10.0
18.512000	28.37	---	60.00	31.63	N	ON	10.0

REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.

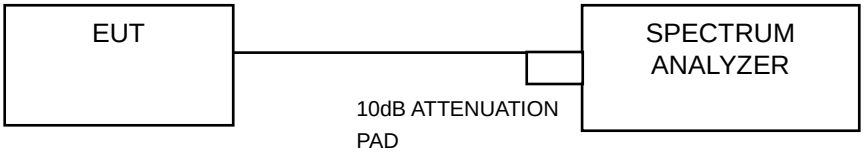


4.3 Number of Hopping Frequency Used

4.3.1 Limits of Hopping Frequency Used Measurement

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

4.3.2 Test Setup



4.3.3 Test Instruments

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Spectrum Analyzer (10Hz–40GHz)	Rohde&Schwarz	FSV40	101003	Apr. 05,16	Apr. 04,17
Power Meter	Anritsu	ML2495A	1139001	Feb.19,16	Feb. 18,17
Power Sensor	Anritsu	MA2411B	1126068	Feb.19,16	Feb. 18,17
Power Sensor	Keysight	U2021XA	MY55060016	May 27,15	May 26,17
Power Sensor	Keysight	U2021XA	MY55060018	May 27,15	May 26,17
Digital Multimeter	FLUKE	15B	A1220010DG	Oct. 12, 15	Oct.11, 16

NOTE:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.
2. The test was performed in RF Oven room.

4.3.4 Test Procedure

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

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

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

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

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

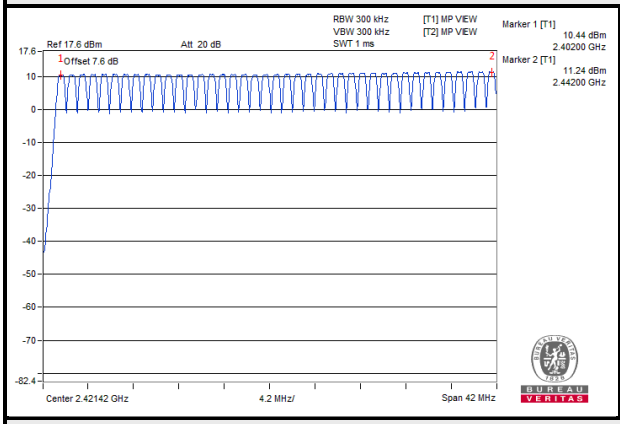
4.3.5 Deviation fromTest Standard

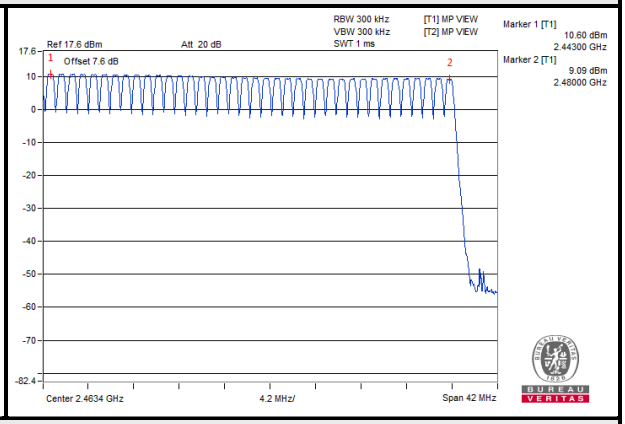
No deviation.

4.3.6 Test Results

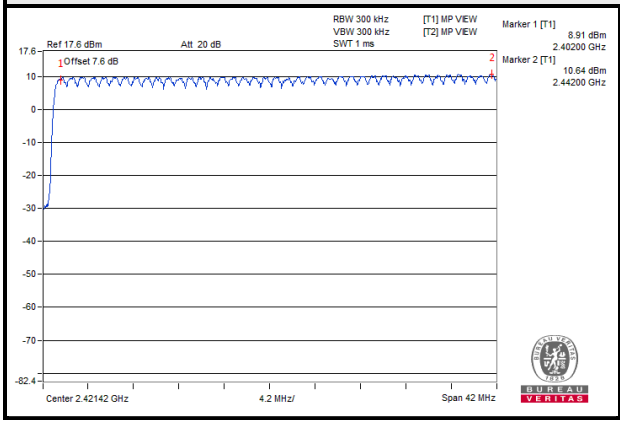
There are 79 hopping frequencies in the hopping mode. Please refer to next page for the test result. On the plots, it shows that the hopping frequencies are equally spaced.

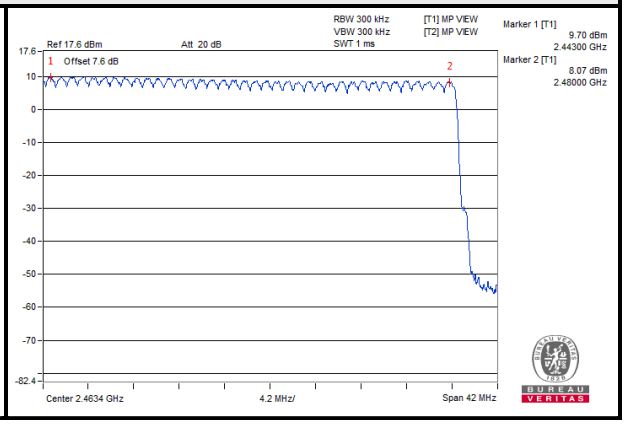
GFSK





8DPSK



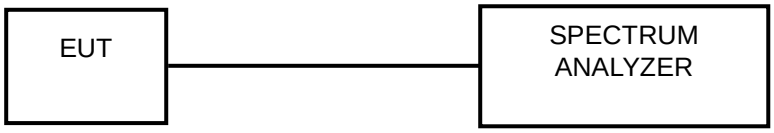


4.4 Dwell Time on Each Channel

4.4.1 Limits of Dwell Time on Each Channel Measurement

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

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.3.3 to get information of above instrument.

4.4.4 Test Procedures

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

.

4.4.5 Deviation from Test Standard

No deviation.

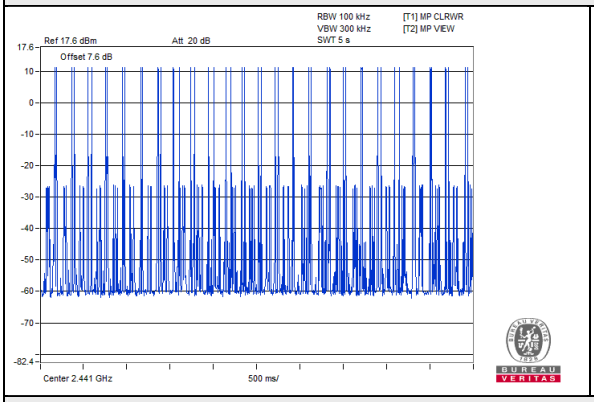
4.4.6 Test Results

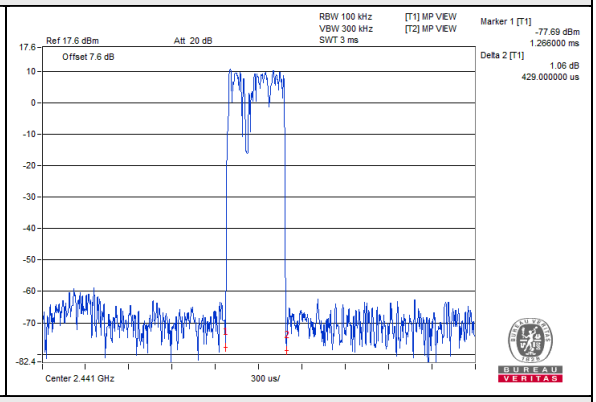
GFSK

Mode	Number of Hopping Channel	Number of transmission in a period(channel number*0.4 sec)				Length of transmission time (msec)	Result (msec)	Limit (msec)	PASS / FAIL
		period (sec)	sweep time (sec)	times in a sweep	times in a period				
DH1	79	31.6	5	48	303.36	0.429	130.14	400	PASS
DH3	79	31.6	5	26	164.32	1.7	279.34	400	PASS
DH5	79	31.6	5	17	107.44	2.975	319.63	400	PASS

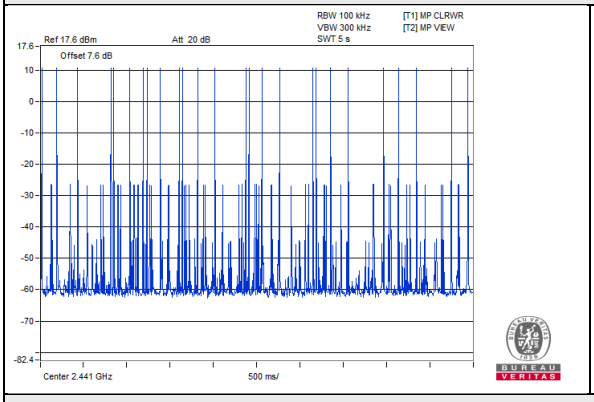
NOTE: Test plots of the transmitting time slot are shown on next 3 pages.

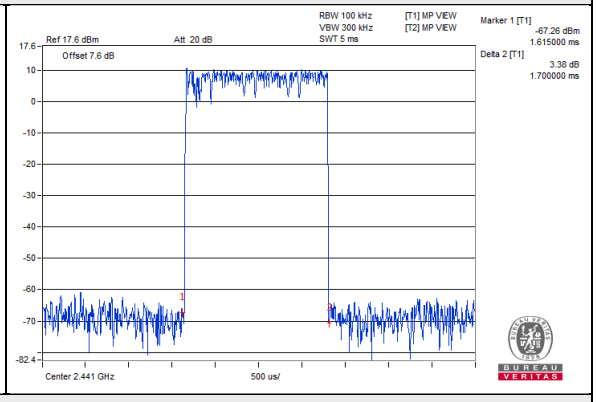
DH1



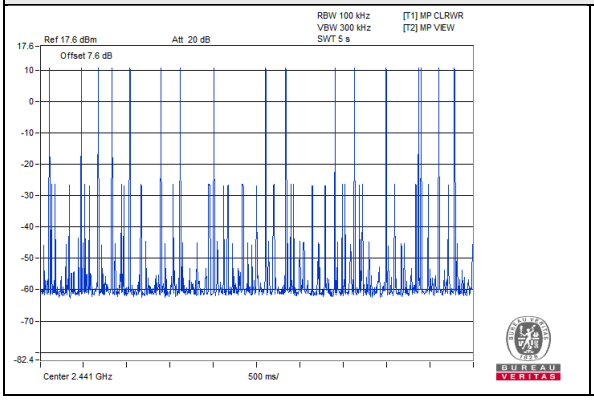


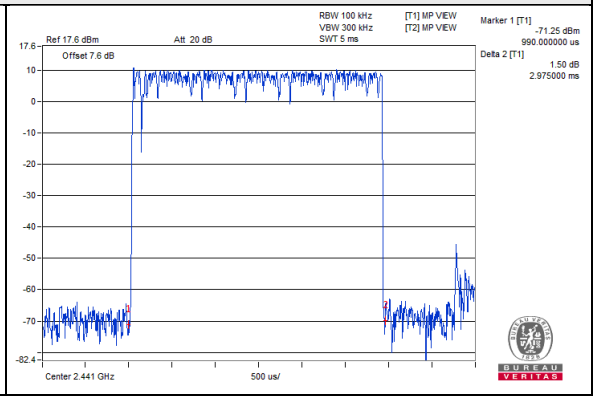
DH3





DH5



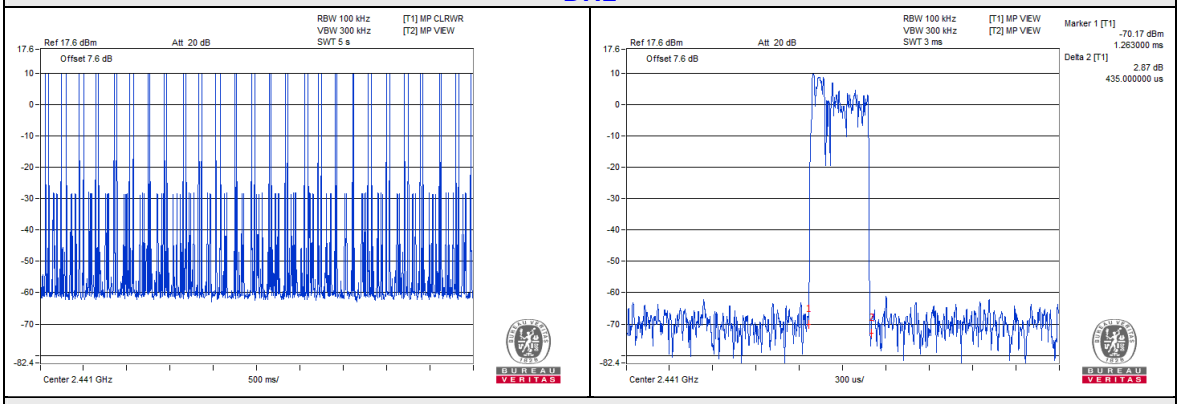


8DPSK

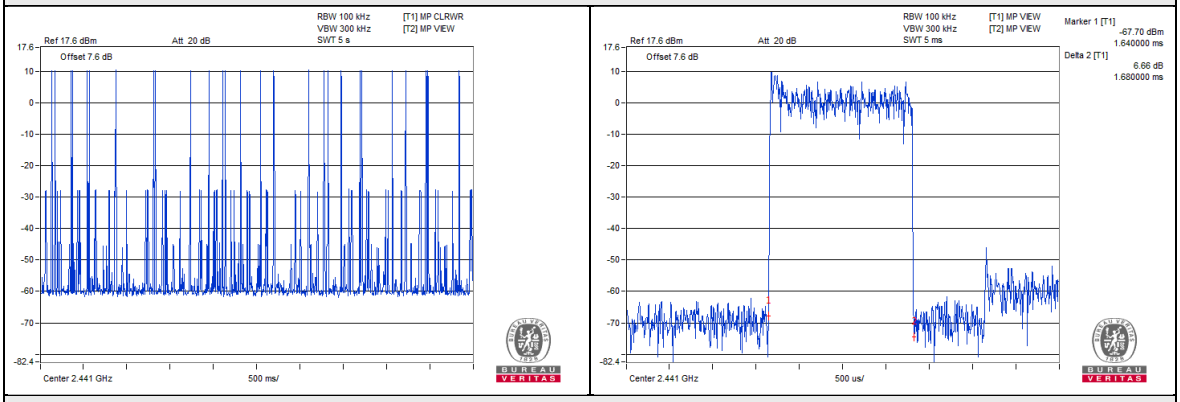
Mode	Number of Hopping Channel	Number of transmission in a period(channel number*0.4 sec)				Length of transmission time (msec)	Result (msec)	Limit (msec)	PASS / FAIL
		period (sec)	sweep time (sec)	times in a sweep	times in a period				
DH1	79	31.6	5	50	316	0.435	137.46	400	PASS
DH3	79	31.6	5	26	164.32	1.68	276.06	400	PASS
DH5	79	31.6	5	18	113.76	2.96	336.73	400	PASS

NOTE: Test plots of the transmitting time slot are shown on next 3 pages.

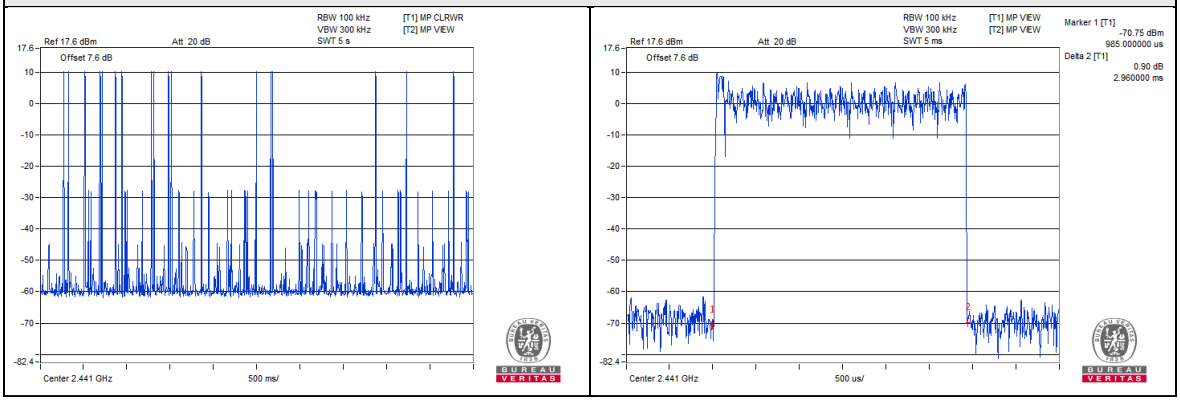
DH1



DH3



DH5

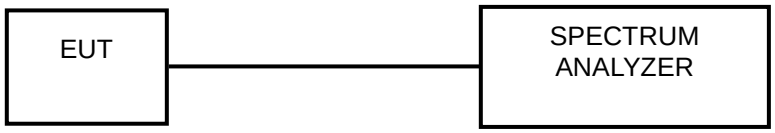


4.5 Channel Bandwidth

4.5.1 Limits of Channel Bandwidth Measurement

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

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.3.3 to get information of above instrument.

4.5.4 Test Procedure

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
d. Repeat above procedures until all frequencies measured were complete.

4.5.5 Deviation from Test Standard

No deviation.

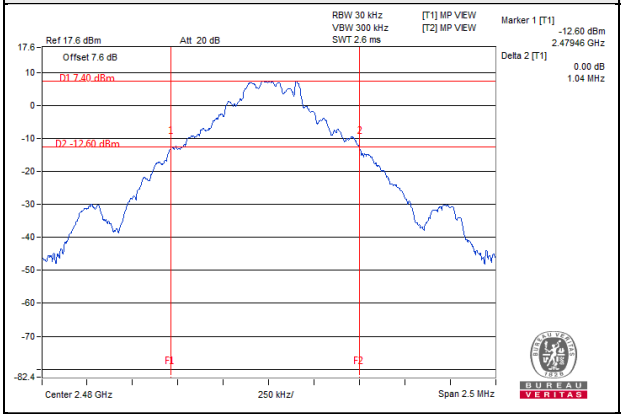
4.5.6 EUT Operating Condition

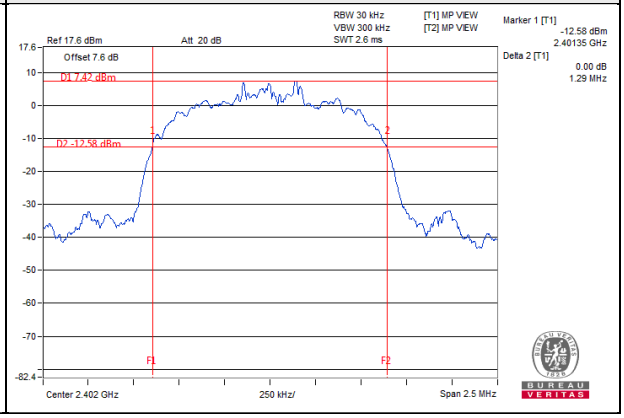
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.5.7 Test Results

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	
		GFSK	8DPSK
0	2402	0.94	1.29
39	2441	0.95	1.28
78	2480	1.04	1.28

Spectrum Plot of Worst Value	
GFSK	8DPSK



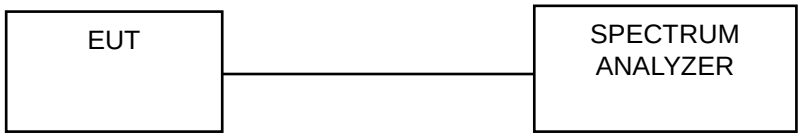


4.6 Hopping Channel Separation

4.6.1 Limits of Hopping Channel Separation Measurement

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

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.3.3 to get information of above instrument.

4.6.4 Test Procedure

Measurement Procedure REF

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

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

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

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

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

4.6.5 Deviation From Test Standard

No deviation.

4.6.6 Test Results

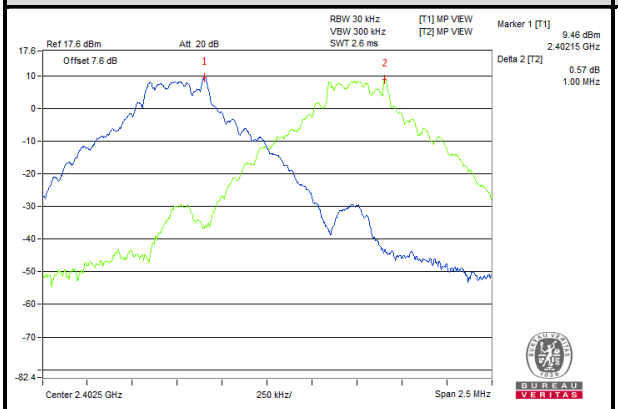
Channel	Frequency (MHz)	Adjacent Channel Separation (MHz)		20dB Bandwidth (MHz)		Minimum Limit (MHz)		Pass / Fail
		GFSK	8DPSK	GFSK	8DPSK	GFSK	8DPSK	
0	2402	1.00	1.01	0.94	1.29	0.63	0.86	Pass
39	2441	1.00	1.01	0.95	1.28	0.63	0.85	Pass
78	2480	1.01	1.01	1.04	1.28	0.69	0.85	Pass

NOTE: The minimum limit is two-third 20dB bandwidth.

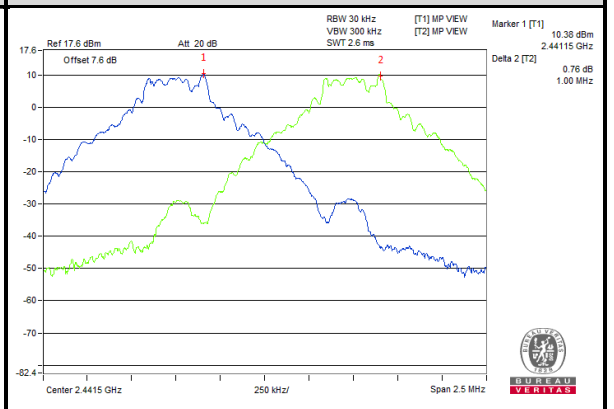
GFSK

SPECTRUM PLOT OF WORST VALUE

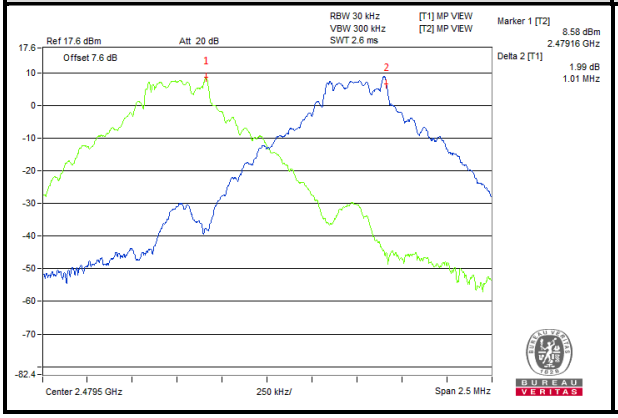
CH0



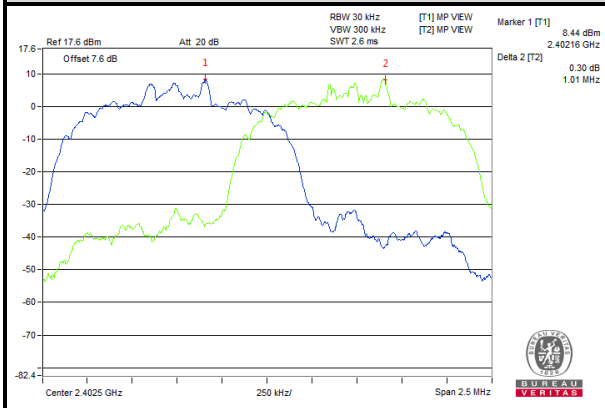
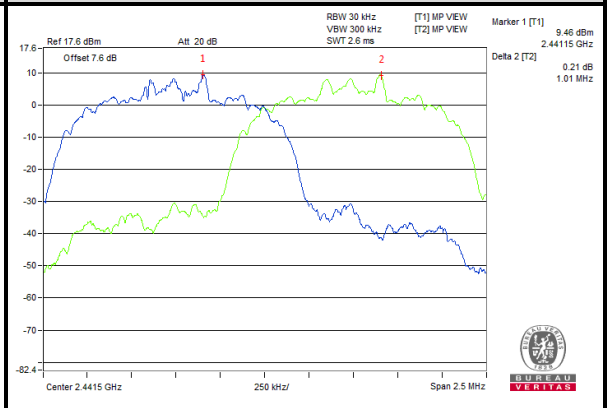
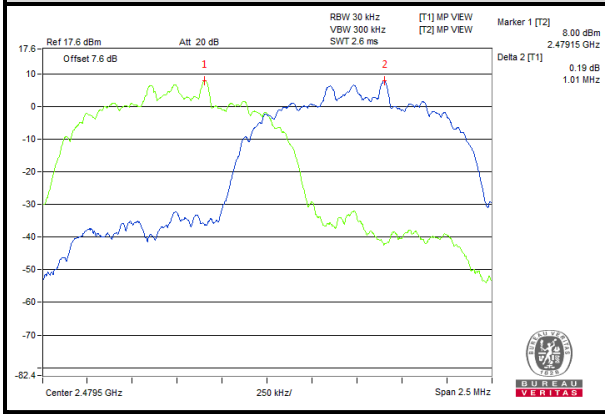
CH39



CH78



8DPSK

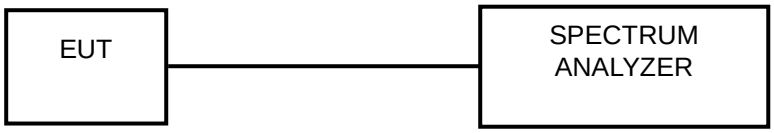
SPECTRUM PLOT OF WORST VALUE	
CH0	**CH39**
	
CH78	
	

4.7 Maximum Output Power

4.7.1 Limits of Maximum Output Power Measurement

The Maximum Output Power Measurement is 125mW.

4.7.2 Test Setup



4.7.3 Test Instruments

Refer to section 4.3.3 to get information of above instrument.

4.7.4 Test Procedure

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

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

c. The center frequency of the spectrum analyzer is set to the fundamental frequency and using 3MHz RBW and 10 MHz VBW.

d. Measure the captured power within the band and recording the plot.

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

4.7.5 Deviation fromTest 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

Channel	Frequency (MHZ)	Output Power (mW)		Output Power (dBm)		Power Limit (mW)	Pass / Fail
		GFSK	8DPSK	GFSK	8DPSK		
0	2402	9.683	12.162	9.86	10.85	125	Pass
39	2441	12.023	**15.241**	10.80	11.83	125	Pass
78	2480	8.035	9.099	9.05	9.59	125	Pass

4.8 Conducted Out of Band Emission Measurement

4.8.1 Limits Of Conducted Out Of Band Emission Measurement

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

4.8.2 Test Instruments

Refer to section 4.3.3 to get information of above instrument.

4.8.3 Test Procedure

The transmitter output was connected to the spectrum analyzer via a low loss cable. of Spectrum Analyzer was set RBW to 100 kHz and VBW to 100 kHz with suitable frequency span including 100 MHz bandwidth from band edge. Detector = PEAK and Trace mode = Max Hold. The band edges was measured and recorded.

4.8.4 Deviation From Test Standard

No deviation.

4.8.5 Eut Operating Condition

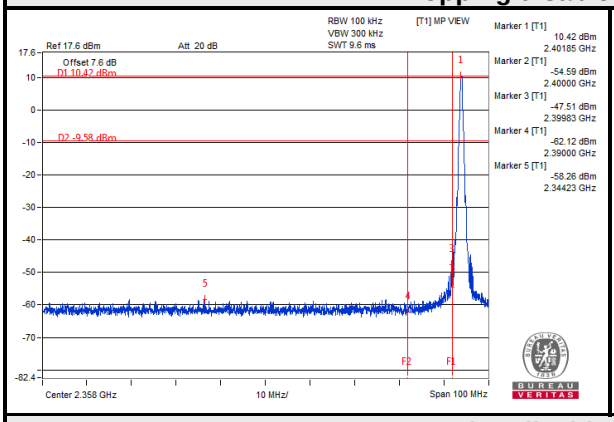
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

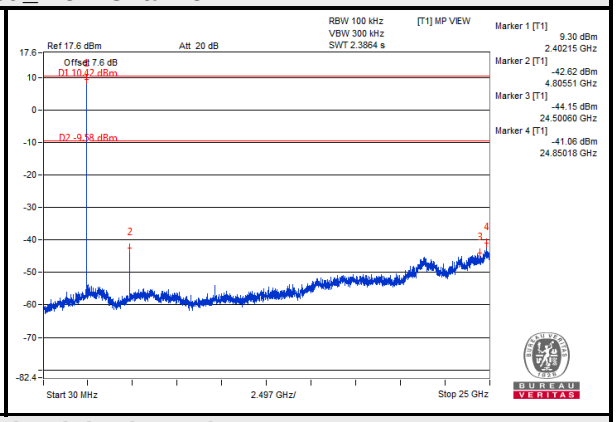
4.8.6 Test Results

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

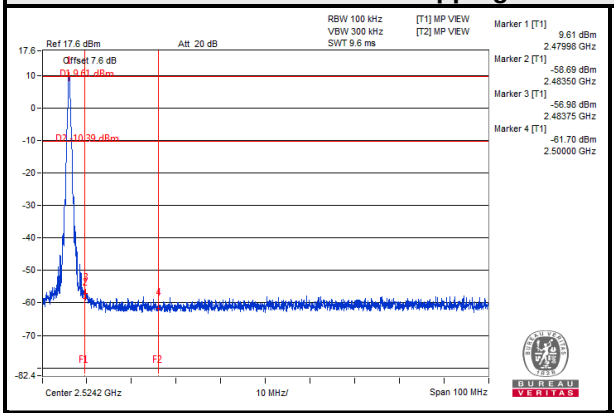
GFSK

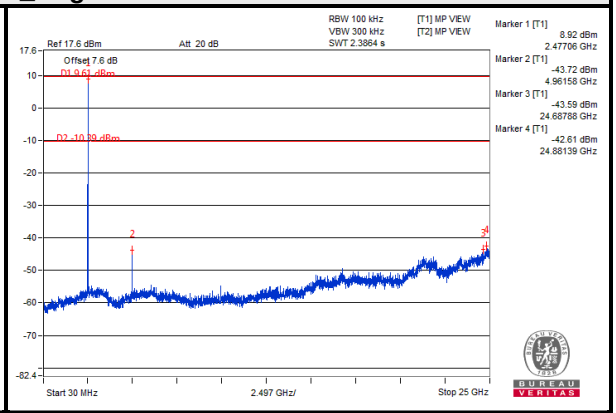
Hopping disabled_ Low Channel



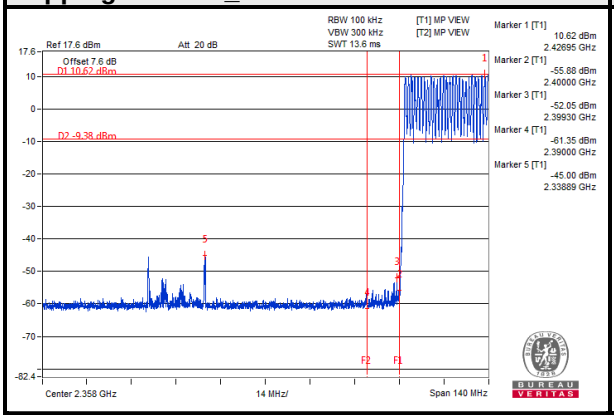


Hopping disabled_ High Channel

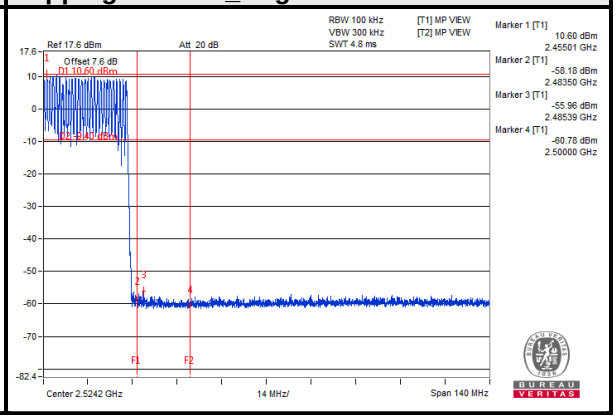




Hopping enabled_ Low Channel

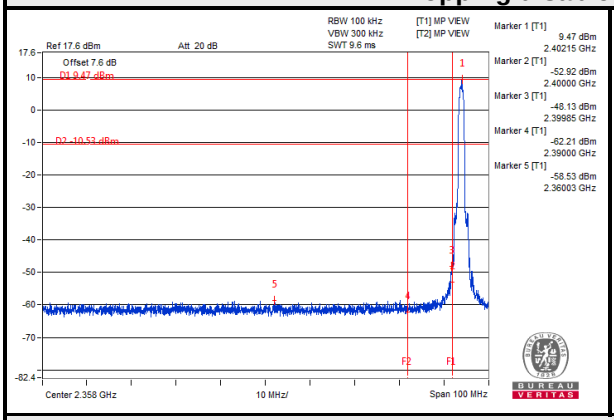


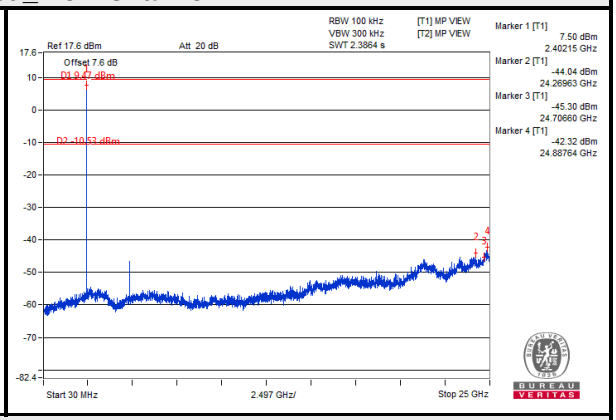
Hopping enabled_ High Channel



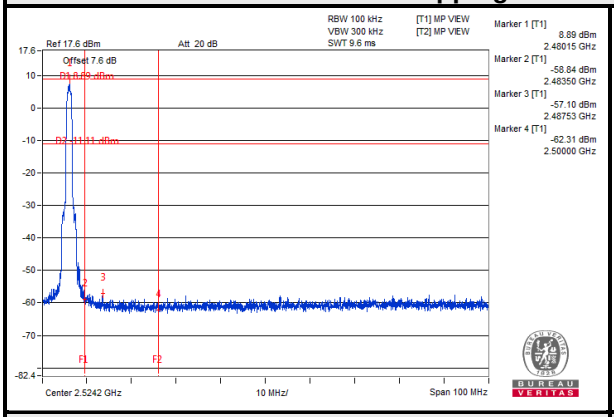
8DPSK

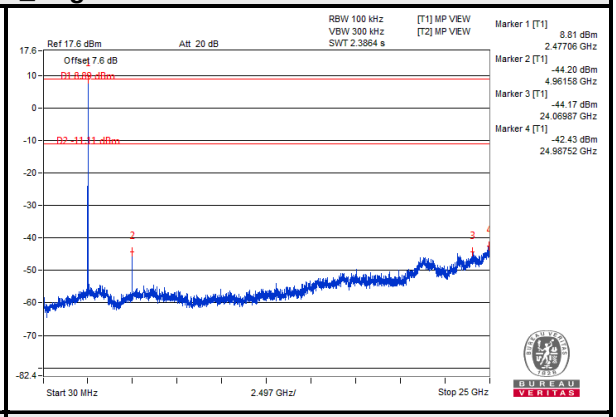
Hopping disabled_ Low Channel



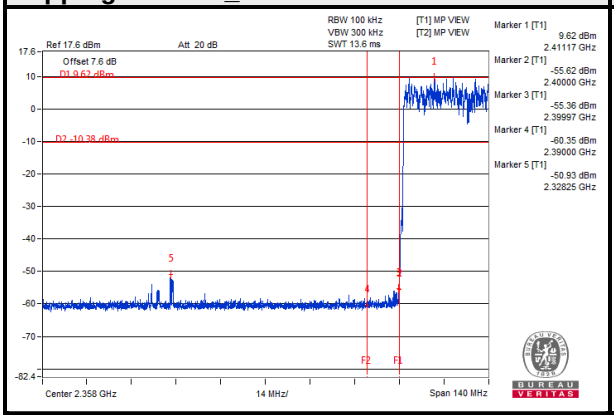


Hopping disabled_ High Channel

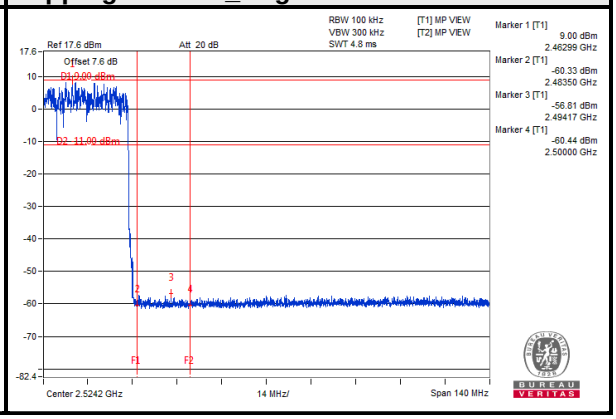




Hopping enabled_ Low Channel



Hopping enabled_ High Channel



5 Test Types and Results(For BT LE 4.0)

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 20dB below the highest level of the desired power:

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

NOTE:

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

5.1.2 Test Instruments

Same as section 4.1.2.

5.1.3 Test Procedures

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:

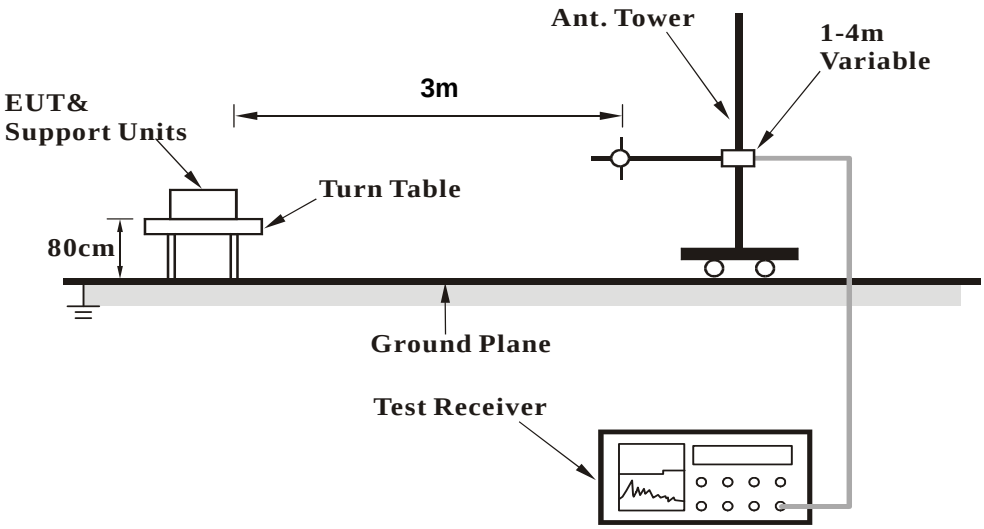
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (Duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (10 log(1/duty cycle)).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

5.1.4 Deviation from Test Standard

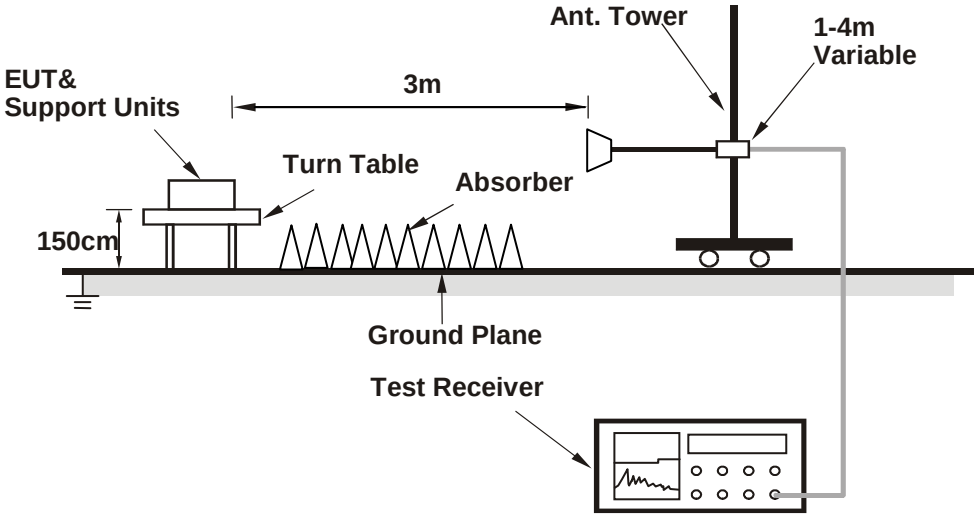
No deviation.

5.1.5 Test Set Up

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



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

5.1.6 EUT Operating Conditions

a. Placed the EUT on the testing table.

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

5.1.7 Test Results

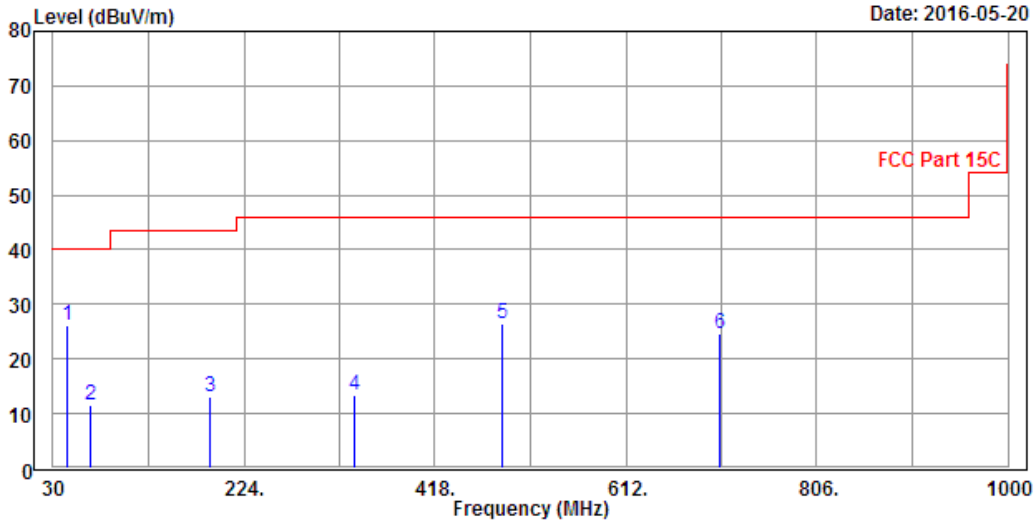
BELOW 1GHz WORST-CASE DATA:

CHANNEL	TX Channel 0	**DETECTOR FUNCTION**	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
Freq. (MHz)	**Emission level (dBuV/m)**	**Read Level (dBuV)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Factor (dB/m)**	**Cable Loss (dB)**	**Antenna Height (cm)**	**Table Angle (degree)**	**Remark**
43.58	26.21	52.49	40.00	-13.79	8.88	-35.16	200	126	QP
67.83	11.56	39.57	40.00	-28.44	6.79	-34.80	200	305	QP
190.05	13.17	37.09	43.50	-30.33	10.00	-33.92	200	168	QP
336.52	13.53	32.40	46.00	-32.47	14.53	-33.40	200	124	QP
486.87	26.55	41.53	46.00	-19.45	18.24	-33.22	200	78	QP
708.03	24.53	34.23	46.00	-21.47	23.09	-32.79	200	172	QP

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

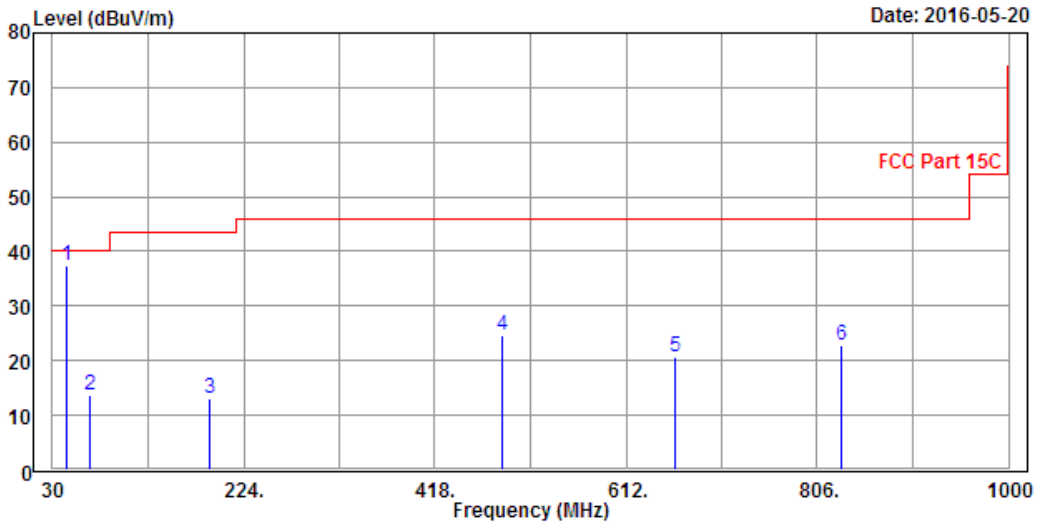


CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M									
Freq. (MHz)	Emission level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Antenna Height (cm)	Table Angle (degree)	Remark
43.58	37.49	63.77	40.00	-2.51	8.88	-35.16	101	78	QP
67.83	13.73	41.74	40.00	-26.27	6.79	-34.80	101	125	QP
190.05	13.09	37.01	43.50	-30.41	10.00	-33.92	101	202	QP
486.87	24.73	39.71	46.00	-21.27	18.24	-33.22	101	248	QP
662.44	20.65	31.47	46.00	-25.35	22.05	-32.87	101	333	QP
831.22	22.90	32.59	46.00	-23.10	23.00	-32.69	101	192	QP

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



ABOVE 1GHz WORST-CASE DATA:

BT_LE

CHANNEL	TX Channel 0	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
FREQ. (MHz)	**EMISSION LEVEL (dBuV/m)**	**READ LEVEL (dBuV)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA HEIGHT (cm)**	**TABLE ANGLE (Degree)**	**CORRECTION FACTOR (dB/m)**	**REMARK**
2390	33.70	41.57	-20.30	54.00	100	300	-7.87	Average
2390	42.87	50.74	-31.13	74.00	100	300	-7.87	Peak
2402	92.23	100.07			100	300	-7.84	Average
2402	97.58	105.42			100	300	-7.84	Peak
4804	46.59	48.63	-7.41	54.00	100	278	-2.04	Average
4804	53.03	55.07	-20.97	74.00	100	278	-2.04	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
FREQ. (MHz)	**EMISSION LEVEL (dBuV/m)**	**READ LEVEL (dBuV)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA HEIGHT (cm)**	**TABLE ANGLE (Degree)**	**CORRECTION FACTOR (dB/m)**	**REMARK**
2390	33.62	41.49	-20.38	54.00	100	180	-7.87	Average
2390	43.31	51.18	-30.69	74.00	100	180	-7.87	Peak
2402	86.42	94.26			100	180	-7.84	Average
2402	93.49	101.33			100	180	-7.84	Peak
4804	42.22	44.26	-11.78	54.00	100	125	-2.04	Average
4804	51.62	53.66	-22.38	74.00	100	125	-2.04	Peak

REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
   Margin value = Emission level – Limit value.
2. 2402MHz: Fundamental frequency.

CHANNEL	TX Channel 19	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	CORRECTION FACTOR (dB/m)	REMARK
2440	88.94	96.67			100	182	-7.73	Average
2440	94.31	102.04			100	182	-7.73	Peak
4880	43.96	45.74	-10.04	54.00	100	152	-1.78	Average
4880	52.85	54.63	-21.15	74.00	100	152	-1.78	Peak
7320	44.37	41.61	-9.63	54.00	100	268	2.76	Average
7320	53.97	51.21	-20.03	74.00	100	268	2.76	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	CORRECTION FACTOR (dB/m)	REMARK
2440	93.31	101.04			100	298	-7.73	Average
2440	99.91	107.64			100	298	-7.73	Peak
4880	36.26	38.04	-17.74	54.00	100	224	-1.78	Average
4880	49.54	51.32	-24.46	74.00	100	224	-1.78	Peak
7320	44.32	41.56	-9.68	54.00	100	124	2.76	Average
7320	55.91	53.15	-18.09	74.00	100	124	2.76	Peak

REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
   Margin value = Emission level – Limit value.
2. 2440MHz: Fundamental frequency.

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	CORRECTION FACTOR (dB/m)	REMARK
2480	87.27	94.88			100	200	-7.61	Average
2480	93.57	101.18			100	200	-7.61	Peak
2483.5	33.95	41.55	-20.05	54.00	100	200	-7.60	Average
2483.5	44.02	51.62	-29.98	74.00	100	200	-7.60	Peak
4880	41.65	43.43	-12.35	54.00	100	65	-1.52	Average
4880	51.63	53.41	-22.37	74.00	100	65	-1.52	Peak
7440	44.00	41.04	-10.00	54.00	100	278	2.96	Average
7440	55.53	52.57	-18.47	74.00	100	278	2.96	Peak
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	CORRECTION FACTOR (dB/m)	REMARK
2480	91.74	99.35			100	286	-7.61	Average
2480	97.14	104.75			100	286	-7.61	Peak
2483.5	34.42	42.02	-19.58	54.00	100	286	-7.60	Average
2483.5	46.06	53.66	-27.94	74.00	100	286	-7.60	Peak
4960	42.86	44.38	-11.14	54.00	100	98	-1.52	Average
4960	51.75	53.27	-22.25	74.00	100	98	-1.52	Peak
7440	43.98	41.02	-10.02	54.00	100	202	2.96	Average
7440	55.72	52.76	-18.28	74.00	100	202	2.96	Peak

REMARKS:

1. Emission Level = Read Level+ Antenna Factor + Cable Loss- Preamp Factor
   Margin value = Emission level – Limit value.
2. 2480MHz: Fundamental frequency.

5.2 Conducted Emission Measurement

5.2.1 Limits of Conducted Emission Measurement

Same as section 4.2.1.

5.2.2 Test Instruments

Same as section 4.2.2.

5.2.3 Test Procedures

Same as section 4.2.3.

5.2.4 Deviation from Test Standard

No deviation.

5.2.5 TEST SETUP

Same as section 4.2.5.

5.2.6 EUT Operating Conditions

Same as section 4.2.6.

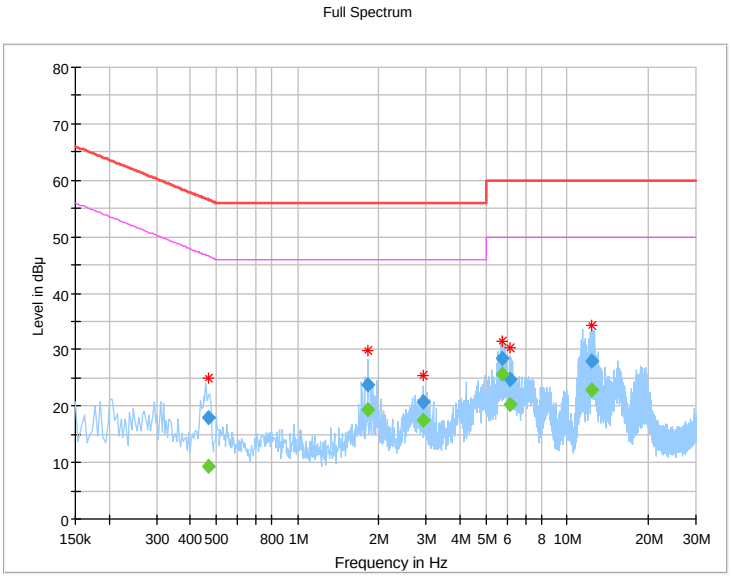
5.2.7 Test Results

CONDUCTED WORST-CASE DATA

TEST VOLTAGE	DC 5V From Adapter Input 230 Vac, 50 Hz	**6dB BANDWIDTH**	9 kHz
ENVIRONMENTAL CONDITIONS	24deg. C, 55RH	**TESTED BY**	Eric

Frequency (MHz)	QuasiPeak (dB¦ìV)	CAverage (dB¦ìV)	Limit (dB¦ìV)	Margin (dB)	Line	Filter	Corr. (dB)
0.468000	---	9.40	46.55	37.15	L	ON	9.7
0.468000	17.99	---	56.55	38.56	L	ON	9.7
1.820000	---	19.38	46.00	26.62	L	ON	9.7
1.820000	23.71	---	56.00	32.29	L	ON	9.7
2.924000	---	17.44	46.00	28.56	L	ON	9.7
2.924000	20.76	---	56.00	35.24	L	ON	9.7
5.772000	---	25.74	50.00	24.26	L	ON	9.8
5.772000	28.41	---	60.00	31.59	L	ON	9.8
6.152000	---	20.38	50.00	29.62	L	ON	9.8
6.152000	24.83	---	60.00	35.17	L	ON	9.8
12.376000	---	22.94	50.00	27.06	L	ON	9.9
12.376000	28.09	---	60.00	31.91	L	ON	9.9

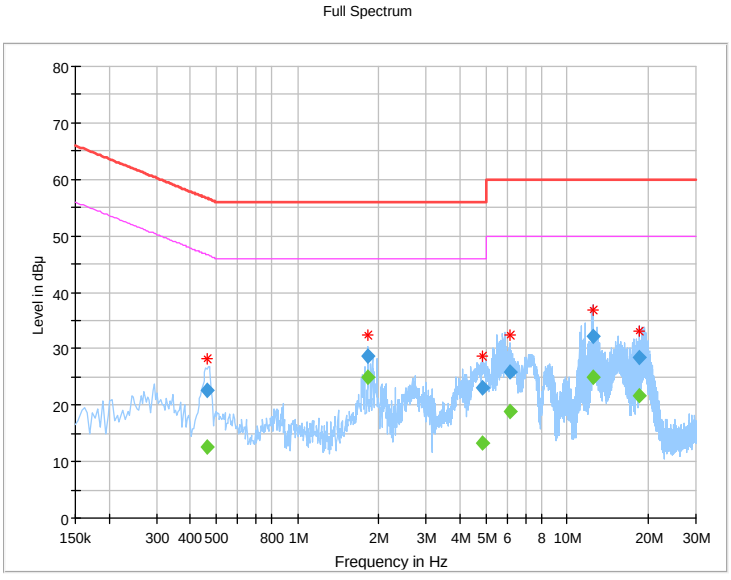
REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.



TEST VOLTAGE	DC 5V From Adapter Input 230 Vac, 50 Hz	**6dB BANDWIDTH**	9 kHz
ENVIRONMENTAL CONDITIONS	24deg. C, 55RH	**TESTED BY**	Eric

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.464000	---	12.53	46.62	34.09	N	ON	10.1
0.464000	22.69	---	56.62	33.93	N	ON	10.1
1.820000	**---**	**25.02**	**46.00**	**20.98**	**N**	**ON**	**9.8**
1.820000	28.75	---	56.00	27.25	N	ON	9.8
4.860000	---	13.38	46.00	32.62	N	ON	9.8
4.860000	23.00	---	56.00	33.00	N	ON	9.8
6.148000	---	18.91	50.00	31.09	N	ON	9.8
6.148000	25.82	---	60.00	34.18	N	ON	9.8
12.444000	---	24.99	50.00	25.01	N	ON	9.9
12.444000	32.22	---	60.00	27.78	N	ON	9.9
18.512000	---	21.78	50.00	28.22	N	ON	10.0
18.512000	28.37	---	60.00	31.63	N	ON	10.0

REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.

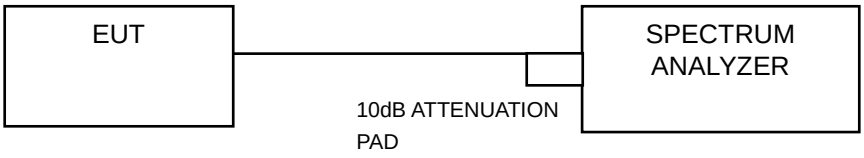


5.3 6dB Bandwidth Measurement

5.3.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

5.3.2 Test Setup



5.3.3 Test Instruments

Refer to section 4.3.3 to get information of above instrument.

5.3.4 Test Procedure

a. Set resolution bandwidth (RBW) = 100kHz
b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = Peak.
c. Trace mode = max hold.
d. Sweep = auto couple.
e. 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

5.3.5 Deviation fromTest Standard

No deviation.

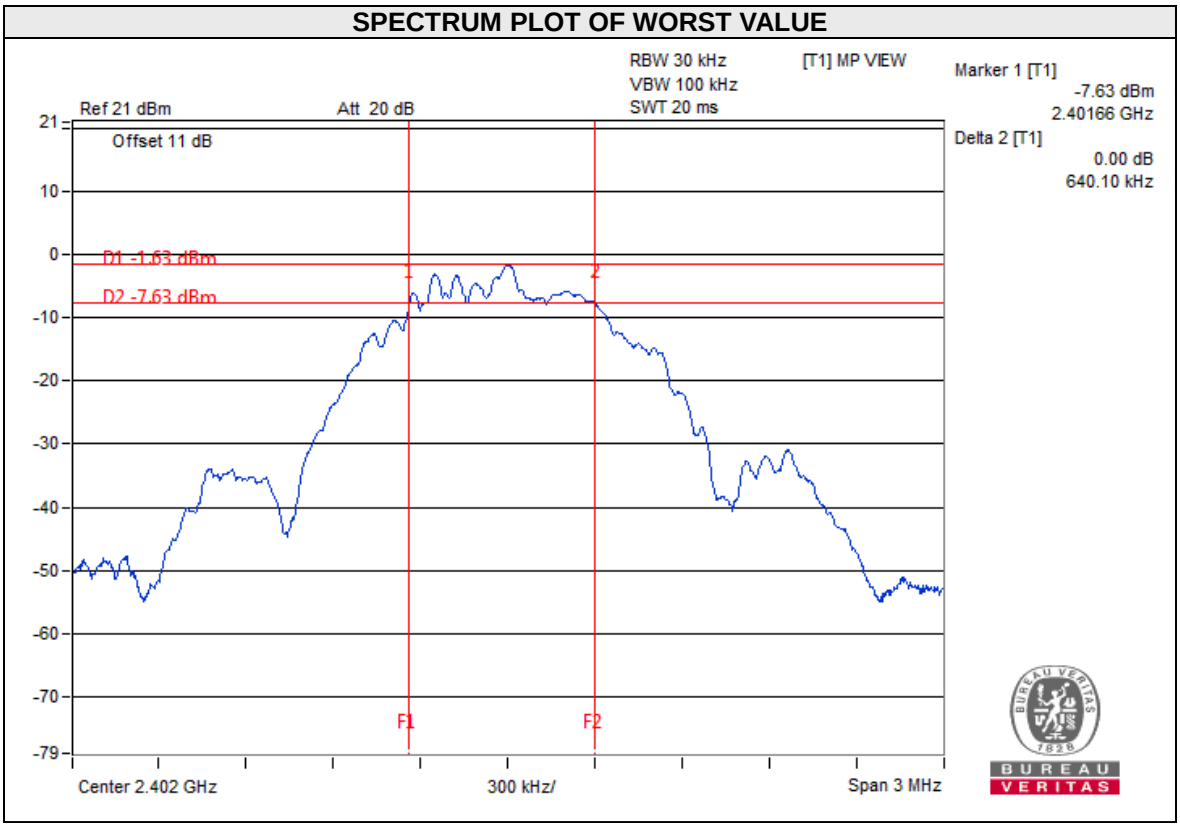
5.3.6 EUT Operating Conditions

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

5.3.7 Test Result

CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
0	2402	0.64	0.5	PASS
19	2440	0.64	0.5	PASS
39	2480	0.64	0.5	PASS

SPECTRUM PLOT OF WORST VALUE

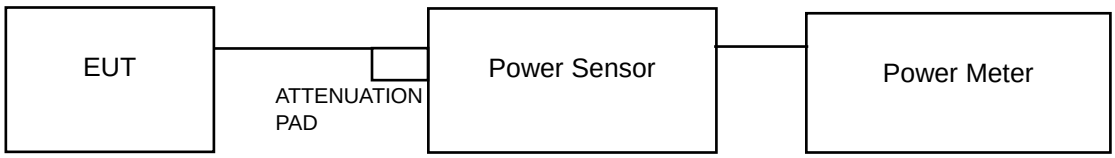


5.4 Conducted Output Power Measurement

5.4.1 Limits OF Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

5.4.2 Test Setup



5.4.3 Test Instruments

Refer to section 4.3.3 to get information of above instrument.

5.4.4 Test Procedures

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

5.4.5 Deviation from Test Standard

No deviation.

5.4.6 EUT Operating Conditions

Same as Item 4.3.6.

5.4.7 Test Results

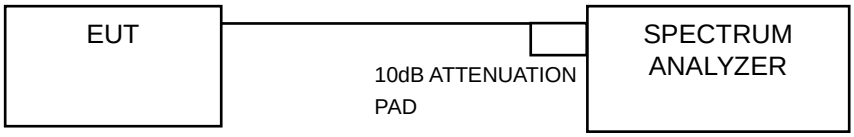
CHANNEL	FREQUENCY (MHz)	PEAK POWER (mW)	PEAK POWER (dBm)	LIMIT (dBm)	PASS/FAIL
0	2402	1.486	1.72	30	PASS
19	2440	**1.726**	2.37	30	PASS
39	2480	1.227	0.89	30	PASS

5.5 Power Spectral Density Measurement

5.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm.

5.5.2 Test Setup



5.5.3 Test Instruments

Refer to section 4.3.3 to get information of above instrument.

5.5.4 Test Procedure

a. Set analyzer center frequency to DTS channel center frequency.
b. Set the span to 1.5 times the DTS bandwidth.
c. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d. Set the VBW ≥ 3 × RBW.
e. Detector = peak.
f. Sweep time = auto couple.
g. Trace mode = max hold.
h. Allow trace to fully stabilize.
i. Use the peak marker function to determine the maximum amplitude level within the RBW.

5.5.5 Deviation from Test Standard

No deviation.

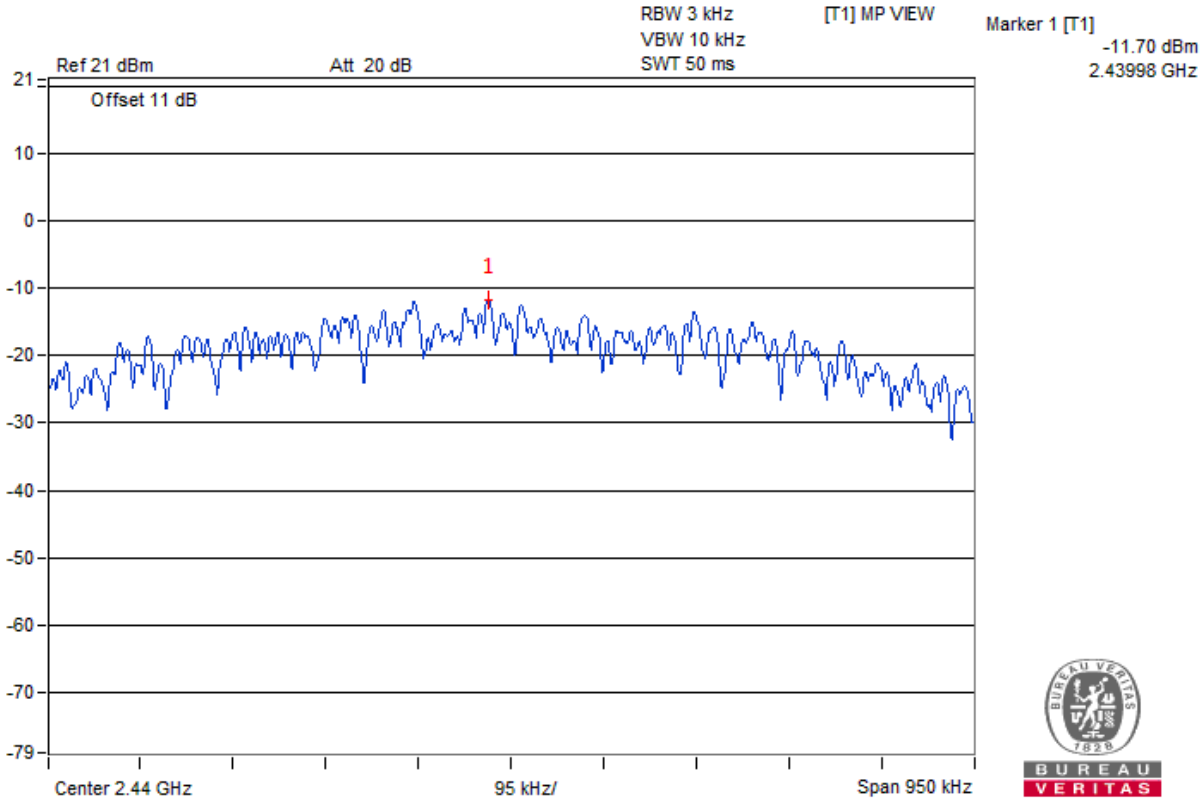
5.5.6 EUT Operating Condition

Same as Item 4.3.6

5.5.7 Test Results

Channel	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	2402	-12.43	8	PASS
19	2440	-11.70	8	PASS
39	2480	-13.12	8	PASS

SPECTRUM PLOT OF WORST VALUE

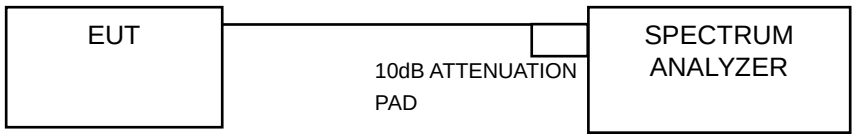


5.6 Conducted Out of Band Emission Measurement

5.6.1 Limits of Conducted Out of Band Emission Measurement

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

5.6.2 Test Setup



5.6.3 Test Instruments

Refer to section 4.3.3 to get information of above instrument.

5.6.4 Test Procedure

MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW ≥ 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOBE

1. Set RBW = 100 kHz.
2. Set VBW ≥ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

5.6.5 Deviation from Test Standard

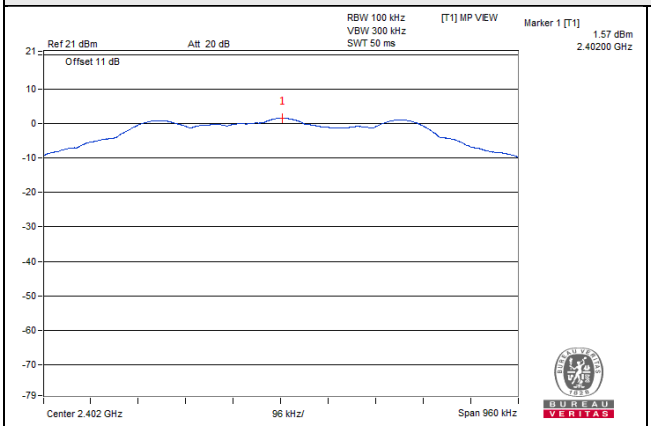
No deviation.

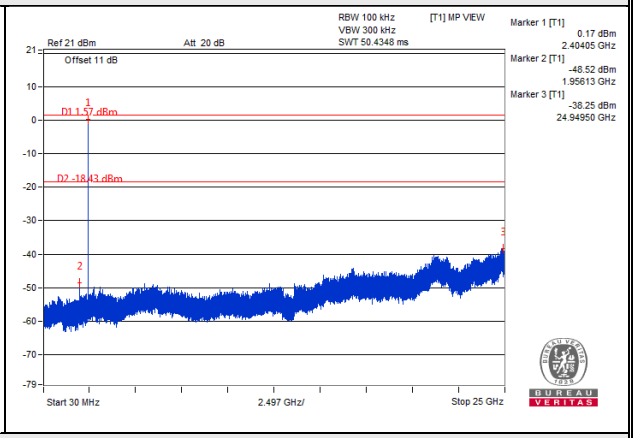
5.6.6 EUT Operating Condition

Same as Item 4.3.6

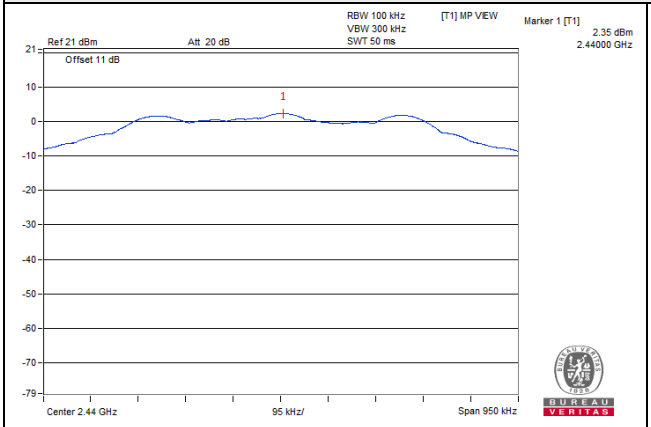
5.6.7 TEST RESULTS

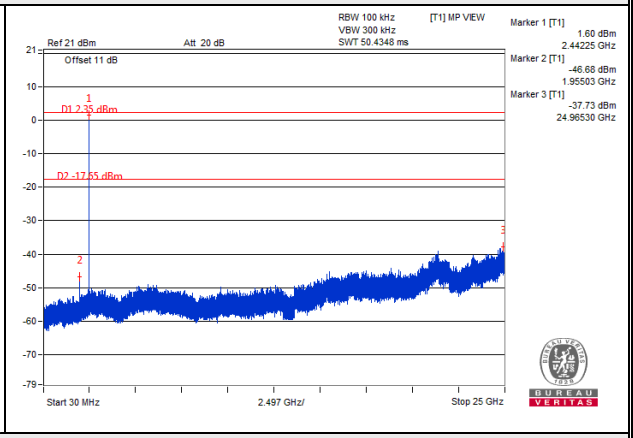
CH 0



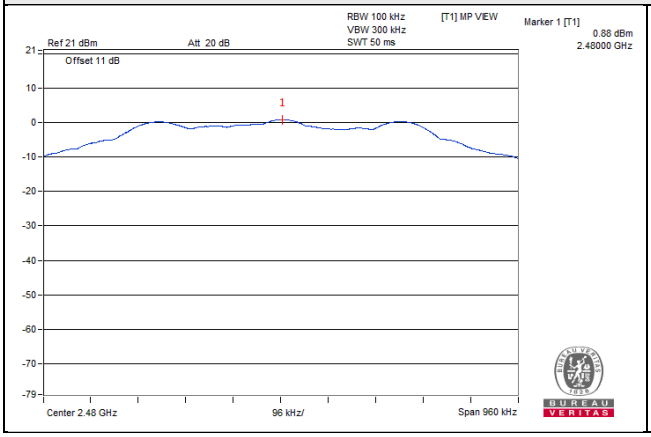


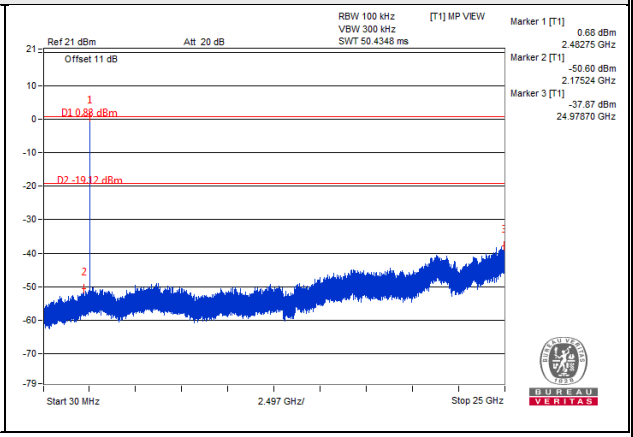
CH 19





CH 39





6 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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Fax: 886-2-26051924

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

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