

TEST REPORT

Report Number: 18120746HKG-001

Application for Original Grant of 47 CFR Part 15 Certification

Single New of RSS-247 Issue 2 Equipment

FCC ID: AL8-E60XXX

IC: 457A-E60XXX

Prepared and Checked by:

Approved by:

Signed On File

Law Kai Chun, Adrian
Senior Lead Engineer



Digitally signed by
Tim Lee
Location: Intertek
Testing Services
Hong Kong Ltd.

Lee Shui Tim, Tim
Senior Lead Engineer
Date: March 05, 2019

Intertek's standard Terms and Conditions can be obtained at our website <http://www.intertek.com/terms/>.

The test report only allows to be revised within the retention period unless further standard or the requirement was noticed.

This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.

© 2017 Intertek

TEST REPORT

GENERAL INFORMATION

Applicant Name:	Plantronics, Inc.
Applicant Address:	345 Encinal Street, Santa Cruz, CA 95060, United States of America.
FCC Specification Standard:	FCC Part 15, October 1, 2016 Edition
FCC ID:	AL8-E60XXX
FCC Model(s):	Elara 60 WS
IC Specification Standard:	RSS-247 Issue 2, February 2017 RSS-Gen Issue 4, December 2014
IC:	457A-E60XXX
HVIN:	Elara 60 WS
PMN:	Elara 60 WS
Firmware Version:	0.8.10
Type of EUT:	Spread Spectrum Transmitter
Description of EUT:	Mobile Phone Station with Bluetooth
Serial Number:	N/A
Sample Receipt Date:	December 17, 2018
Date of Test:	December 17, 2018 to February 26, 2019
Report Date:	March 05, 2019
Environmental Conditions:	Temperature: +10 to 40°C Humidity: 10 to 90%
Conclusion:	Test was conducted by client submitted sample. The submitted sample as received complied with the 47 CFR Part 15 / RSS-247 Issue 2 Certification.

TEST REPORT

TABLE OF CONTENTS

1.0	TEST RESULTS SUMMARY & STATEMENT OF COMPLIANCE	4
1.1	Summary of Test Results	4
1.2	Statement of Compliance	4
2.0	GENERAL DESCRIPTION	5
2.1	Product Description	5
2.2	Test Methodology	5
2.3	Test Facility	5
3.0	SYSTEM TEST CONFIGURATION	6
3.1	Justification	6
3.2	EUT Exercising Software	7
3.3	Details of EUT and Description of Accessories.....	8
3.4	Measurement Uncertainty	8
4.0	TEST RESULTS	9
4.1	Maximum Conducted Output Power at Antenna Terminals.....	9
4.2	Maximum 20 dB RF Bandwidth.....	12
4.3	Minimum Number of Hopping Frequencies.....	16
4.4	Minimum Hopping Channel Carrier Frequency Separation	18
4.5	Average Channel Occupancy Time.....	20
4.6	Out of Band Conducted Emissions	23
4.7	Field Strength Calculation.....	29
4.8	Transmitter Radiated Emissions in Restricted Bands and Spurious Emissions.....	30
4.8.1	Radiated Emission Configuration Photograph.....	31
4.8.2	Radiated Emission Data	31
4.8.3	Radiated Emission Test Setup	32
4.9	AC Power Line Conducted Emission.....	37
4.9.1	AC Power Line Conducted Emission Configuration Photograph	37
4.9.2	AC Power Line Conducted Emission Data.....	37
4.9.3	Conducted Emission Test Setup	39
5.0	EQUIPMENT LIST.....	40

TEST REPORT

1.0 TEST RESULTS SUMMARY & STATEMENT OF COMPLIANCE

1.1 Summary of Test Results

Test Items	FCC Part 15 Section	RSS-247/ RSS-Gen# Section	Results	Details See Section
Antenna Requirement	15.203	7.1.2#	Pass	2.1
Max. Conducted Output Power	15.247(b)(1)	5.1(b)	Pass	4.1
Max. 20 dB RF Bandwidth	15.247(a)(1)	5.1(a)		4.2
Min. Number of Hopping Frequency	15.247(a)(1)	5.1(d)	Pass	4.3
Min. Hopping Channel Carrier Frequency Separation	15.247(a)(1)	5.1(b)	Pass	4.4
Average Channel Occupancy Time	15.247(a)(1)	5.1(d)	Pass	4.5
Out of Band Conducted Emissions	15.247(d)	5.5	Pass	4.6
Radiated Emission in Restricted Bands and Spurious Emissions	15.247(d), 15.209 & 15.109	5.5	Pass	4.8
AC Power Line Conducted Emission	15.207 & 15.107	7.2.4#	Pass	4.9

Note: Pursuant to FCC Part 15 Section 15.215(c), the 20dB bandwidth of the emission was contained within the frequency band designated (mentioned as above) which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over expected variations in temperature and supply voltage were considered.

1.2 Statement of Compliance

The equipment under test is found to be complying with the following standards:

FCC Part 15, October 1, 2016 Edition
RSS-247 Issue 2, February 2017
RSS-Gen Issue 5, April 2018

TEST REPORT

2.0 GENERAL DESCRIPTION

2.1 Product Description

The Elara 60 WS is a Mobile Phone Station with Bluetooth. A wireless mobile phone dock consisting of a base unit and either wireless headset/wireless USB dongle or corded headset.

The Equipment Under Test (EUT) operates at frequency range of 2402MHz to 2480 MHz. There are totally 79 with 1MHz channel separation and 20 active channels out of the 79 channels.

The EUT is powered by a 100-240VAC 50/60Hz AC adaptor.

The antenna used in the EUT is integral, and the test sample is a prototype.

The circuit description and frequency hopping algorithm are attached in the Appendix and saved with filename: descri.pdf.

2.2 Test Methodology

Both AC power line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013). Preliminary radiated scans and all radiated measurements were performed in radiated emission test sites. All Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application. Antenna port conducted measurements were performed according to ANSI C63.10 (2013) and KDB Publication No.558074 D01 v05r02 (02-April-2019) All other measurements were made in accordance with the procedures in 47 CFR Part 2 and RSS-Gen Issue 5 (2018).

2.3 Test Facility

The radiated emission test site, antenna port conducted measurement facility used to collect the radiated data, AC Power Line conducted data, and conductive data are at Intertek Testing Services Hong Kong Ltd., which is located at Workshop No. 3, G/F., World-Wide Industrial Centre, 43-47 Shan Mei Street, Fo Tan, Sha Tin, N.T., Hong Kong. This test facility and site measurement data have been fully placed on file with FCC and Industry Canada No. 2042V.

TEST REPORT

3.0 SYSTEM TEST CONFIGURATION

3.1 Justification

For radiated emissions testing, the equipment under test (EUT) was setup to transmit / receive continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, all cables (if any) were manipulated to produce worst case emissions.

The EUT was powered by a 100-240VAC 50/60Hz adaptor.

For the measurements, the EUT was attached to a plastic stand if necessary and placed on the wooden turntable at 0.8m height from the ground plane for emission testing at or below 1GHz and 1.5m for emission measurements above 1GHz. If the base unit attached to peripherals, they were connected and operational (as typical as possible).

The signal was maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization were varied during the search for maximum signal level. The antenna height was varied from 1 to 4 meters. Radiated emissions were taken at three meters unless the signal level was too low for measurement at that distance. If necessary, a pre-amplifier was used and/or the test was conducted at a closer distance.

For any intentional radiator powered by AC power line, measurements of the radiated signal level of the fundamental frequency component of the emission was performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage.

For transmitter radiated measurement, the spectrum analyzer resolution bandwidth was 100 kHz for frequencies below 1000 MHz. The resolution bandwidth was 1 MHz for frequencies above 1000 MHz.

Radiated emission measurement for transmitter were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. Receiver was performed from 30MHz to the fifth harmonic of the highest frequency or 40GHz, whichever is lower.

TEST REPORT

3.1 Justification - Cont'd

Emission that are directly caused by digital circuits in the transmit path and transmitter portion were measured, and the limit are according to FCC Part 15 Section 15.209. Digital circuitry used to control additional functions other than the operation of the transmitter is subject to FCC Part Section 15.109 Limits.

Detector function for radiated emissions was in peak mode. Average readings, when required, were taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in section 4.3.4.

Determination of pulse desensitization was made according to *Hewlett Packard Application Note 150-2, Spectrum Analysis... Pulsed RF*. The effective period (Teff) was referred to Exhibit 4.3.4. With the resolution bandwidth 1MHz and spectrum analyzer IF bandwidth 3dB, the pulse desensitization factor was 0dB.

For AC line conducted emission test, the EUT along with its peripherals were placed on a 1.0m(W)x1.5m(L) and 0.8m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane. The EUT was connected to power mains through a line impedance stabilization network (LISN), which provided 50ohm coupling impedance for measuring instrument. The LISN housing, measuring instrument case, reference ground plane, and vertical ground plane were bounded together. The excess power cable between the EUT and the LISN was bundled.

All connecting cables of EUT and peripherals were manipulated to find the maximum emission.

All relevant operation modes have been tested, and the worst case data is included in this report.

3.2 EUT Exercising Software

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use.

TEST REPORT

3.3 Details of EUT and Description of Accessories

Details of EUT:

An AC adaptor (provided with the unit) was used to power the device. Their description are listed below.

- (1) An AC adaptor (100-240VAC 50/60Hz 0.6A to 12VDC 1.5A, Model: SSC-120150) (Provided by Client)

Description of Accessories:

- (1) Pika Cradle model: 5200 #003 and docking. (Provided by Client)
- (2) Pika Cradle model: Focus #01 and docking. (Provided by Client)
- (3) Pika Cradle model: USB-A #01 (Provided by Client)
- (4) Bluetooth USB Model:BT600 (Provided by Client)
- (5) USB loading 5V 1A (Provided by Intertek)
- (6) Samsung S8 (provided by Intertek)

3.4 Measurement Uncertainty

When determining of the test conclusion, the Measurement Uncertainty of test at a level of confidence of 95% has been considered. The values of the Measurement uncertainty for radiated emission test and RF conducted measurement test are $\pm 5.3\text{dB}$ and $\pm 0.99\text{dB}$ respectively. The value of the Measurement uncertainty for conducted emission test is $\pm 4.2\text{dB}$.

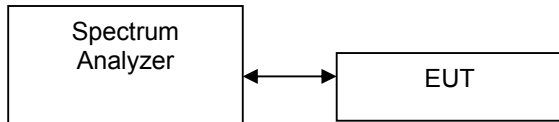
Uncertainty and Compliance - Unless the standard specifically states that measured values are to be extended by the measurement uncertainty in determining compliance, all compliance determinations are based on the actual measured value.

TEST REPORT

4.0 TEST RESULTS

RF Conducted measurement Test Setup by a Spectrum Analyzer.

The figure below shows the test setup, which is utilized to make these measurements.



4.1 Maximum Conducted (peak) Output Power at Antenna Terminals

- ☐ The antenna power of the EUT was connected to the input of a power meter. Power was read directly and cable loss correction was added to the reading to obtain power at the EUT antenna terminals.
- ☒ The antenna port of the EUT was connected to the input of a spectrum analyzer. The analyzer was set for RBW>20dB bandwidth and power was read directly in dBm. External attenuation and cable loss were compensated for using the OFFSET function of the analyzer.

Antenna Gain = -2.0 dBi

Frequency (MHz)	Output in dBm	Output in mWatt
Low Channel: 2402	0.5	1.12
Middle Channel: 2441	0.9	1.23
High Channel: 2480	0.5	1.12

Cable loss : 0.5 dB External Attenuation : 0 dB

Cable loss, external attenuation: ☒ included in OFFSET function
☐ added to SA raw reading

dBm max. output level = 0.9 dBm

Limits:

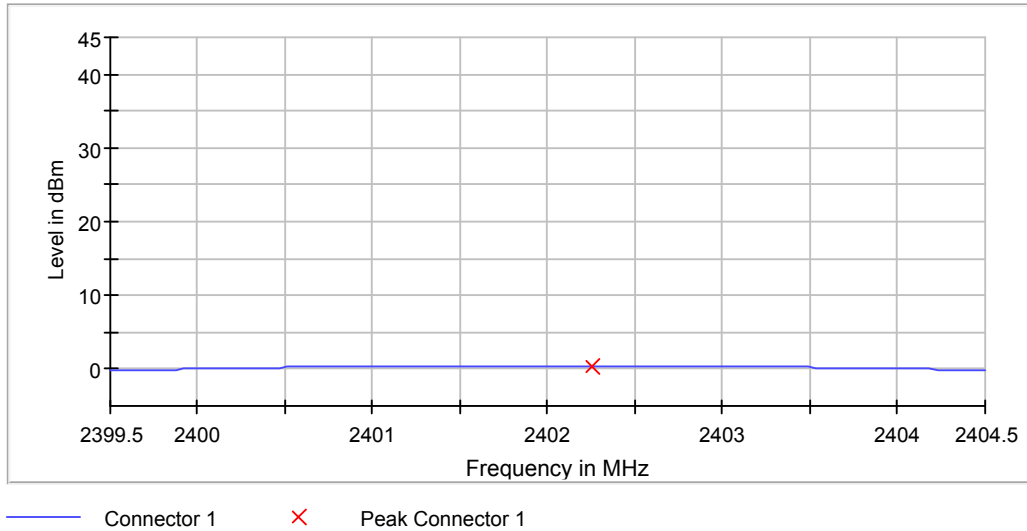
- ☒ 0.125W (21dBm) for antennas with gains of 6dBi or less
- ☐ 0.25W (24dBm) for antennas with gains of 6dBi or less
- ☐ 1W (30dBm) for antennas with gains of 6dBi or less
- ☐ ___W (___dBm) for antennas with gains more than 6dBi

The plots of conducted output power are saved as below.

TEST REPORT

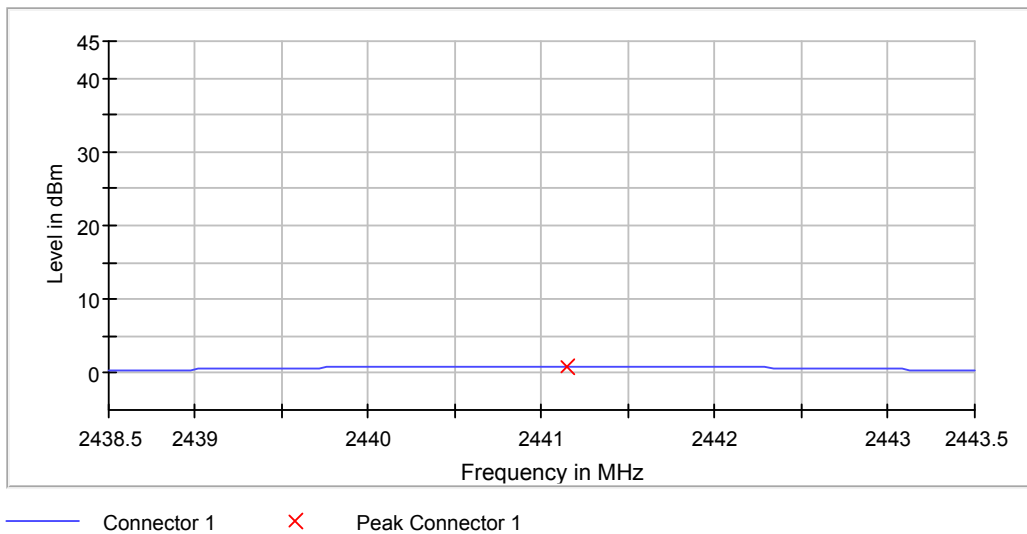
PLOTS OF CONDUCTED OUTPUT POWER

Lowest Channel



DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2402.000000	0.5	21.0	PASS

Middle Channel

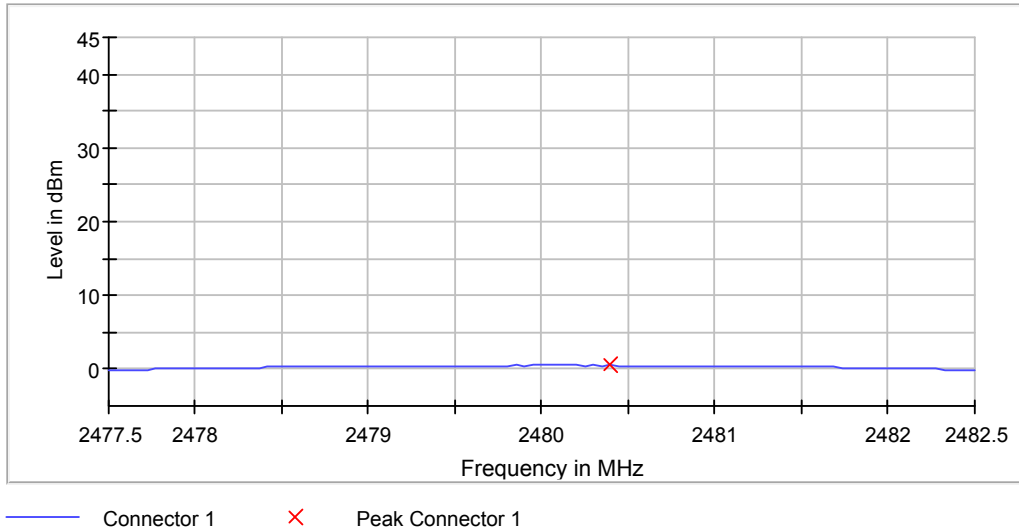


DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2441.000000	0.9	21.0	PASS

TEST REPORT

PLOTS OF CONDUCTED OUTPUT POWER

Highest Channel



DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2480.000000	0.5	21.0	PASS

TEST REPORT

4.2 Maximum 20 dB RF Bandwidth

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RES BW was chosen so that the display was a result of the hopping channel modulation. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 20 dB lower than PEAK level. The 20 dB bandwidth was determined from where the channel output spectrum intersected the display line.

Frequency (MHz)	20 dB Bandwidth (MHz)
Low Channel: 2402	0.445
Middle Channel: 2441	0.440
High Channel: 2480	0.445

Limits

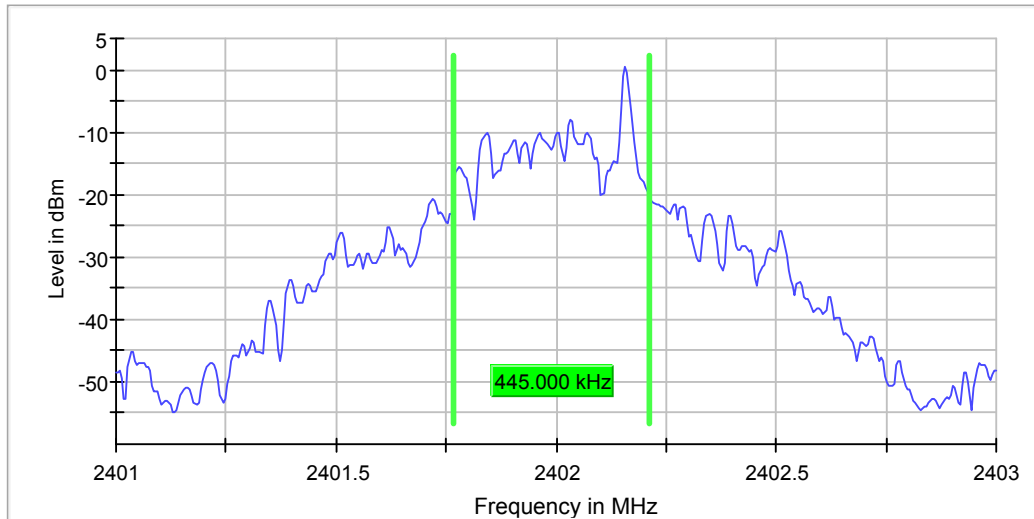
- ☐ ≤500kHz for 902-928MHz
- ☒ N/A for 2400-2483.5MHz
- ☐ ≤1MHz for 5725-5850MHz

The plots of 20dB RF bandwidth are saved as below.

TEST REPORT

PLOTS OF 20dB RF BANDWIDTH

Lowest Channel



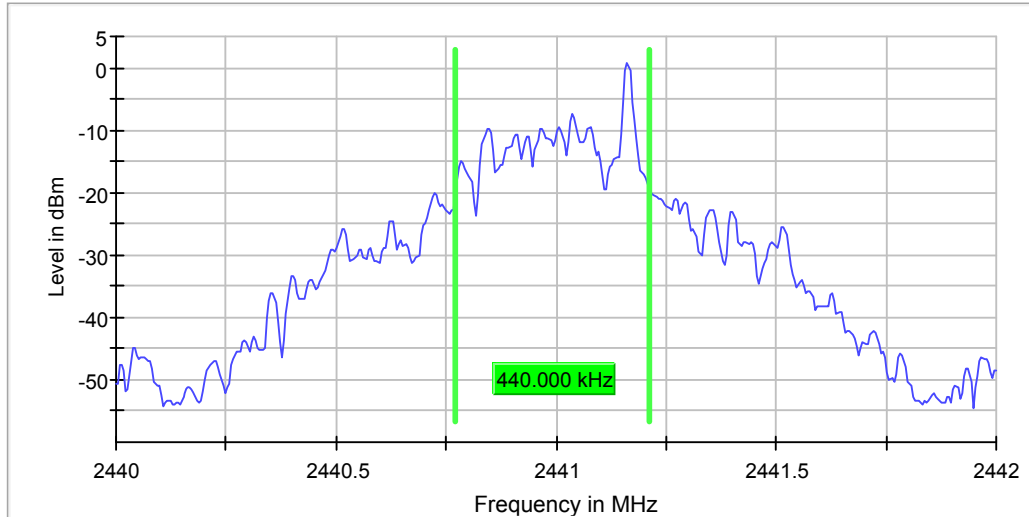
DUT Frequency (MHz)	Bandwidth (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2402.000000	0.445000	2401.767500	2402.212500

Setting	Instrument Value	Target Value
Start Frequency	2.40100 GHz	2.40100 GHz
Stop Frequency	2.40300 GHz	2.40300 GHz
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	~ 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	400	~ 400
SweepTime	189.648 μ s	AUTO
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamplifier	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	3 / max. 5	max. 5
Stable	2 / 2	2
Max Stable Difference	0.08 dB	0.50 dB

TEST REPORT

PLOTS OF 20dB RF BANDWIDTH

Middle Channel



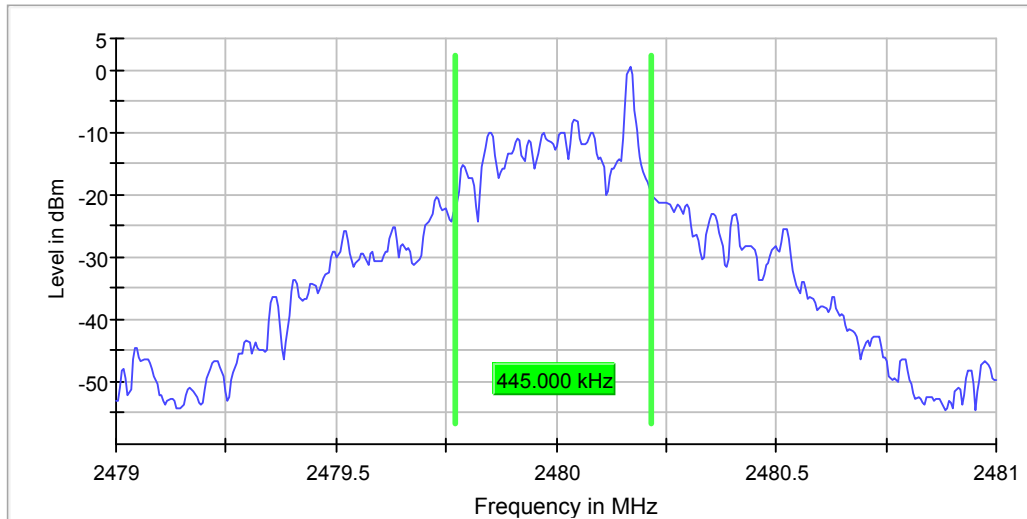
DUT Frequency (MHz)	Bandwidth (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2441.000000	0.440000	2440.772500	2441.212500

Setting	Instrument Value	Target Value
Start Frequency	2.43900 GHz	2.43900 GHz
Stop Frequency	2.44300 GHz	2.44300 GHz
Span	4.000 MHz	4.000 MHz
RBW	100.000 kHz	~ 100.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	101	~ 80
Sweptime	18.938 μ s	AUTO
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	19 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.00 dB	0.50 dB

TEST REPORT

PLOTS OF 20dB RF BANDWIDTH

Highest Channel



DUT Frequency (MHz)	Bandwidth (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)
2480.000000	0.445000	2479.772500	2480.217500

Setting	Instrument Value	Target Value
Start Frequency	2.47900 GHz	2.47900 GHz
Stop Frequency	2.48100 GHz	2.48100 GHz
Span	2.000 MHz	2.000 MHz
RBW	10.000 kHz	~ 10.000 kHz
VBW	30.000 kHz	>= 30.000 kHz
SweepPoints	400	~ 400
SweepTime	189.648 μ s	AUTO
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	4 / max. 5	max. 5
Stable	2 / 2	2
Max Stable Difference	0.10 dB	0.50 dB

TEST REPORT

4.3 Minimum Number of Hopping Frequencies

With the analyzer set to MAX HOLD readings were taken for 2-3 minutes in each band. The channel peaks so recorded were added together, and the total number compared to the minimum number of channels required in the regulation.

No. of Hopping Channels	79
-------------------------	----

Minimum Requirements:

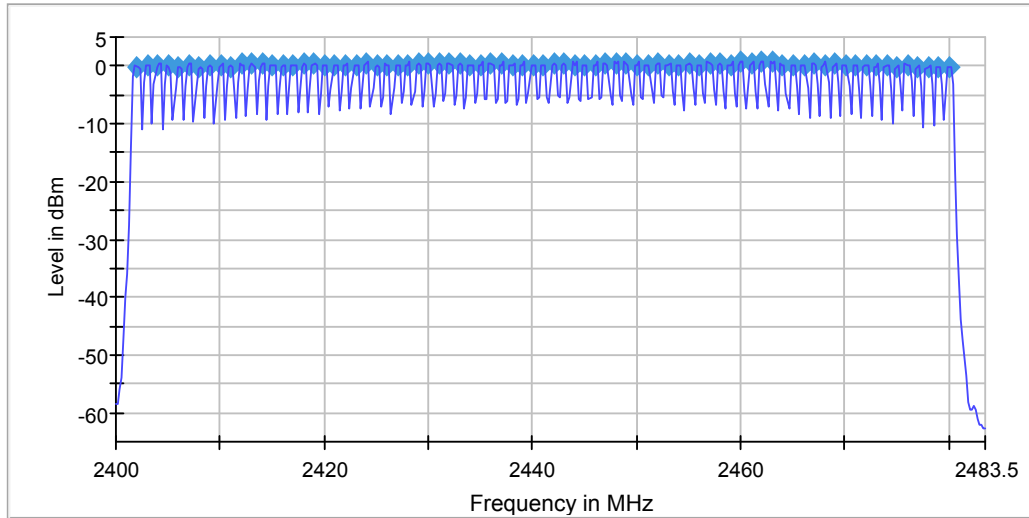
- ☐ at least 50 hopping channels for 902MHz-928MHz (20 dB bandwidth of hopping channel < 250kHz)
- ☐ at least 25 hopping channels for 902MHz-928MHz (20 dB bandwidth of hopping channel ≥ 250kHz)
- ☒ at least 15 hopping channels for 2400MHz-2483.5MHz.
- ☐ at least 75 hopping channels for 5725MHz-5850MHz.

The plots of number of hopping frequencies are saved as below.

TEST REPORT

PLOTS OF NUMBER OF HOPPING FREQUENCIES

Plot A



Channels	Limit Min	Limit Max	Result
79	15	---	PASS

Setting	Instrument Value	Target Value
Start Frequency	2.40000 GHz	2.40000 GHz
Stop Frequency	2.48350 GHz	2.48350 GHz
Span	83.500 MHz	83.500 MHz
RBW	200.000 kHz	<= 299.000 kHz
VBW	200.000 kHz	>= 200.000 kHz
SweepPoints	418	~ 418
SweepTime	1.060 ms	AUTO
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	34 / max. 150	max. 150
Stable	3 / 3	3
Max Stable Difference	0.40 dB	0.50 dB

TEST REPORT

4.4 Minimum Hopping Channel Carrier Frequency Separation

Using the DELTA MARKER function of the analyzer, the frequency separation between two adjacent channels was measured and met the requirement.

Channel Separation (2441MHz and 2442MHz)	1.01MHz
--	---------

Limits:

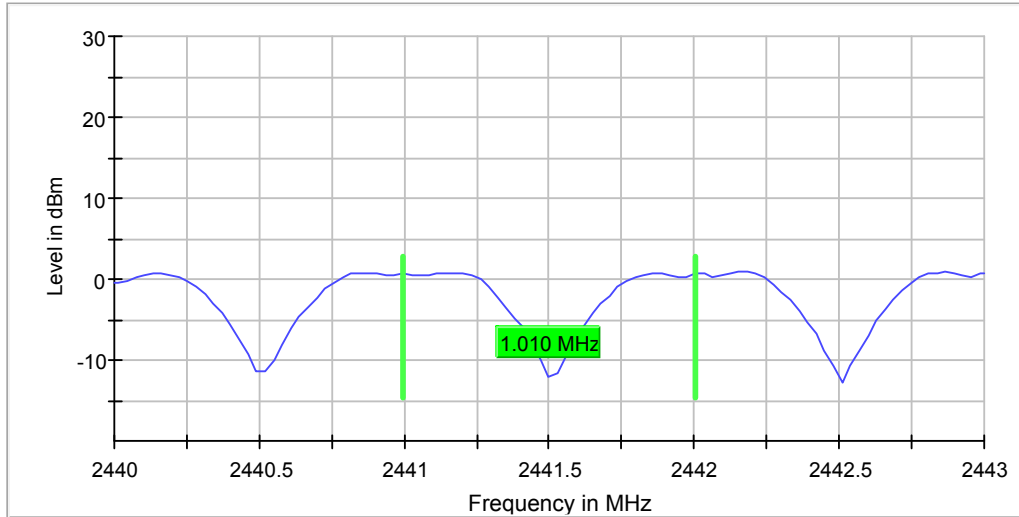
The channel separation must be larger than:

- ☐ 25 kHz
- ☐ 20 dB bandwidth of hopping channel: ____ Hz
- ☒ 2/3 of 20dB bandwidth of hopping channel: __296.7_ kHz

The plot(s) of hopping channel carrier frequency separation is saved as below.

TEST REPORT

PLOTS OF HOPPING CHANNEL CARRIER FREQUENCY SEPARATION



DUT Frequency (MHz)	Frequency Separation (MHz)	Limit Min (MHz)	Center Frequency low Channel (MHz)	Center Frequency high Channel (MHz)
2441.000000	1.009900	0.2967	2440.995050	2442.004950

Setting	Instrument Value	Target Value
Start Frequency	2.44000 GHz	2.44000 GHz
Stop Frequency	2.44300 GHz	2.44300 GHz
Span	3.000 MHz	3.000 MHz
RBW	300.000 kHz	<= 300.000 kHz
VBW	300.000 kHz	>= 300.000 kHz
SweepPoints	101	~ 10
SweepTime	1.000 ms	AUTO
Reference Level	-10.000 dBm	-10.000 dBm
Attenuation	10.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	200	200
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	Sweep	Sweep
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	12 / max. 150	max. 150
Stable	10 / 10	10
Max Stable Difference	0.00 dB	0.50 dB

TEST REPORT

4.5 Average Channel Occupancy Time

The spectrum analyzer center frequency was set to one of the known hopping channels. The SWEEP was set to 1ms, the SPAN was set to ZERO SPAN, and the TRIGGER was set to VIDEO. The time duration of the transmission so captured was measured with the MARKER DELTA function.

The SWEEP was then set to the time required by the regulation (20 seconds for 902-928 MHz devices, if the 20dB bandwidth is less than 250kHz, 10 seconds for 902-928 MHz if the 20dB bandwidth is or greater than 250kHz, "0.4 seconds x Number of hopping channels employed" seconds for 2400-2483.5 MHz, 30 seconds for 5725-5850 MHz). The analyzer was set to SINGLE SWEEP, the total ON time was added and compared against the limit (0.4 seconds).

Average Occupancy Time (Traffic – in a clear RF environment) =	336.270
---	---------

Limits:

Average 0.4 seconds maximum occupancy in:

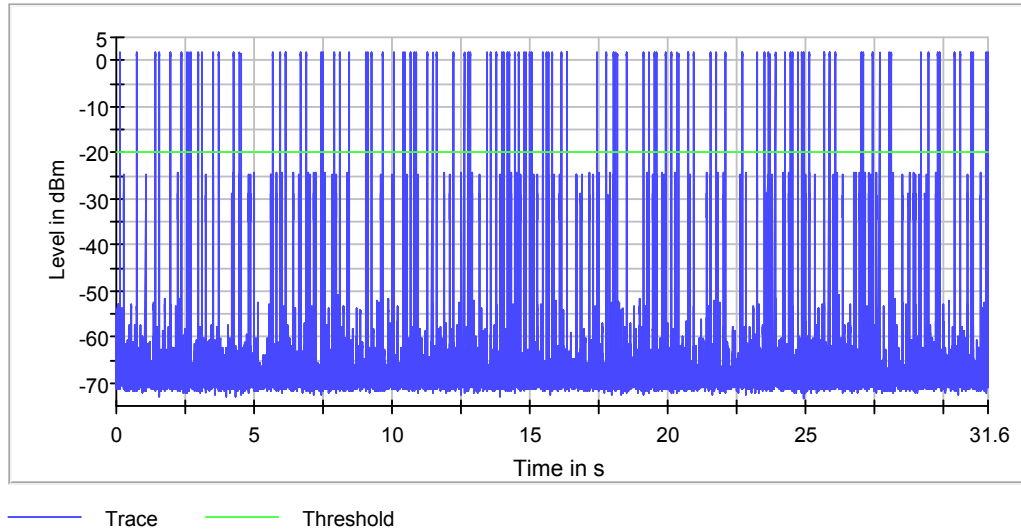
- ☒ 31.6 seconds (0.4 sec. x 79) for 2400MHz-2483.5MHz
(Traffic – in a clear RF environment)
- ☐ 20 seconds for 902MHz-928MHz $\geq$ 50 hopping channels
- ☐ 10 seconds for 902MHz-928MHz $\geq$ 25 hopping channels
- ☐ 30 seconds for 5725-5850MHz

The plots of average channel occupancy time are saved as below.

TEST REPORT

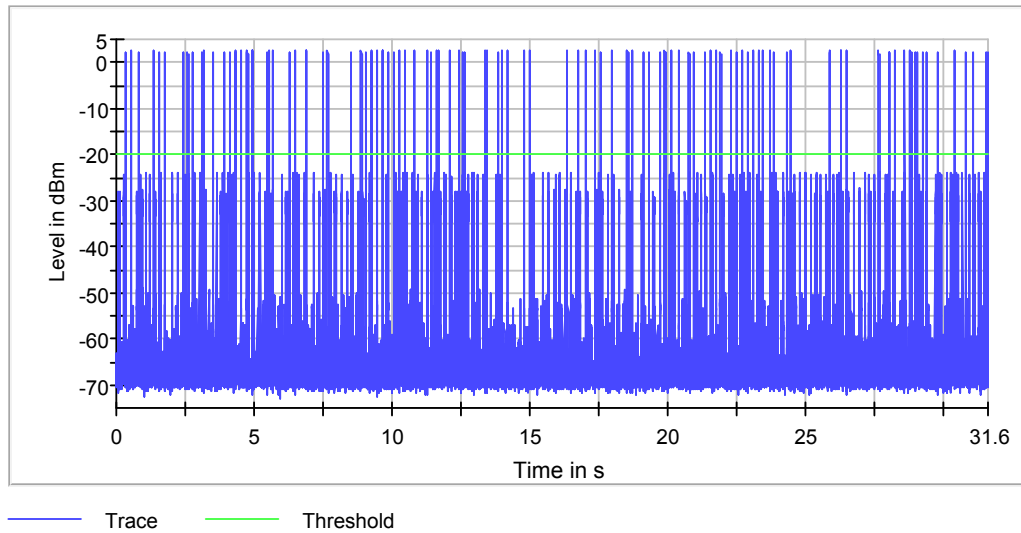
PLOTS AVERAGE CHANNEL OCCUPANCY TIME

Plot A



DUT Frequency (MHz)	Time (ms)	Limit Max (ms)	Limit Min (ms)	Threshold (dBm)	Result
2402.000000	336.270	400.000	0.000	-20.0	PASS

Plot B

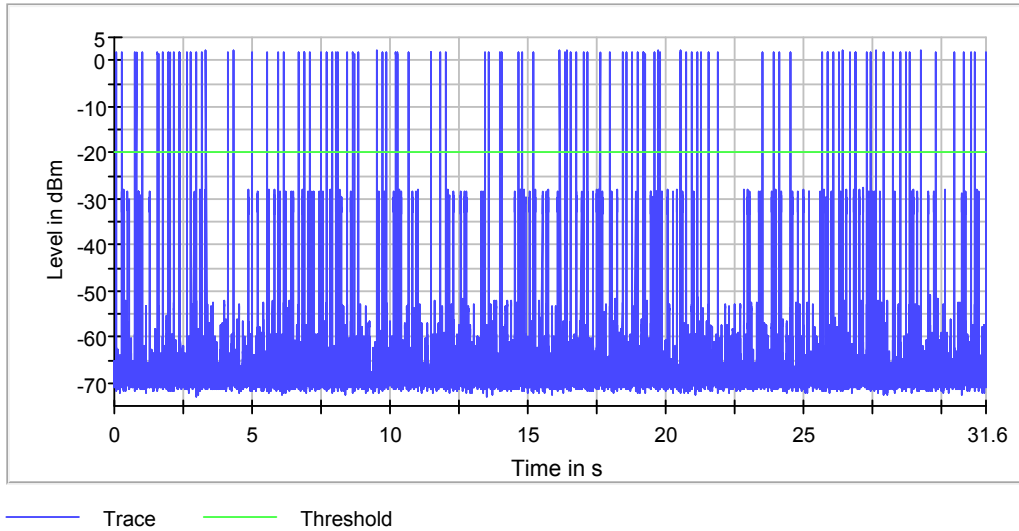


DUT Frequency (MHz)	Time (ms)	Limit Max (ms)	Limit Min (ms)	Threshold (dBm)	Result
2441.000000	330.470	400.000	0.000	-20.0	PASS

TEST REPORT

PLOTS AVERAGE CHANNEL OCCUPANCY TIME

Plot C



DUT Frequency (MHz)	Time (ms)	Limit Max (ms)	Limit Min (ms)	Threshold (dBm)	Result
2480.000000	307.260	400.000	0.000	-20.0	PASS

TEST REPORT

4.6 Out of Band Conducted Emissions

In any 100 kHz bandwidth outside the EUT passband, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20 dB below that of the maximum in-band 100 kHz emission.

The plot(s) of bandedge compliance is shown the worst-case which has been already considered between enable and disable the hopping function of the EUT.

Furthermore, delta measurement technique for measuring bandedge emissions was incorporated in the test of the edge at 2483.5MHz.

Limits:

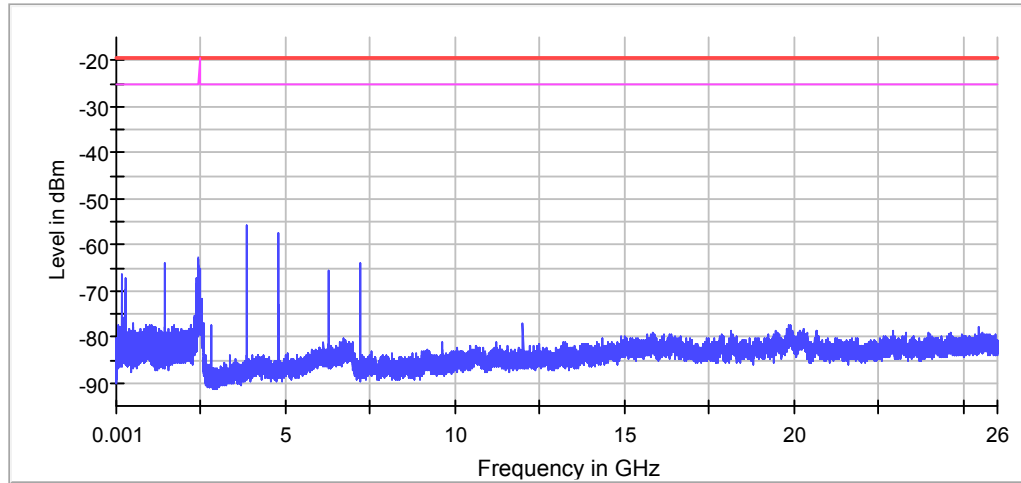
All spurious emission and up to the tenth harmonic was measured and they were found to be at least 20 dB below the highest level of the desired power in the passband.

The plots of out of band conducted emissions are saved as below.

TEST REPORT

PLOTS OF OUT OF BAND CONDUCTED EMISSIONS

Lowest Channel, Plot 1



— Limit — Sum Level — Threshold × Critical × Final Critical

DUT Frequency (MHz)	Result
2402.000000	PASS

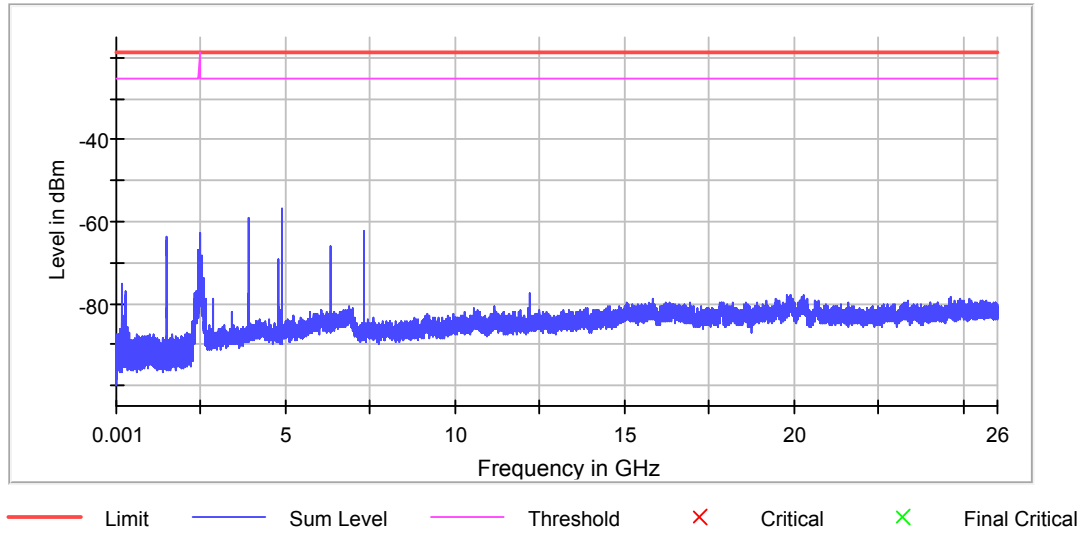
Pre Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
3843.372606	-55.9	36.5	-19.4
4804.579505	-57.4	38.0	-19.4
2400.000000	-62.7	43.3	-19.4
2399.962517	-62.7	43.3	-19.4
2399.512718	-63.1	43.7	-19.4
2399.437752	-63.2	43.8	-19.4
1441.067201	-64.0	44.6	-19.4
7206.861887	-64.1	44.7	-19.4
4803.844638	-64.4	45.0	-19.4
2399.812584	-64.5	45.1	-19.4
2399.887550	-64.9	45.5	-19.4
2398.987954	-65.0	45.6	-19.4
2399.062920	-65.1	45.7	-19.4
2498.564787	-65.1	45.7	-19.4
6245.654987	-65.4	46.0	-19.4

TEST REPORT

PLOTS OF OUT OF BAND CONDUCTED EMISSIONS

Middle Channel, Plot 1



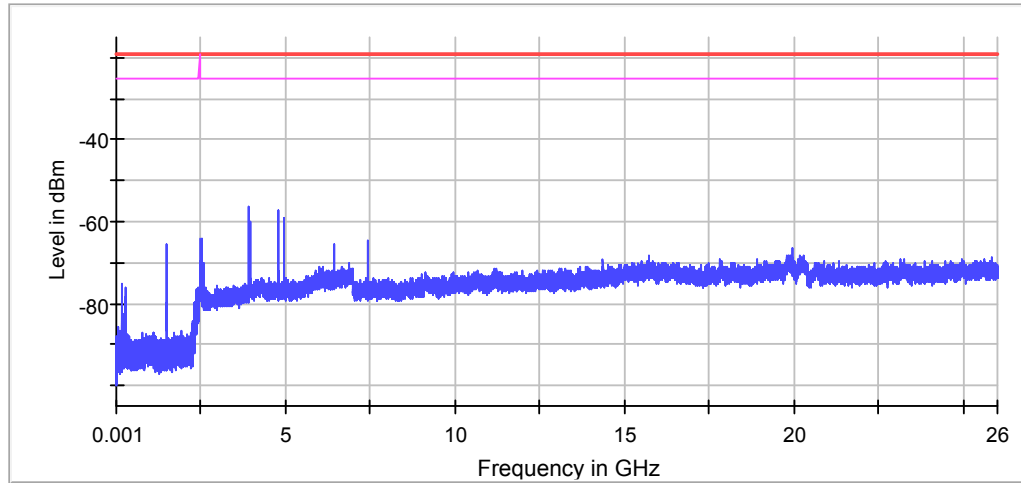
DUT Frequency (MHz)	Result
2440.000000	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
4882.475477	-56.9	38.0	-18.9
3905.836357	-59.2	40.3	-18.9
4881.740610	-59.4	40.5	-18.9
7323.705845	-62.4	43.5	-18.9
2489.011507	-62.7	43.8	-18.9
1464.456720	-63.5	44.6	-18.9
1464.531687	-64.4	45.6	-18.9
1464.681619	-64.8	45.9	-18.9
3906.571224	-65.7	46.8	-18.9
6347.066724	-66.0	47.1	-18.9
2393.215540	-66.8	47.9	-18.9
2393.140574	-67.0	48.1	-18.9
7322.236110	-67.4	48.6	-18.9
6346.331857	-68.0	49.2	-18.9
2537.512773	-68.1	49.2	-18.9

TEST REPORT

PLOTS OF OUT OF BAND CONDUCTED EMISSIONS

Highest Channel, Plot 1



— Limit — Sum Level — Threshold × Critical × Final Critical

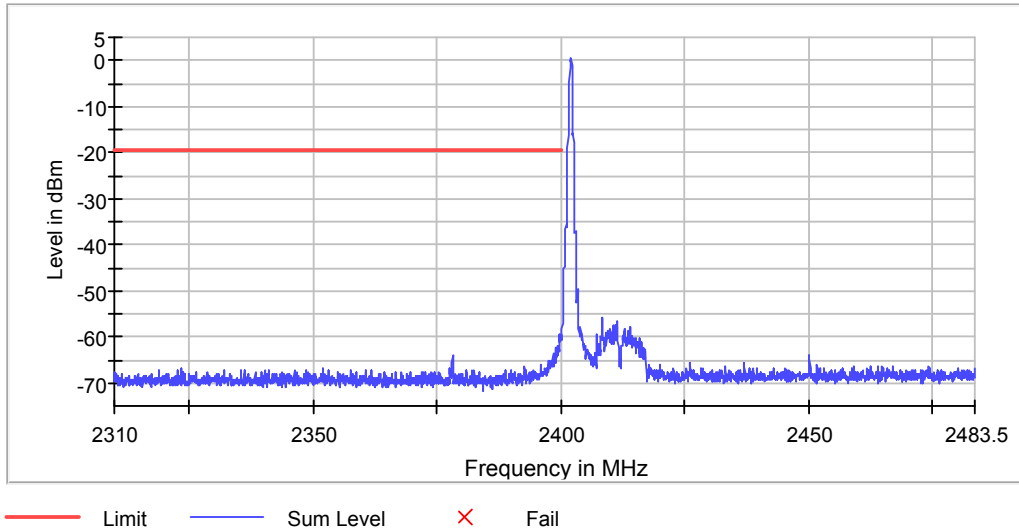
DUT Frequency (MHz)	Result
2480.000000	PASS

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)
3894.078474	-56.4	37.3	-19.1
4794.291358	-57.4	38.3	-19.1
4960.371449	-59.1	40.0	-19.1
3968.300108	-60.1	40.9	-19.1
2483.867434	-64.2	45.1	-19.1
2483.500000	-64.2	45.1	-19.1
2527.959493	-64.2	45.1	-19.1
7440.549803	-64.5	45.4	-19.1
4959.636582	-64.9	45.8	-19.1
6448.478462	-65.3	46.2	-19.1
1487.846239	-65.5	46.4	-19.1
1487.921206	-65.9	46.8	-19.1
19934.769765	-66.4	47.3	-19.1
4933.181346	-66.6	47.5	-19.1
1487.996172	-67.1	48.0	-19.1

TEST REPORT

PLOTS OF BANDEDGE

Lowest Bandedge



DUT Frequency (MHz)	Result
2402.000000	PASS

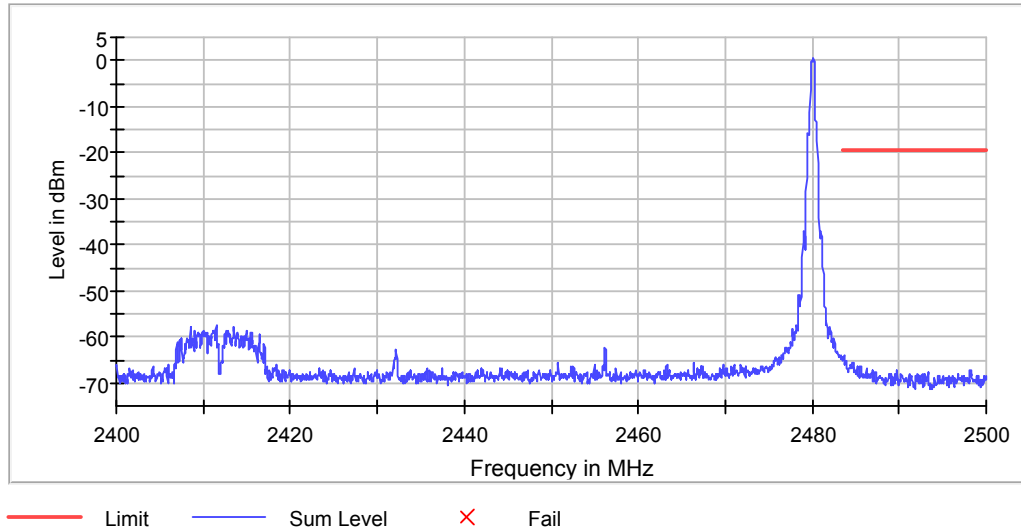
Frequency (MHz)	Level (dBm)
2402.175000	0.4

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.875000	-59.5	39.9	-19.6	PASS
2399.825000	-60.0	40.4	-19.6	PASS
2399.975000	-60.4	40.7	-19.6	PASS
2399.925000	-61.0	41.3	-19.6	PASS
2399.775000	-61.4	41.8	-19.6	PASS
2399.725000	-61.9	42.2	-19.6	PASS
2399.675000	-61.9	42.3	-19.6	PASS
2399.325000	-62.1	42.4	-19.6	PASS
2399.375000	-62.1	42.5	-19.6	PASS
2398.925000	-62.3	42.6	-19.6	PASS
2399.575000	-62.6	42.9	-19.6	PASS
2399.025000	-62.9	43.2	-19.6	PASS
2398.975000	-62.9	43.3	-19.6	PASS
2398.875000	-62.9	43.3	-19.6	PASS
2399.525000	-63.0	43.3	-19.6	PASS

TEST REPORT

PLOTS OF BANDEGE

Highest Bandedge



DUT Frequency (MHz)	Result
2480.000000	PASS

Frequency (MHz)	Level (dBm)
2480.175000	0.4

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2483.625000	-64.2	44.6	-19.6	PASS
2483.525000	-64.4	44.8	-19.6	PASS
2483.575000	-64.7	45.2	-19.6	PASS
2483.675000	-64.8	45.2	-19.6	PASS
2483.875000	-65.1	45.5	-19.6	PASS
2483.925000	-65.4	45.8	-19.6	PASS
2483.825000	-65.5	45.9	-19.6	PASS
2484.675000	-65.7	46.2	-19.6	PASS
2484.725000	-65.8	46.2	-19.6	PASS
2484.475000	-65.9	46.4	-19.6	PASS
2484.425000	-66.2	46.6	-19.6	PASS
2483.775000	-66.2	46.6	-19.6	PASS
2483.725000	-66.2	46.6	-19.6	PASS
2485.575000	-66.3	46.7	-19.6	PASS
2485.175000	-66.5	46.9	-19.6	PASS

TEST REPORT

4.7 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

$$FS = RA + AF + CF - AG + PD + AV$$

where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB
- PD = Pulse Desensitization in dB
- AV = Average Factor in -dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

$$FS = RA + AF + CF - AG + PD + AV$$

Example

Assume a receiver reading of 62.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

$$\begin{aligned} RA &= 62.0 \text{ dB}\mu\text{V} \\ AF &= 7.4 \text{ dB} \\ CF &= 1.6 \text{ dB} \\ AG &= 29 \text{ dB} \\ PD &= 0 \text{ dB} \\ AV &= -10 \text{ dB} \\ FS &= 62 + 7.4 + 1.6 - 29 + 0 + (-10) = 32 \text{ dB}\mu\text{V/m} \end{aligned}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$$

TEST REPORT

4.8 Transmitter Radiated Emissions in Restricted Bands and Spurious Emissions

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

TEST REPORT

4.8.1 Radiated Emission Configuration Photograph

Worst Case Restricted Band Radiated Emission
at

0.361 MHz

The worst case radiated emission configuration photographs are attached in the Appendix and saved with filename: config photos.pdf

4.8.2 Radiated Emission Data

The data in tables 1-4 list the significant emission frequencies, the limit and the margin of compliance.

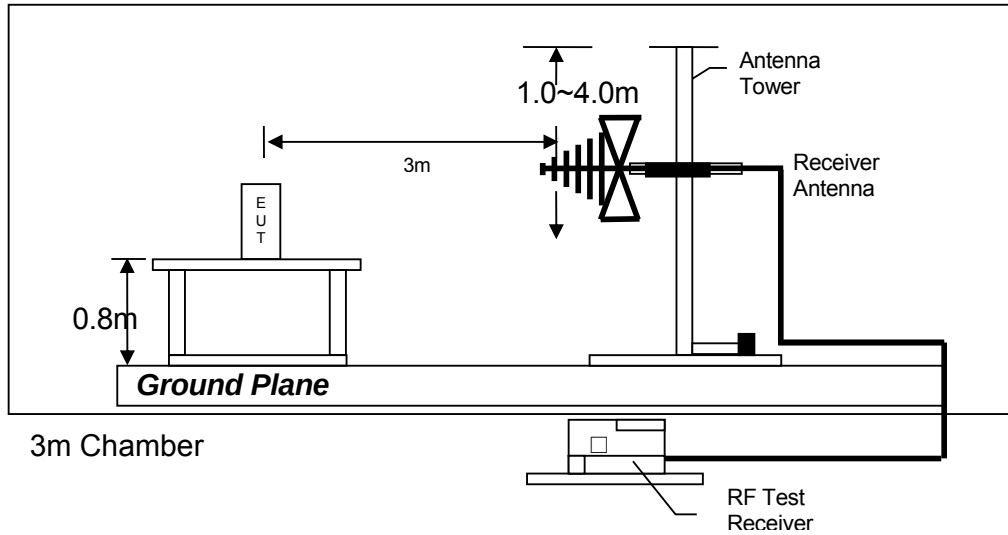
Judgement -

Base Unit: Passed by 3.2 dB

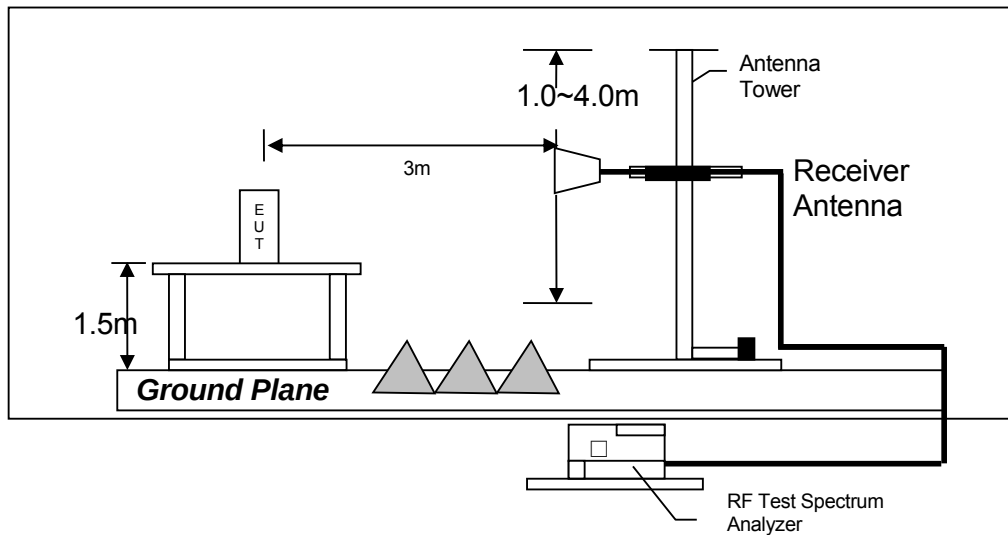
TEST REPORT

4.8.3 Radiated Emission Test Setup

The figure below shows the test setup, which is utilized to make these measurements.



Test setup of radiated emissions up to 1GHz



Test setup of radiated emissions above 1GHz

TEST REPORT

RADIATED EMISSION DATA

Mode: TX-2402MHz

Table 1

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Average Factor (dB)	Calculated at 3m (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
H	2400.000	51.3	33	29.4	47.7	0	47.7	54.0	-6.3
V	4804.000	28.9	33	34.9	30.8	0	30.8	54.0	-23.2
H	7206.000	29.4	33	37.9	34.3	0	34.3	54.0	-19.7
V	9608.000	29.7	33	40.4	37.1	0	37.1	54.0	-16.9
V	12010.000	32.5	33	40.5	40.0	0	40.0	54.0	-14.0
H	14412.000	36.1	33	40.0	43.1	0	43.1	54.0	-10.9

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
H	2400.000	69.1	33	29.4	65.5	74.0	-8.5
H	4804.000	40.5	33	34.9	42.4	74.0	-31.6
H	7206.000	41.4	33	37.9	46.3	74.0	-27.7
H	9608.000	43.1	33	40.4	50.5	74.0	-23.5
H	12010.000	44.7	33	40.5	52.2	74.0	-21.8
H	14412.000	46.6	33	40.0	53.6	74.0	-20.4

- NOTES:
1. Peak detector is used for the emission measurement.
 2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
 3. Negative value in the margin column shows emission below limit.
 4. Horn antenna is used for the emission over 1000MHz.
 5. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205 / RSS-Gen Section 8.10.

TEST REPORT

Mode: TX-2441MHz

Table 2

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Average Factor (dB)	Calculated at 3m (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
V	4882.000	29.2	33	34.9	31.1	0	31.1	54.0	-22.9
H	7323.000	29.1	33	37.9	34.0	0	34.0	54.0	-20.0
V	9764.000	29.6	33	40.4	37.0	0	37.0	54.0	-17.0
V	12205.000	32.8	33	40.5	40.3	0	40.3	54.0	-13.7
H	14646.000	37.4	33	38.4	42.8	0	42.8	54.0	-11.2

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
V	4882.000	40.7	33	34.9	42.6	74.0	-31.4
V	7323.000	42.1	33	37.9	47.0	74.0	-27.0
H	9764.000	42.9	33	40.4	50.3	74.0	-23.7
V	12205.000	44.9	33	40.5	52.4	74.0	-21.6
V	14646.000	48.1	33	38.4	53.5	74.0	-20.5

- NOTES:
1. Peak detector is used for the emission measurement.
 2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
 3. Negative value in the margin column shows emission below limit.
 4. Horn antenna is used for the emission over 1000MHz.
 5. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205 / RSS-Gen Section 8.10.

TEST REPORT

Mode: TX-2480

Table 3

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Average Factor (dB)	Calculated at 3m (dBμV/m)	Average Limit at 3m (dBμV/m)	Margin (dB)
V	2483.500	51.1	33	29.4	47.5	0	47.5	54.0	-6.5
V	4960.000	28.8	33	34.9	30.7	0	30.7	54.0	-23.3
H	7440.000	29.0	33	37.9	33.9	0	33.9	54.0	-20.1
V	9920.000	29.9	33	40.4	37.3	0	37.3	54.0	-16.7
H	12400.000	33.0	33	40.5	40.5	0	40.5	54.0	-13.5
H	14880.000	37.9	33	38.4	43.3	0	43.3	54.0	-10.7

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dBμV/m)	Peak Limit at 3m (dBμV/m)	Margin (dB)
V	2483.500	66.8	33	29.4	63.2	74.0	-10.8
V	4960.000	40.0	33	34.9	41.9	74.0	-32.1
H	7440.000	41.9	33	37.9	46.8	74.0	-27.2
V	9920.000	43.2	33	40.4	50.6	74.0	-23.4
H	12400.000	44.9	33	40.5	52.4	74.0	-21.6
H	14880.000	48.3	33	38.4	53.7	74.0	-20.3

- NOTES:
1. Peak detector is used for the emission measurement.
 2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
 3. Negative value in the margin column shows emission below limit.
 4. Horn antenna is used for the emission over 1000MHz.
 5. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205 / RSS-Gen Section 8.10.

TEST REPORT

Worst-Case Operating Mode: On Mode

Table 4
Pursuant to FCC Part 15 Section 15.109 / RSS-210 4.4 Requirement

Polarization	Frequency (MHz)	Reading (dBμV)	Pre-amp (dB)	Antenna Factor (dB)	Net at 3m (dBμV/m)	Limit at 3m (dBμV/m)	Margin (dB)
V	47.328	26.1	16	11.0	21.1	40.0	-18.9
V	112.759	26.6	16	14.0	24.6	43.5	-18.9
V	120.254	38.3	16	14.0	36.3	43.5	-7.2
H	180.306	30.5	16	20.0	34.5	43.5	-9.0
H	240.534	35.5	16	19.0	38.5	46.0	-7.6
H	360.726	34.8	16	24.0	42.8	46.0	-3.2
H	371.220	31.3	16	24.0	39.3	46.0	-6.7
H	438.723	27.5	16	26.0	37.5	46.0	-8.5
V	941.447	22.3	16	33.0	39.3	46.0	-6.7

- NOTES:
1. Peak Detector Data unless otherwise stated.
 2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
 3. Negative sign in the column shows value below limit.
 4. Horn antenna is used for the emission over 1000MHz.
 5. Emission (the row indicated by ***bold italic***) within the restricted band meets the requirement of FCC Part 15 Section 15.205 / RSS-210 4.1.
 6. Measurement Uncertainty is ± 5.3 dB at a level of confidence of 95%.

TEST REPORT

4.9 AC Power Line Conducted Emission

- ☐ Not applicable – EUT is only powered by battery for operation.
- ☒ EUT connects to AC power line. Emission Data is listed in following pages.
- ☐ Base Unit connects to AC power line and has transmission. Handset connects to AC power line but has no transmission. Emission Data of Base Unit is listed in following pages.

4.9.1 AC Power Line Conducted Emission Configuration Photograph

Worst Case Line-Conducted Configuration
at

199.5 kHz

The worst case line conducted configuration photographs are attached in the Appendix and saved with filename: config photos.pdf

4.9.2 AC Power Line Conducted Emission Data

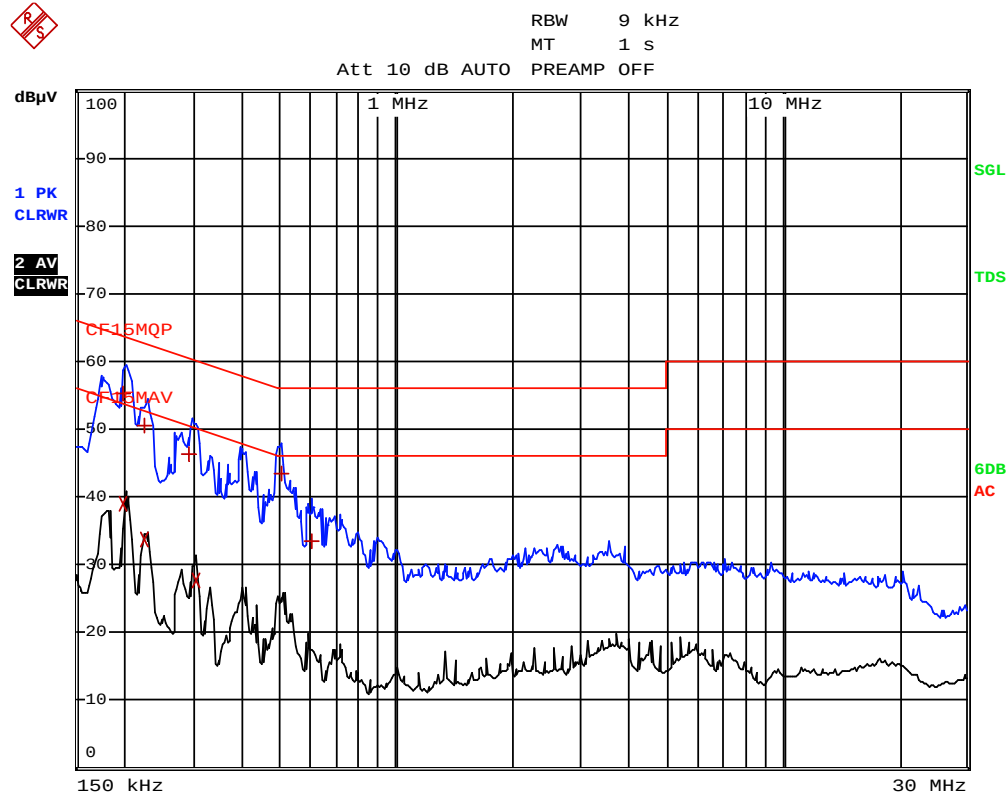
The plot(s) and data in the following pages list the significant emission frequencies, the limit and the margin of compliance.

Passed by 8.31 dB margin compare with Quasi-peak limit

TEST REPORT

AC POWER LINE CONDUCTED EMISSION

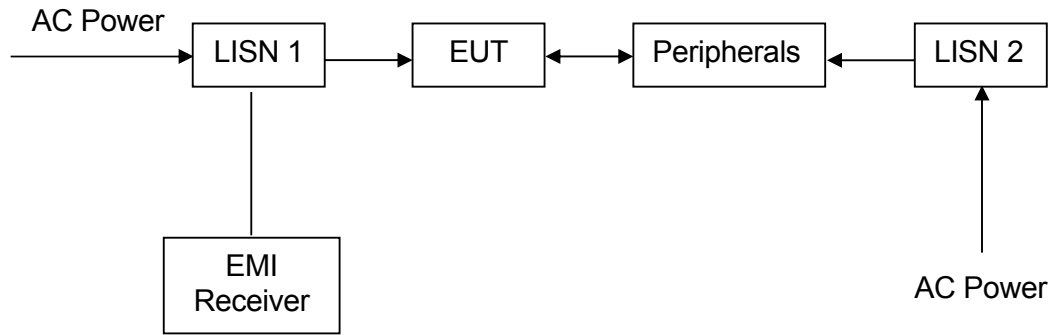
Worst Case: Bluetooth on mode with full load



EDIT PEAK LIST (Final Measurement Results)				
Trace1:	CF15MQP			
Trace2:	CF15MAV			
Trace3:	---			
TRACE	FREQUENCY	LEVEL	dBμV	DELTA LIMIT
1 Quasi Peak	199.5 kHz	55.31	N	-8.31
2 CISPR Average	199.5 kHz	38.93	N	-14.69
1 Quasi Peak	226.5 kHz	50.42	N	-12.15
2 CISPR Average	226.5 kHz	33.73	N	-18.84
1 Quasi Peak	294 kHz	46.43	N	-13.97
2 CISPR Average	303 kHz	27.77	N	-22.38
1 Quasi Peak	505.5 kHz	43.42	N	-12.57
1 Quasi Peak	600 kHz	33.37	N	-22.62

TEST REPORT

4.9.3 Conducted Emission Test Setup



TEST REPORT

5.0 EQUIPMENT LIST

1) Radiated Emissions Test

Equipment	EMI Test Receiver	Spectrum Analyzer	Biconical Antenna
Registration No.	EW-2500	EW-2253	EW-0571
Manufacturer	R&S	R&S	EMCO
Model No.	ESCI	FSP40	3104C
Calibration Date	November 28, 2018	November 27, 2018	February 27, 2018
Calibration Due Date	November 28, 2019	November 27, 2019	August 27, 2019

Equipment	Log Periodic Antenna	Double Ridged Guide Antenna
Registration No.	EW-0447	EW-1133
Manufacturer	EMCO	EMCO
Model No.	3146	3115
Calibration Date	January 17, 2018	November 29, 2018
Calibration Due Date	July 17, 2019	May 29, 2020

2) Conducted Emissions Test

Equipment	EMI Test Receiver	Artificial Mains Network
Registration No.	EW-2500	EW-2874
Manufacturer	R&S	R&S
Model No.	ESCI	ENV-216
Calibration Date	November 28, 2018	March 29, 2018
Calibration Due Date	November 28, 2019	March 29, 2019

3) Conductive Measurement Test

Equipment	Spectrum Analyzer
Registration No.	EW-2253
Manufacturer	R&S
Model No.	FSP40
Calibration Date	November 27, 2018
Calibration Due Date	November 27, 2019

END OF TEST REPORT