

FCC IC Test Report (BT-LE)

Report No.: FCC_IC_RF_SL19102501-XIR-017

FCC ID: GKM-XT3182D

IC: 10281A-XT3182D

Test Model: XT3182D

Received Date: 12/2/2019

Test Date: 12/5/2019 and 12/18/2019

Issued Date: 12/19/2019

Applicant: Xirgo Technologies, LLC

Address: 188 Camino Ruiz, Camarillo CA 93012

Manufacturer: Xirgo Technologies, LLC

Address: 188 Camino Ruiz, Camarillo CA 93012

Issued By: Bureau Veritas Consumer Products Services, Inc.

Lab Address: 775 Montague Expressway, Milpitas, CA 95035

Test Location (1): 775 Montague Expressway, Milpitas, CA 95035

**FCC Registration /
Designation Number:** 540430

ISED# / CAB identifier: 4842D



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Table of Contents

Release Control Record	4
1 Certificate of Conformity	5
2 Summary of Test Results	6
2.1 Measurement Uncertainty	6
2.2 Modification Record	6
3 General Information	7
3.1 General Description of EUT	7
3.2 Description of Test Modes	8
3.2.1 Test Mode Applicability and Tested Channel Detail	9
3.3 Description of Support Units	10
3.3.1 Configuration of System under Test	10
3.4 General Description of Applied Standards	10
4 Test Types and Results	11
4.1 Radiated Emission and Bandedge Measurement	11
4.1.1 Limits of Radiated Emission and Bandedge Measurement	11
4.1.2 Test Instruments	12
4.1.3 Test Procedures	13
4.1.4 Deviation from Test Standard	14
4.1.5 Test Setup	14
4.1.6 EUT Operating Conditions	15
4.1.7 Test Results	16
4.2 Conducted Emission Measurement	25
4.2.1 Limits of Conducted Emission Measurement	25
4.2.2 Test Instruments	25
4.2.3 Test Procedures	26
4.2.4 Deviation from Test Standard	26
4.2.5 Test Setup	26
4.2.6 EUT Operating Conditions	26
4.3 6dB Bandwidth & 99% Bandwidth Measurement	27
4.3.1 Limits of 6dB Bandwidth Measurement	27
4.3.2 Test Setup	27
4.3.3 Test Instruments	27
4.3.4 Test Procedure	27
4.3.5 Deviation from Test Standard	27
4.3.6 EUT Operating Conditions	27
4.3.7 Test Result	28
4.4 Conducted Output Power Measurement	30
4.4.1 Limits of Conducted Output Power Measurement	30
4.4.2 Test Setup	30
4.4.3 Test Instruments	30
4.4.4 Test Procedures	30
4.4.5 Deviation from Test Standard	30
4.4.6 EUT Operating Conditions	30
4.4.7 Test Results	31
4.5 Power Spectral Density Measurement	33
4.5.1 Limits of Power Spectral Density Measurement	33
4.5.2 Test Setup	33
4.5.3 Test Instruments	33
4.5.4 Test Procedure	33
4.5.5 Deviation from Test Standard	33
4.5.6 EUT Operating Condition	33
4.5.7 Test Results	34

4.6	Conducted Out of Band Emission Measurement.....	36
4.6.1	Limits of Conducted Out of Band Emission Measurement	36
4.6.2	Test Setup.....	36
4.6.3	Test Instruments	36
4.6.4	Test Procedure	36
4.6.5	Deviation from Test Standard	36
4.6.6	EUT Operating Condition	36
4.6.7	Test Results	37
5	Pictures of Test Arrangements.....	38
	Appendix – Information on the Testing Laboratories	39

Release Control Record

Issue No.	Description	Date Issued
FCC_IC_RF_SL19102501-XIR-017	Original Release	12/19/2019

1 Certificate of Conformity

Product: Smart Trailer Platform with Integrated Cargo Sensor

Brand: Xirgo Technologies, LLC

Test Model: XT3182D

Sample Status: Engineering sample

Applicant: Xirgo Technologies, LLC

Test Date: 12/5/2019 - 12/18/2019

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)

RSS-247 Issue 2, February 2017

ANSI C63.10: 2013

RSS-Gen Issue 5, March 2019

558074 D01 15.247 Meas Guidance v05r02

The above equipment has been tested by **Bureau Veritas Consumer Products Services, Inc., Milpitas 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:** 12/19/2019
Deon Dai / Test Engineer


Approved by : _____, **Date:** 12/19/2019
Chen Ge / Engineer Reviewer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247) RSS 247 Issue2, RSS Gen Issue5			
FCC / IC Clause	Test Item	Result	Remarks
15.207 RSS Gen 8.8	AC Power Conducted Emission	N/A	The EUT is DC powered.
15.205 &15.209 & 15.247(d) RSS 247 5.5C	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit.
15.247(a)(2) RSS 247 5.2.1 RSS Gen 6.7	6dB bandwidth & 99% bandwidth	PASS	Meet the requirement of limit.
15.247(b) RSS 247 5.4.4	Conducted power	PASS	Meet the requirement of limit.
15.247(e) RSS 247 5.2.2	Power Spectral Density	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	Meet the requirements. 1. External Antenna – FAKRA I 2. SMD Antenna – permanently attached.

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) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	3.51dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	3.73dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	4.64dB
	6GHz ~ 18GHz	4.82dB
	18GHz ~ 40GHz	4.91dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Cargo Sensor
Brand	Xirgo Technologies, LLC
Test Model	XT3182D
Identification No. of EUT	53793268
Status of EUT	Engineering Sample
Power Supply Rating	12 V DC
Modulation Type	GFSK
Modulation Technology	DTS
Transfer Rate	Up to 1Mbps
Operating Frequency	2.402 ~ 2.480GHz
Number of Channel	40
Antenna 1 Type	External, 4dBi (see below additional antenna info)
Antenna 1 Connector	FAKRA I
Antenna 2 Type	SMD chip antenna, 1.5dBi
Antenna 2 Connector	N/A

External Antenna Description

The MA2010.A.LBCG.001 antenna is a 4-in-1, custom profile, fully IP67 waterproof external antenna for use on vehicles and containers for telematics, transportation and remote monitoring applications. The MA2010.A.LBCG.001 delivers best in class LTE, GNSS and WILAN antenna performance.

3.2 Description of Test Modes

40 channels are provided to this EUT:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (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

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

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.

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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0,19,39	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.

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

Antenna Port Conducted Measurement:

- ☒ 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.

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 $\geq$ 1G	25deg. C, 65%RH	120Vac, 60Hz	Deon Dai
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	Deon Dai
PLC	25deg. C, 68%RH	120Vac, 60Hz	Deon Dai
APCM	21deg. C, 60%RH	120Vac, 60Hz	Deon Dai

3.3 Description of Support Units

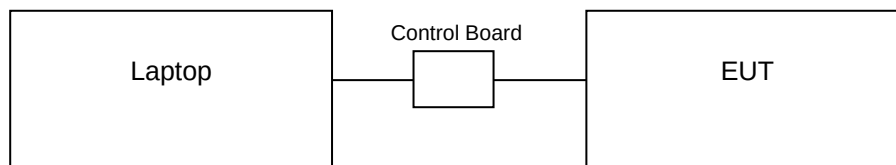
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	Acer	N17Q1	NXGNPAA0167300AA1C7600	DOC	Provided by lab
B.	Laptop Power Supply	LITEON	PA-1450-26	ADT KP045030107201F23FPE01	NA	Provided by lab

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	RS 232 Cable	1	1.82	No	0	Supplied by client
2.	USB Jumper Cable	1	1.52	No	0	Supplied by client
3.	External Antenna Cable	4	1.82	No	0	Supplied by client

Note: The core(s) is(are) originally attached to the cable(s).

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:

47 CFR FCC Part 15, Subpart C (Section 15.247)
RSS 247 Issue2, February 2017
ANSI C63.10: 2013
RSS Gen Issue5, March 2019
558074 D01 15.247 Meas Guidance v05r02

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

4 Test Types and Results

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

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
EMI Test Receiver ROHDE & SCHWARZ	ESIB 40	100179	08/28/2019	08/28/2020
Spectrum Analyzer KEYSIGHT	N9030B	MY57140374	07/22/2019	07/22/2020
Hybrid Antenna SUNAR	JB6	A111717	03/09/2019	03/09/2020
DRG Horn Antenna ETS LINDGREN	3117	214309	11/22/2019	11/22/2020
Preamplifier RF-LAMBDA	RAMP00M50GA	17032300047	09/19/2019	09/19/2020
Preamplifier RF-BAY	LPA-6-30	11170602	05/06/2019	05/06/2020

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. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

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

For Radiated emission above 30MHz

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

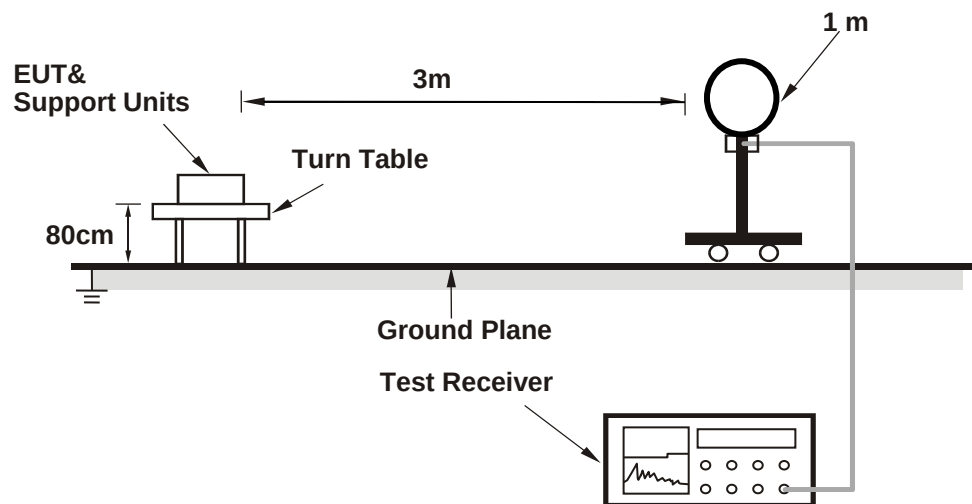
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

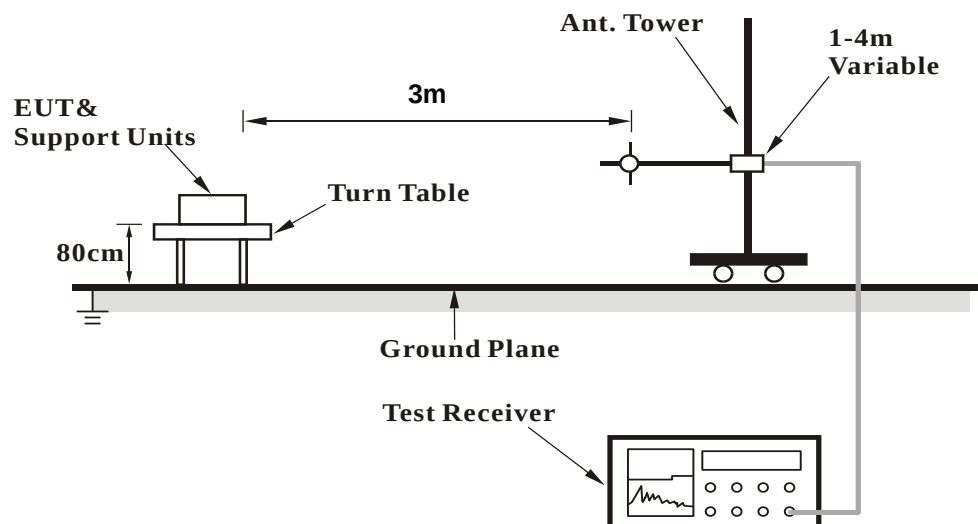
No deviation.

4.1.5 Test Setup

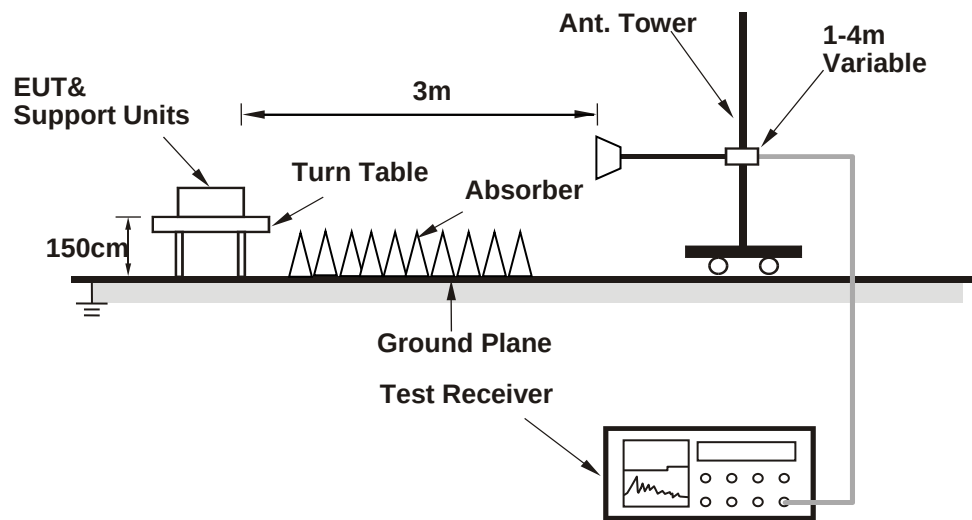
For Radiated emission below 30MHz



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 Notebook Computer which is placed on remote site.
- Controlling software has been activated to set the EUT on specific status.

4.1.7 Test Results

BELOW 1GHz WORST-CASE DATA:

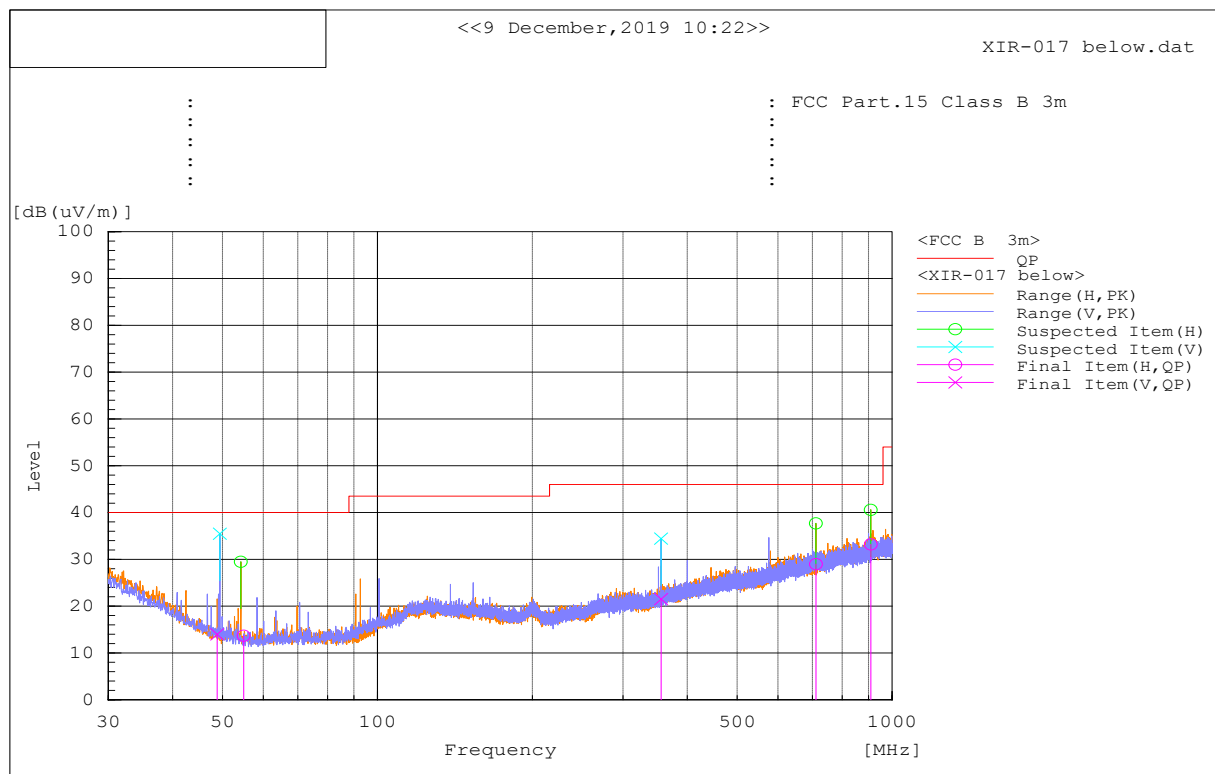
BT-LE (GFSK)

CHANNEL	TX Channel 19	DETECTOR FUNCTION	Quasi Peak
FREQUENCY RANGE	30MHz – 1GHz		

ANTENNA POLARITY & test distance: HORIZONTAL & VERTICAL at 3 m											
No	Freq. [MHz]	Raw (dBuV)	Factor (dB)	Level (dBuV/m)	Measurement Type	Pol	Hgt (cm)	Azt Deg	Limit (dBuV/m)	Margin (dB)	Pass /Fail
1	48.805	0	14	14	Quasi Max	V	132.3	357	40	-26	Pass
2	54.956	0.3	13.4	13.7	Quasi Max	H	347.7	319.2	40	-26.3	Pass
3	355.805	0.1	21.4	21.5	Quasi Max	V	307.5	6.6	40	-24.5	Pass
4	711.25	1.2	27.8	29	Quasi Max	H	400.2	199	40	-17	Pass
5	909.152	1.9	31.3	33.2	Quasi Max	H	375.7	167.4	43.5	-12.8	Pass

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss (dB) + AF (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.



ABOVE 1GHz TEST DATA External antenna:

BT-LE (GFSK)

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak
FREQUENCY RANGE	1GHz ~ 25GHz		Average
REMARK	External Antenna		

ANTENNA POLARITY & test distance: HORIZONTAL& VERTICAL at 3 m

Frequency [MHz]	P ol	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/ m)]	Level AV [dB(uV/ m)]	Level PK [dB(uV/ m)]	Limit\AV [dB(uV/ m)]	Limit\PK [dB(uV/ m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [deg]
1414.71	H	40.1	53.7	-16	24.6	38.2	54	74	-29.4	-35.8	398	256
3546.82	H	35	48.3	-7.3	27.7	41	54	74	-26.3	-33	175	224
10904.3	H	21.6	34.7	11.2	32.8	45.9	54	74	-21.2	-28.1	107	351

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss (dB) + AF (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.

CHANNEL	TX Channel 19	DETECTOR FUNCTION	Peak Average
FREQUENCY RANGE	1GHz ~ 25GHz		
REMARK	External Antenna		

ANTENNA POLARITY & test distance: HORIZONTAL& VERTICAL at 3 m												
Frequency [MHz]	P ol	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/ m)]	Level AV [dB(uV/ m)]	Level PK [dB(uV/ m)]	Limit\AV [dB(uV/ m)]	Limit\PK [dB(uV/ m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [deg]
2504.81	H	38.8	52.3	-9.5	29.3	42.8	54	74	-24.7	-31.2	222	314
2825.39	V	37.7	50.6	-9.1	28.6	41.5	54	74	-25.4	-32.5	122	1.6
8193.27	V	25.2	39.9	6.6	31.8	46.5	54	74	-22.2	-27.5	186	237

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss (dB) + AF (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Peak Average
FREQUENCY RANGE	1GHz ~ 25GHz		
REMARK	External Antenna		

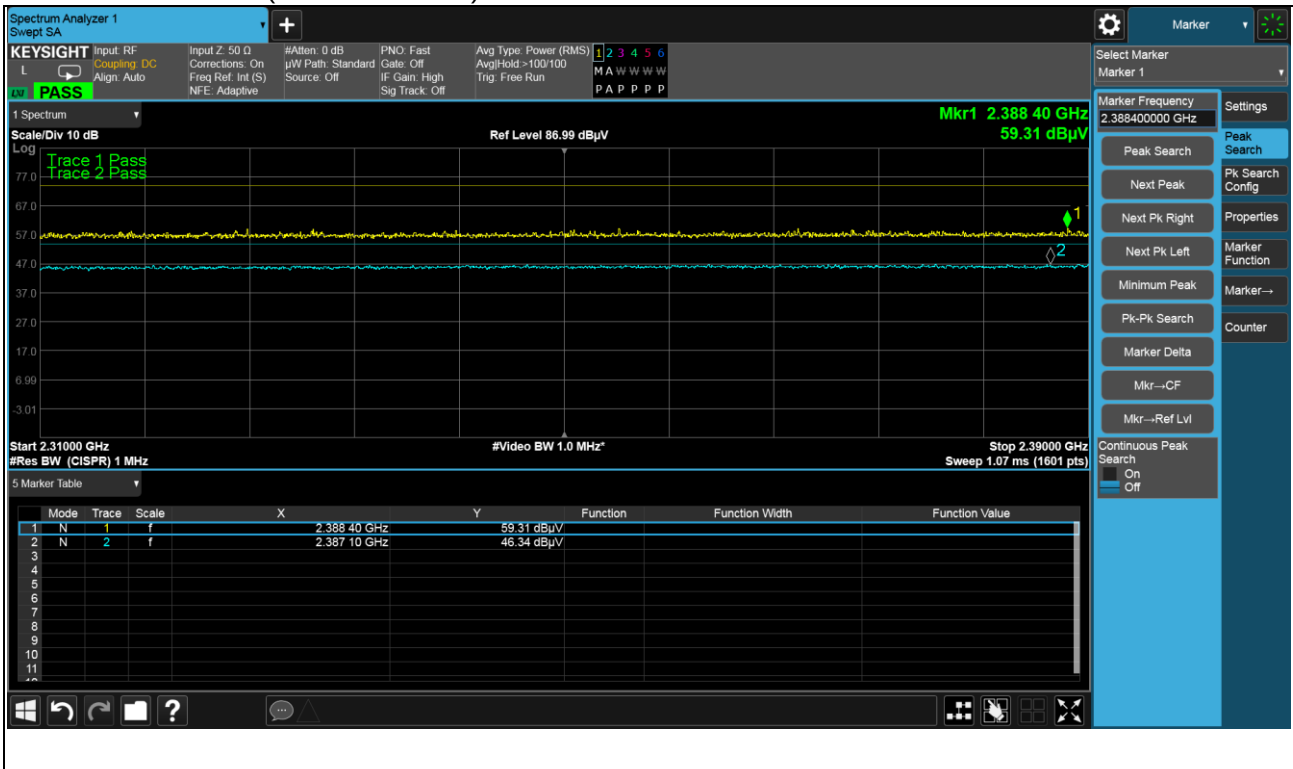
ANTENNA POLARITY & test distance: HORIZONTAL & VERTICAL at 3 m

Frequency [MHz]	P ol	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit\AV [dB(uV/m)]	Limit\PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [deg]
1230.70	H	41.1	54.3	-16	25.3	38.5	54	74	-28.7	-35.5	231	279
2620.99	V	38.3	51.2	-9.1	29.2	42.1	54	74	-24.8	-31.9	378	293
6907.20	V	27.3	40.2	4.7	32	44.9	54	74	-22	-29.1	163	10.6

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss (dB) + AF (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.

RESTRICTED BAND (LOW CHANNEL)



RESTRICTED BAND (HIGH CHANNEL)



ABOVE 1GHz TEST DATA Internal antenna:

BT-LE (GFSK)

CHANNEL	TX Channel 0	DETECTOR FUNCTION	Peak
FREQUENCY RANGE	1GHz ~ 25GHz		Average
REMARK	Internal Antenna		

ANTENNA POLARITY & test distance: HORIZONTAL& VERTICAL at 3 m

Frequency [MHz]	P ol	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/ m)]	Level AV [dB(uV/ m)]	Level PK [dB(uV/ m)]	Limit\AV [dB(uV/ m)]	Limit\PK [dB(uV/ m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [deg]
1297.101	V	40.7	53.9	-14.8	25.9	39.1	54	74	-28.1	-34.9	398	20
2010.68	H	38.8	52	-10.5	28.3	41.5	54	74	-25.7	-32.5	297	93
3197.438	H	35.4	48.8	-7.4	28	41.4	54	74	-26	-32.6	369	177

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss (dB) + AF (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.

CHANNEL	TX Channel 19	DETECTOR FUNCTION	Peak Average
FREQUENCY RANGE	1GHz ~ 25GHz		
REMARK	Internal Antenna		

ANTENNA POLARITY & test distance: HORIZONTAL& VERTICAL at 3 m

Frequency [MHz]	P ol	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/ m)]	Level AV [dB(uV/ m)]	Level PK [dB(uV/ m)]	Limit\AV [dB(uV/ m)]	Limit\PK [dB(uV/ m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [deg]
4969.923	V	32.6	45.6	-2.5	30.1	43.1	54	74	-23.9	-30.9	327.1	119
5178.231	H	30.8	43.8	-2.1	28.7	41.7	54	74	-25.3	-32.3	133.4	320
6478.025	V	29.2	42.4	1.7	30.9	44.1	54	74	-23.1	-29.9	214.5	342

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss (dB) + AF (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Peak Average
FREQUENCY RANGE	1GHz ~ 25GHz		
REMARK	External Antenna		

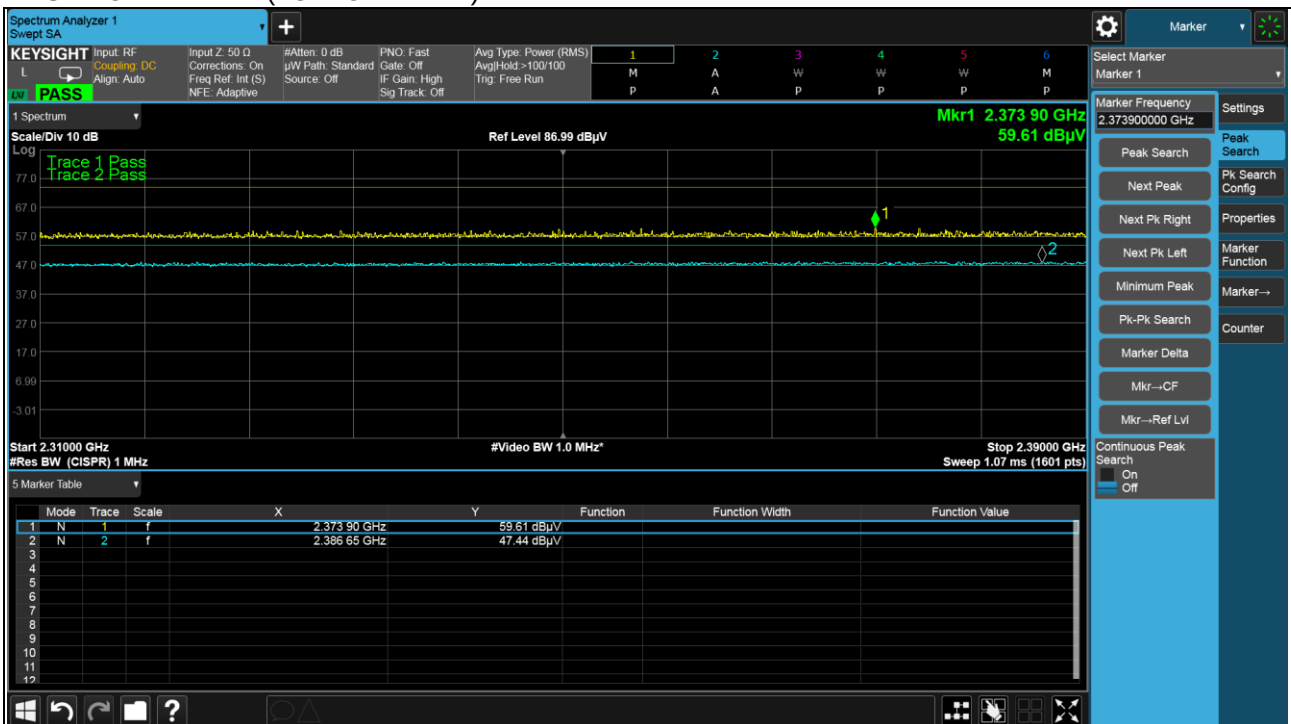
ANTENNA POLARITY & test distance: HORIZONTAL& VERTICAL at 3 m

Frequency [MHz]	P ol	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/ m)]	Level AV [dB(uV/ m)]	Level PK [dB(uV/ m)]	Limit\AV [dB(uV/ m)]	Limit\PK [dB(uV/ m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [deg]
9136.433	V	23.9	36.8	8.5	32.4	45.3	54	74	-21.6	-28.7	239.3	262
12139.43	V	21.7	34.9	11.6	33.3	46.5	54	74	-20.7	-27.5	100.3	318
14983.15	H	19.2	32.2	16	35.2	48.2	54	74	-18.8	-25.8	233.1	309

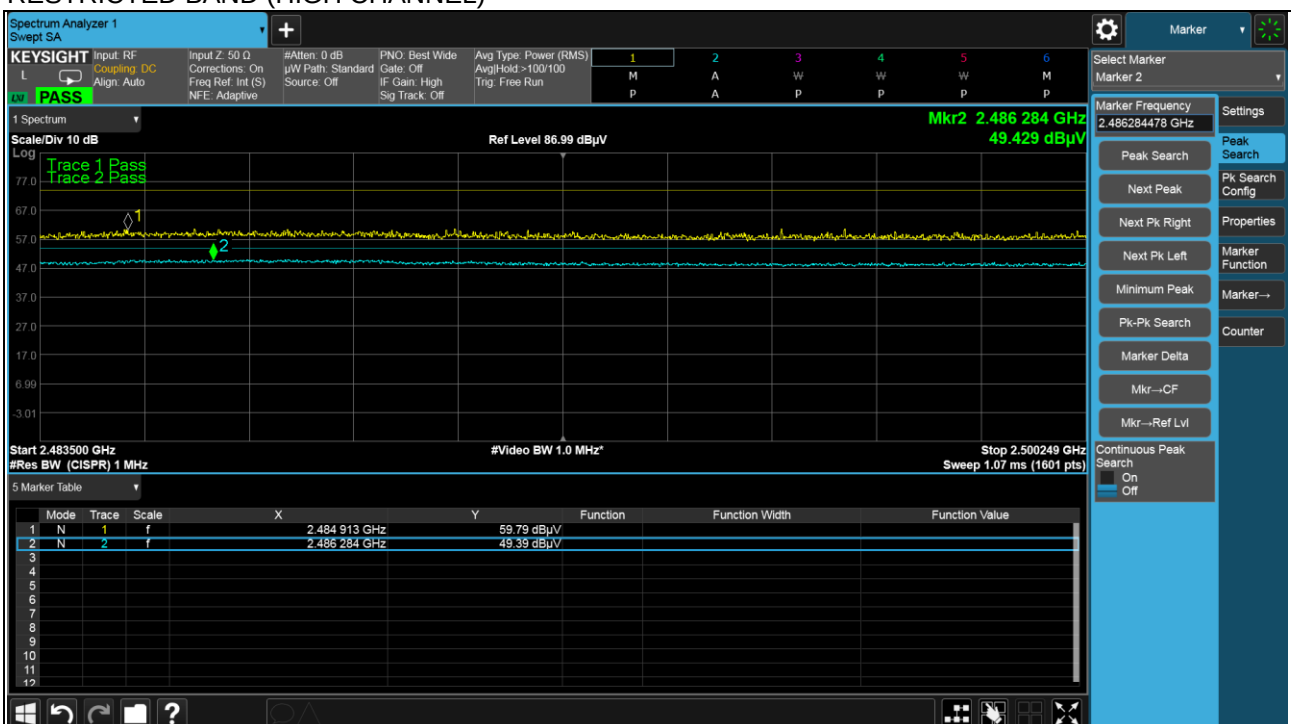
REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss (dB) + AF (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.

RESTRICTED BAND (LOW CHANNEL)



RESTRICTED BAND (HIGH CHANNEL)



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.	Date Of Calibration	Due Date Of Calibration
EMI Test Receiver ROHDE & SCHWARZ	ESIB 40	100179	08/28/2018	08/28/2020
Transient Limiter ELECTRO-METRICS	EM-7600-5	106	12/31/2018	12/31/2019
LISN EMCO	3816/2NM	214372	01/10/2019	01/10/2020

4.2.3 Test Procedures

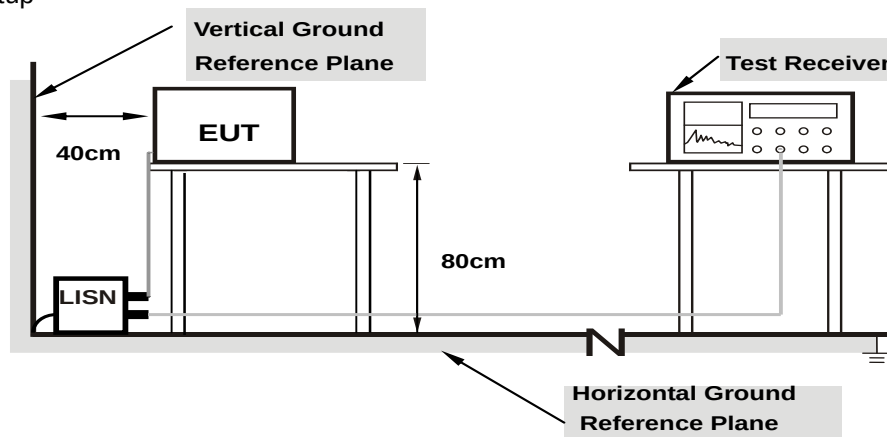
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

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

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



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

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

4.2.6 EUT Operating Conditions

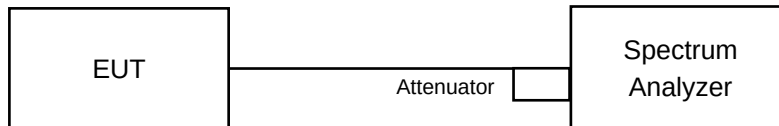
The EUT is DC powered.

4.3 6dB Bandwidth & 99% Bandwidth Measurement

4.3.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

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

- 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

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

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

4.3.7 Test Result

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
0	2402	0.687	1.04	0.5	PASS
19	2440	0.683	1.04	0.5	PASS
39	2480	0.681	1.04	0.5	PASS

Test Plots:



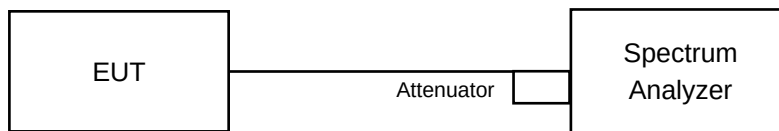


4.4 Conducted Output Power Measurement

4.4.1 Limits of Conducted Output Power Measurement

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

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

- a. Set the RBW $\geq$ DTS bandwidth.
- b. Set VBW $\geq 3 \times$ RBW.
- c. Set span $\geq 3 \times$ RBW
- d. Sweep time = auto couple.
- e. Detector = peak.
- f. Trace mode = max hold.
- g. Allow trace to fully stabilize.
- h. Use peak marker function to determine the peak amplitude level.

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Conditions

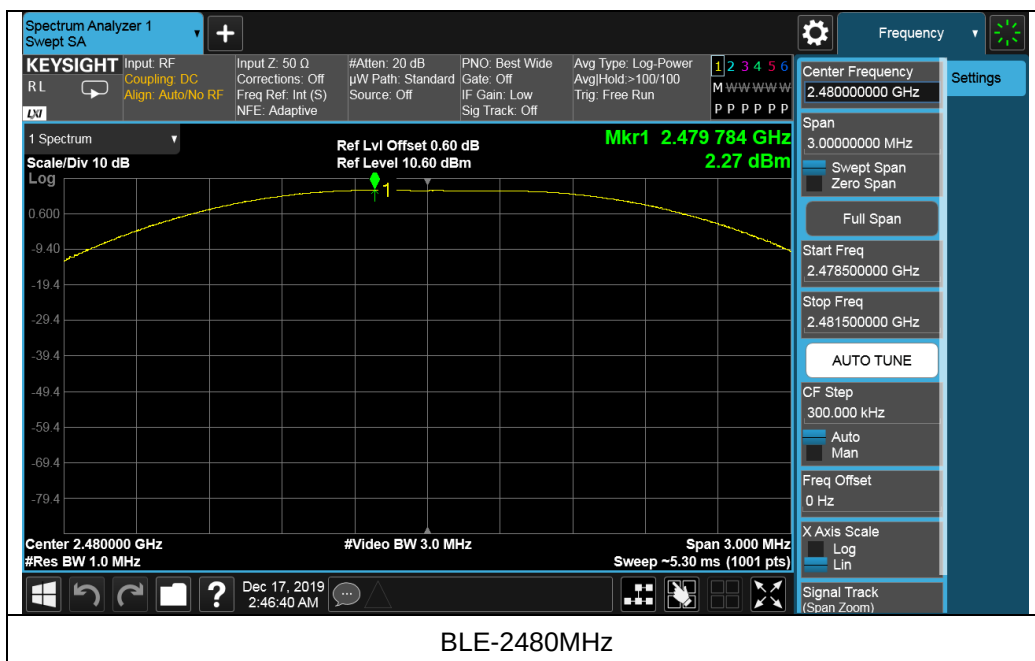
Same as Item 4.3.6.

4.4.7 Test Results

Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Pass/Fail
0	2402	3.46	30	Pass
19	2440	3.96	30	Pass
39	2480	2.27	30	Pass

Test Plots:



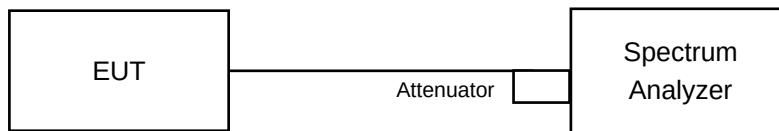


4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm in any 3 kHz.

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

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set the VBW $\geq 3 \times \text{RBW}$.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.

4.5.5 Deviation from Test Standard

No deviation.

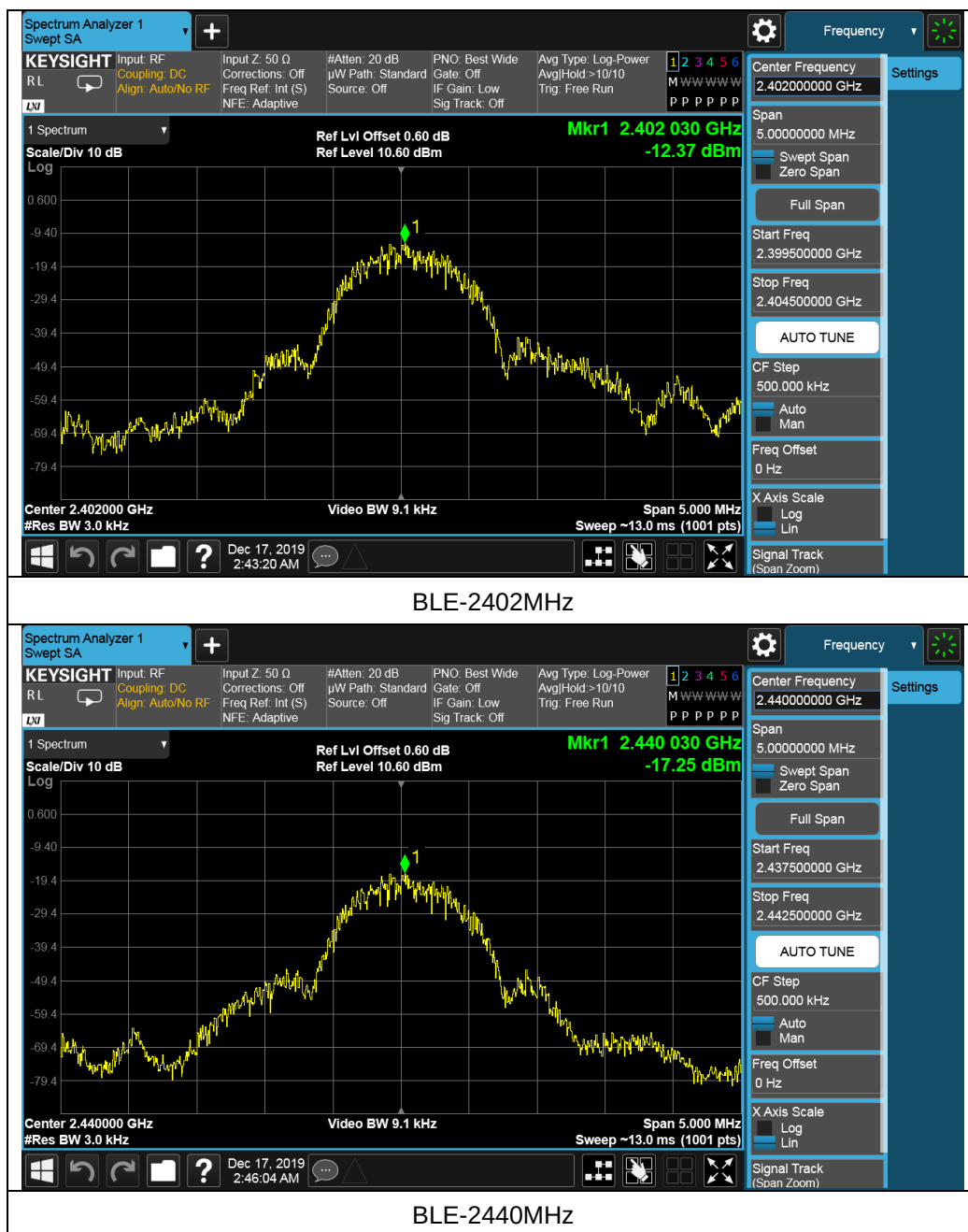
4.5.6 EUT Operating Condition

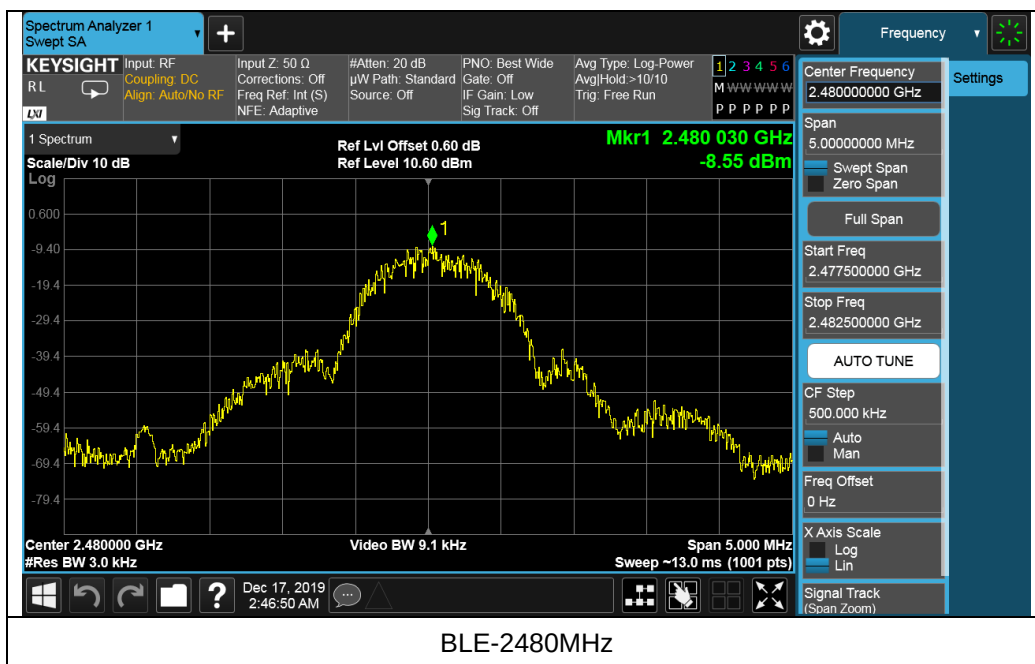
Same as Item 4.3.6

4.5.7 Test Results

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass/Fail
0	2402	-12.37	8	Pass
19	2440	-17.25	8	Pass
39	2480	-8.55	8	Pass

Test Plots:



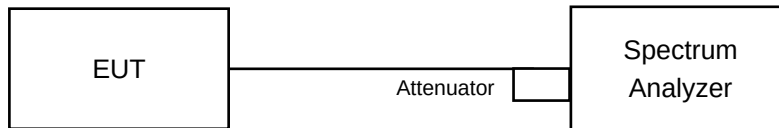


4.6 Conducted Out of Band Emission Measurement

4.6.1 Limits of Conducted Out of Band Emission Measurement

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

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

MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW $\geq$ 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 OOB

1. Set RBW = 100 kHz.
2. Set VBW $\geq$ 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.

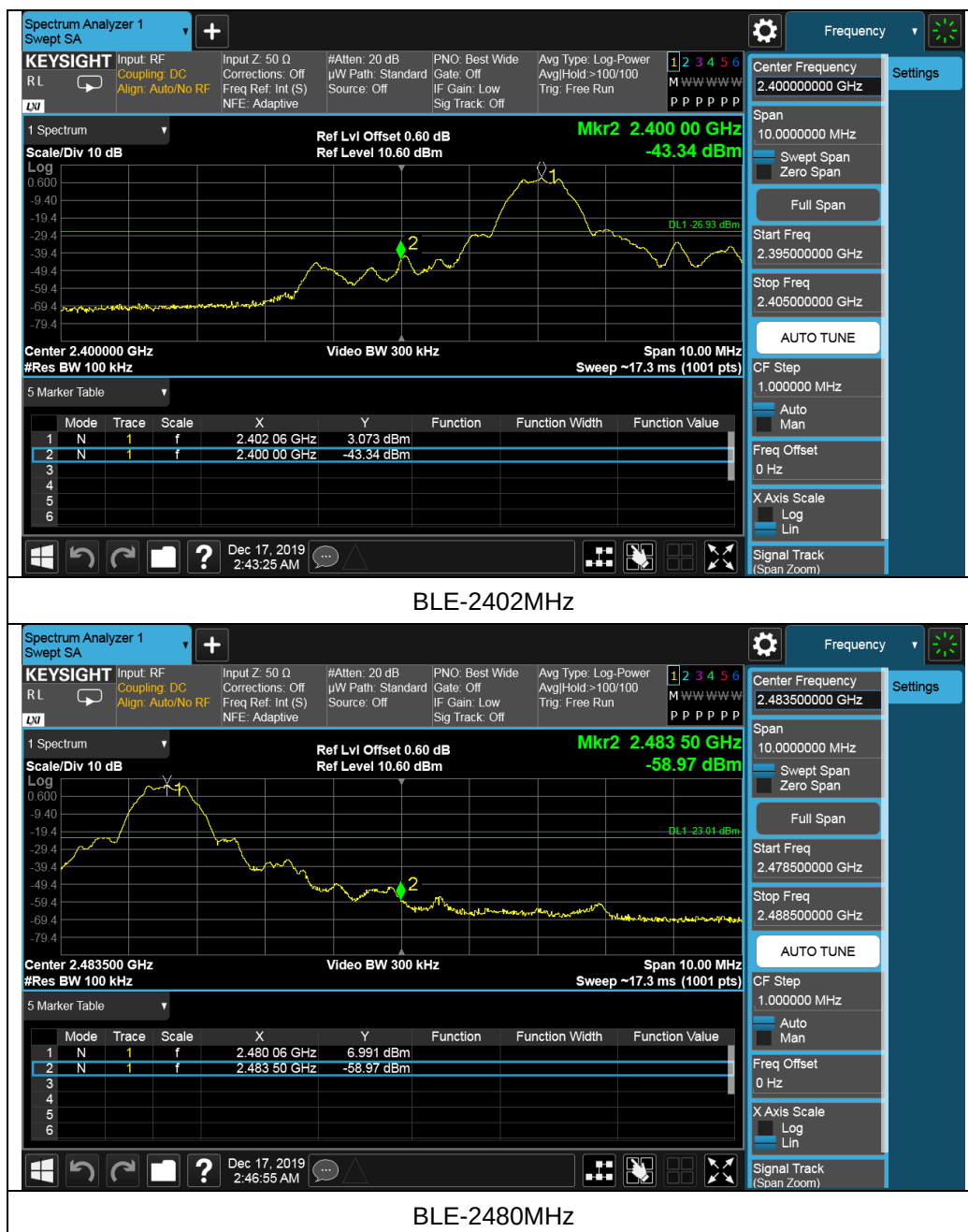
4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

Same as Item 4.3.6

4.6.7 Test Results



5 Pictures of Test Arrangements

Please see setup photo file.

Appendix – Information on the Testing Laboratories

Bureau Veritas is a global leader in testing, inspection and certification (TIC) services. We help businesses improve safety, sustainability and productivity; and our clients include the majority of leading brands in retail, manufacturing and other industries. With a presence in every major country around the world, our quality assurance and compliance solutions are vital in helping our customers enhance product quality and concept-to-consumer journeys. We also assist with increasing speed to market, profitability and brand equity throughout the supply chain. Bureau Veritas is a leading wireless/IoT testing, inspection, audit and certification provider, with a global network of test laboratories to support the IoT industry in areas of connectivity, security, interoperability as well as quality, health & safety, and environmental/chemical requirements.

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

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Email: sales.eaw@us.bureauveritas.com

Web Site: www.cpsusa-bureauveritas.com

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

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