



FCC RADIO TEST REPORT

FCC ID : N89-NM3531
Equipment : 802.11a/b/g/n/ac BT5.0 combo NGFF M.2 2230 card
Brand Name : CyberTAN
Model Name : NM353-1
Applicant : CyberTAN Technology Inc.
No. 99, Park Avenue III Science-based Industrial
Park Hsinchu Taiwan 308
Manufacturer : CyberTAN Technology Inc.
No. 99, Park Avenue III Science-based Industrial
Park Hsinchu Taiwan 308
Standard : 47 CFR FCC Part 15.247

The product was received on Apr. 03, 2018, and testing was started from Apr. 10, 2018 and completed on Apr. 26, 2018. We, SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)



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Appendix A. Test Results of AC Power-line Conducted Emissions**Appendix B. Test Results of DTS Bandwidth****Appendix C. Test Results of Maximum Conducted Output Power****Appendix D. Test Results of Power Spectral Density****Appendix E. Test Results of Emissions in Non-restricted Frequency Bands****Appendix F. Test Results of Emissions in Restricted Frequency Bands****Appendix G. Test Results of Radiated Emission Co-location****Appendix H. Test Photos****Photographs of EUT v01**



History of this test report



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
1.1.2	15.203	Antenna Requirement	PASS	-
3.1	15.207	AC Power-line Conducted Emissions	PASS	-
3.2	15.247(a)	DTS Bandwidth	PASS	-
3.3	15.247(b)	Maximum Conducted Output Power	PASS	-
3.4	15.247(e)	Power Spectral Density	PASS	-
3.5	15.247(d)	Emissions in Non-restricted Frequency Bands	PASS	-
3.6	15.247(d)	Emissions in Restricted Frequency Bands	PASS	-

Reviewed by: Sam Chen

Report Producer: Sandy Chuang



1 General Description

1.1 Information

1.1.1 RF General Information

Frequency Range (MHz)	Bluetooth Mode	Ch. Frequency (MHz)	Channel Number
2400-2483.5	LE	2402-2480	0-39 [40]

Band	Mode	BWch (MHz)	Nant
2.4-2.4835GHz	BT5.0-LE	1	1TX

Note:

- Bluetooth LE uses a GFSK (1Mbps) modulation for DSSS.
- BWch is the nominal channel bandwidth.
- Nss-Min is the minimum number of spatial streams.
- Nant is the number of outputs. e.g., 2(2, 3) means have 2 outputs for port 2 and port 3. 2 means have 2 outputs for port 1 and port 2.



1.1.2 Antenna Information

Ant.	Port	Brand	Model Name	Antenna Type	Connector	Gain (dBi)		
						2.4GHz WLAN	5GHz WLAN	Bluetooth
1	1	INPAQ	WA-P-LB-01-213	Dipole Antenna	I-PEX	2.92	3.99	2.92
2	2	INPAQ	WA-P-LB-02-564	Dipole Antenna	I-PEX	2.82	4.00	-

Note: 1. The EUT has two antennas.

Note: 2. Ant. 1 supports WLAN and Bluetooth, Ant. 2 supports WLAN only.

<For 2.4GHz Band>

For IEEE 802.11b mode (1TX/2RX)

The EUT supports 1TX/2RX function, and it supports TX diversity function.

Both Port 1 and Port 2 could be used as transmitting antenna, but only one of them will be used at one time. Port 1 and Port 2 could receive simultaneously.

Port 2 generated the worst case than Port 1, so it is tested and recorded in the report.

For IEEE 802.11g/n mode (2TX/2RX)

Port 1 and Port 2 can be used as transmitting/receiving antenna.

Port 1 and Port 2 could transmit/receive simultaneously.

<For 5GHz Band>

For IEEE 802.11a/n/ac mode (2TX/2RX)

Port 1 and Port 2 can be used as transmitting/receiving antenna.

Port 1 and Port 2 could transmit/receive simultaneously.

<For Bluetooth function>

For bluetooth mode (1TX/1RX):

Only Port 1 can be used as transmitting/receiving antenna.



1.1.3 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)	VBW(Hz) $\geq 1/T$
BT5.0-LE	0.628	2.02	392.5u	3k

1.1.4 EUT Operational Condition

EUT Power Type	From host system			
Function	<input checked="" type="checkbox"/>	Point-to-multipoint	<input type="checkbox"/>	Point-to-point
Test Software Version	Hyper Terminal 5.1.2600.0			



1.2 Testing Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR FCC Part 15
- ♦ ANSI C63.10-2013
- ♦ FCC KDB 558074 D01 v04
- ♦ FCC KDB 412172 D01 v01r01

1.3 Testing Location Information

Testing Location				
<input type="checkbox"/>	HWA YA	ADD : No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL : 886-3-327-3456 FAX : 886-3-318-0055		
<input checked="" type="checkbox"/>	JHUBEI	ADD : No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C. TEL : 886-3-656-9065 FAX : 886-3-656-9085		

Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
RF Conducted	TH01-CB	Brian Sun / Caster Chang / Justin Liu	22°C / 54%	Apr. 15, 2018~Apr. 23, 2018
Radiated	03CH01-CB	Ekko Hsieh / Gino Huang	23.5°C / 49%	Apr. 10, 2018~Apr. 26, 2018
AC Conduction	CO01-CB	GN Hou	23°C / 58%	Apr. 24, 2018

Test site Designation No. TW0006 with FCC.

Test site registered number IC 4086D with Industry Canada.

1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	3.2 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	3.6 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Conducted Emission	1.7 dB	Confidence levels of 95%
Output Power Measurement	1.33 dB	Confidence levels of 95%
Power Density Measurement	1.27 dB	Confidence levels of 95%
Bandwidth Measurement	9.74 x10 ⁻⁸	Confidence levels of 95%



2 Test Configuration of EUT

2.1 Test Channel Mode

Mode	PowerSetting
BT5.0-LE_Nss1_1TX	-
2402MHz	Default
2440MHz	Default
2480MHz	Default



2.2 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests

Tests Item	AC power-line conducted emissions
Condition	AC power-line conducted measurement for line and neutral
Operating Mode	CTX
1	2.4GHz
2	5GHz
3	Bluetooth

For operating mode 1 is the worst case and it was record in this test report.

The Worst Case Mode for Following Conformance Tests

Tests Item	DTS Bandwidth Maximum Conducted Output Power Power Spectral Density Emissions in Non-restricted Frequency Bands
Test Condition	Conducted measurement at transmit chains

The Worst Case Mode for Following Conformance Tests

Tests Item	Emissions in Restricted Frequency Bands
Test Condition	Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type.
Operating Mode < 1GHz	CTX

Radiated Emissions above 1GHz test was performed at its 3-axis (X-axis, Y-axis and Z-axis). Y-axis was the worst case, so Radiated Emission test below 1GHz will follow this same configuration.

1	2.4GHz in Y-axis
2	5GHz in Y-axis
3	Bluetooth in Y-axis

For operating mode 1 is the worst case and it was record in this test report.

Operating Mode > 1GHz

1	CTX
2	5GHz in Y-axis
3	Bluetooth in Y-axis

Radiated Emissions above 1GHz test was performed at its 3-axis (X-axis, Y-axis and Z-axis). Y-axis was the worst case, so test will follow this same configuration.

1	CTX + bluetooth in Y-axis
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The Worst Case Mode for Following Conformance Tests	
Tests Item	Simultaneous Transmission Analysis - Radiated Emission Co-location
Test Condition	Radiated measurement
Operating Mode	Normal Link
1	WLAN 5GHz+ Bluetooth

Refer to Appendix G for Radiated Emission Co-location.

The Worst Case Mode for Following Conformance Tests	
Tests Item	Simultaneous Transmission Analysis - Co-location RF Exposure Evaluation
Operating Mode	
1	WLAN 5GHz+ Bluetooth

Refer to Sporton Test Report No.: FA832852 for Co-location RF Exposure Evaluation.

2.3 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

2.4 Support Equipment

For Test Site No: CO01-CB

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Test fixture	CyberTAN	T32X010CT00	N/A
2	NB	DELL	E6220	N/A
No.	Equipment	Brand Name	Model Name	FCC ID
3	Adapter	DEE VAN ENTERPRISE CO., LTD.	DSA-12PFU-05 FUS 050200	N/A

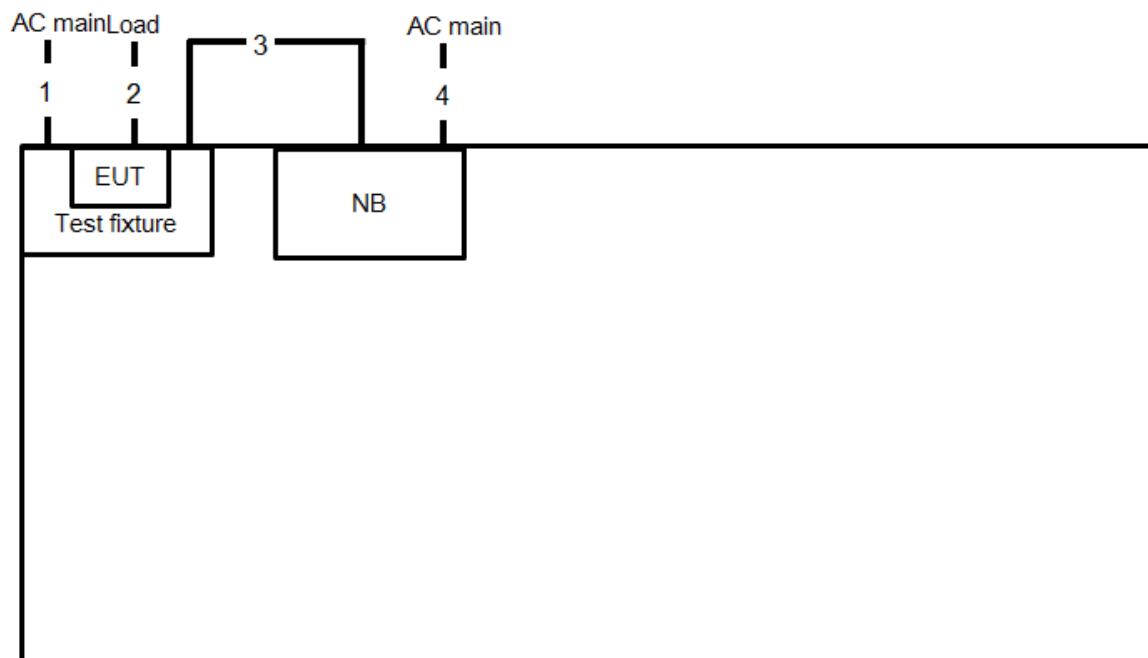
For Test Site No: 03CH01-CB and TH01-CB

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
1	NB	DELL	E4300	DoC
2	Test fixture	CyberTAN	T32X010CT00	N/A
No.	Equipment	Brand Name	Model Name	FCC ID
3	Adapter	DEE VAN ENTERPRISE CO., LTD.	DSA-12PFU-05 FUS 050200	N/A



2.5 Test Setup Diagram

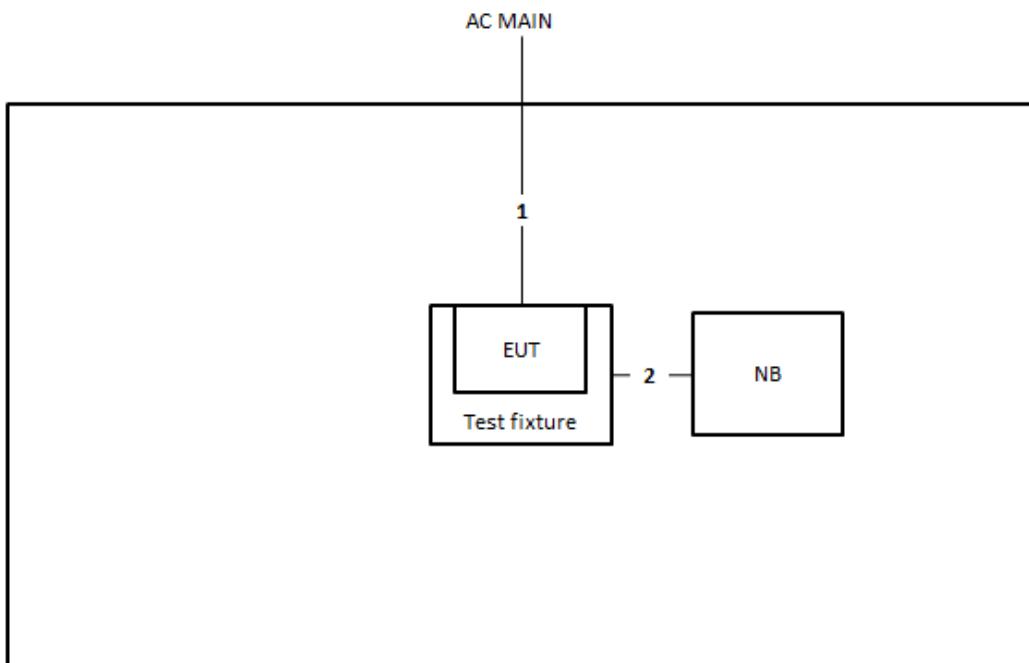
Test Setup Diagram – AC Line Conducted Emission Test



Item	Connection	Shielded	Length
1	Power cable	No	1.5m
2	RJ-45 cable	No	1.5m
3	Console cable	Yes	1.5m
4	Power cable	No	2.6m



Test Setup Diagram - Radiated Test



Item	Connection	Shielded	Length
1	Power cable	No	1.5m
2	Console cable	Yes	0.6m



3 Transmitter Test Result

3.1 AC Power-line Conducted Emissions

3.1.1 AC Power-line Conducted Emissions Limit

AC Power-line Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

Note 1: * Decreases with the logarithm of the frequency.

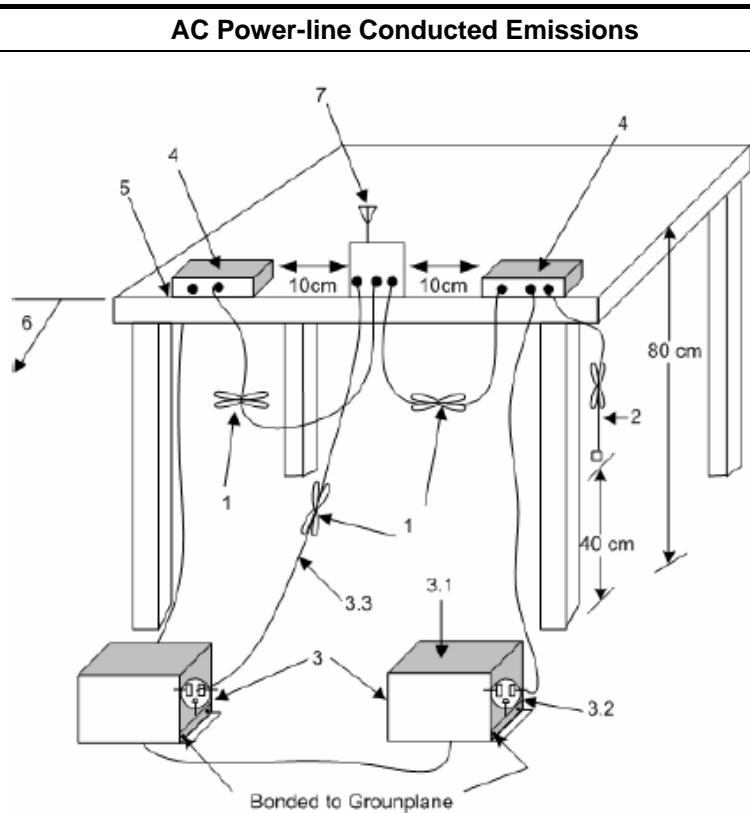
3.1.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.1.3 Test Procedures

Test Method
▪ Refer as ANSI C63.10-2013 , clause 6.2 for AC power-line conducted emissions.

3.1.4 Test Setup



- 1—Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long.
- 2—The I/O cables that are not connected to an accessory shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- 3—EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω loads. LISN may be placed on top of, or immediately beneath, reference ground plane.
 - 3.1—All other equipment powered from additional LISN(s).
 - 3.2—A multiple-outlet strip may be used for multiple power cords of non-EUT equipment.
 - 3.3—LISN at least 80 cm from nearest part of EUT chassis.
- 4—Non-EUT components of EUT system being tested.
- 5—Rear of EUT, including peripherals, shall all be aligned and flush with edge of tabletop.
- 6—Edge of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane.
- 7—Antenna can be integral or detachable. If detachable, then the antenna shall be attached for this test.

3.1.5 Test Result of AC Power-line Conducted Emissions

Refer as Appendix A



3.2 DTS Bandwidth

3.2.1 6dB Bandwidth Limit

6dB Bandwidth Limit
Systems using digital modulation techniques:
▪ 6 dB bandwidth \geq 500 kHz.

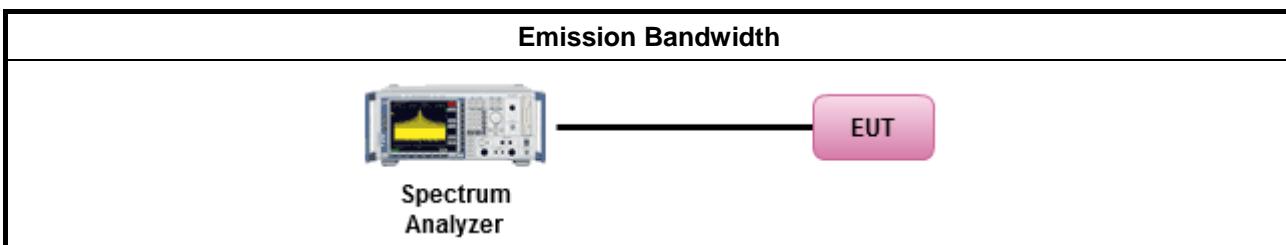
3.2.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.2.3 Test Procedures

Test Method
▪ For the emission bandwidth shall be measured using one of the options below:
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 8.1 Option 1 for 6 dB bandwidth measurement.
<input type="checkbox"/> Refer as FCC KDB 558074, clause 8.2 Option 2 for 6 dB bandwidth measurement.
<input type="checkbox"/> Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.

3.2.4 Test Setup



3.2.5 Test Result of Emission Bandwidth

Refer as Appendix B



3.3 Maximum Conducted Output Power

3.3.1 Maximum Conducted Output Power Limit

Maximum Conducted Output Power Limit	
	<ul style="list-style-type: none">▪ If $G_{TX} \leq 6 \text{ dBi}$, then $P_{Out} \leq 30 \text{ dBm}$ (1 W)
	<ul style="list-style-type: none">▪ Point-to-multipoint systems (P2M): If $G_{TX} > 6 \text{ dBi}$, then $P_{Out} = 30 - (G_{TX} - 6) \text{ dBm}$
	<ul style="list-style-type: none">▪ Point-to-point systems (P2P): If $G_{TX} > 6 \text{ dBi}$, then $P_{Out} = 30 - (G_{TX} - 6)/3 \text{ dBm}$
	<ul style="list-style-type: none">▪ Smart antenna system (SAS):<ul style="list-style-type: none">- Single beam: If $G_{TX} > 6 \text{ dBi}$, then $P_{Out} = 30 - (G_{TX} - 6)/3 \text{ dBm}$- Overlap beam: If $G_{TX} > 6 \text{ dBi}$, then $P_{Out} = 30 - (G_{TX} - 6)/3 \text{ dBm}$- Aggregate power on all beams: If $G_{TX} > 6 \text{ dBi}$, then $P_{Out} = 30 - (G_{TX} - 6)/3 + 8\text{dB dBm}$

P_{Out} = maximum peak conducted output power or maximum conducted output power in dBm,

G_{TX} = the maximum transmitting antenna directional gain in dBi.

3.3.2 Measuring Instruments

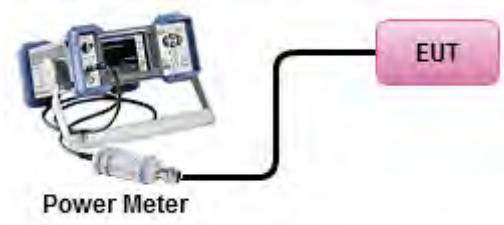
Refer a test equipment and calibration data table in this test report.



3.3.3 Test Procedures

Test Method	
▪ Maximum Peak Conducted Output Power	<input type="checkbox"/> Refer as FCC KDB 558074, clause 9.1.1 Option 1 (RBW \geq EBW method). <input type="checkbox"/> Refer as FCC KDB 558074, clause 9.1.3 (peak power meter for VBW \geq DTS BW)
▪ Maximum Conducted Output Power	<p>[duty cycle \geq 98% or external video / power trigger]</p> <input type="checkbox"/> Refer as FCC KDB 558074, clause 9.2.2.2 Method AVGSA-1 (spectral trace averaging). <input type="checkbox"/> Refer as FCC KDB 558074, clause 9.2.2.3 Method AVGSA-1 Alt. (slow sweep speed) <p>duty cycle < 98% and average over on/off periods with duty factor</p> <input type="checkbox"/> Refer as FCC KDB 558074, clause 9.2.2.4 Method AVGSA-2 (spectral trace averaging). <input type="checkbox"/> Refer as FCC KDB 558074, clause 9.2.2.5 Method AVGSA-2 Alt. (slow sweep speed) <p>Measurement using a power meter (PM)</p> <input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 9.2.3 Method AVGPM (using an RF average power meter). <input type="checkbox"/> Refer as FCC KDB 558074, clause 9.2.3.2 Method AVGPM-G (using an gate RF average power meter).
▪ For conducted measurement.	<ul style="list-style-type: none">If the EUT supports multiple transmit chains using options given below: Refer as FCC KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them.If multiple transmit chains, EIRP calculation could be following as methods: $P_{total} = P_1 + P_2 + \dots + P_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $EIRP_{total} = P_{total} + DG$

3.3.4 Test Setup

Maximum Conducted Output Power (Power Meter)


3.3.5 Test Result of Maximum Conducted Output Power

Refer as Appendix C



3.4 Power Spectral Density

3.4.1 Power Spectral Density Limit

Power Spectral Density Limit

- Power Spectral Density (PSD)≤8 dBm/3kHz

3.4.2 Measuring Instruments

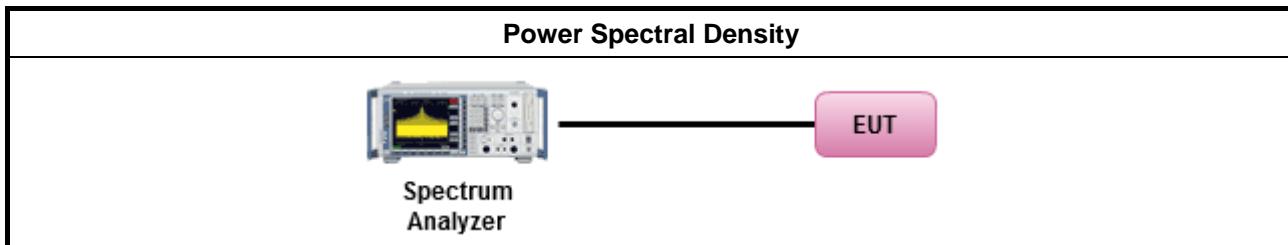
Refer a test equipment and calibration data table in this test report.

3.4.3 Test Procedures

Test Method
▪ Peak power spectral density procedures that the same method as used to determine the conducted output power. If maximum peak conducted output power was measured to demonstrate compliance to the output power limit, then the peak PSD procedure below (Method PKPSD) shall be used. If maximum conducted output power was measured to demonstrate compliance to the output power limit, then one of the average PSD procedures shall be used, as applicable based on the following criteria (the peak PSD procedure is also an acceptable option).
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 10.2 Method PKPSD (RBW=3-100kHz; Detector=peak). [duty cycle ≥ 98% or external video / power trigger]
<input type="checkbox"/> Refer as FCC KDB 558074, clause 10.3 Method AVGPSD-1 (spectral trace averaging).
<input type="checkbox"/> Refer as FCC KDB 558074, clause 10.4 Method AVGPSD-2 (slow sweep speed)
duty cycle < 98% and average over on/off periods with duty factor
<input type="checkbox"/> Refer as FCC KDB 558074, clause 10.5 Method AVGPSD-1 Alt (spectral trace averaging).
<input type="checkbox"/> Refer as FCC KDB 558074, clause 10.6 Method AVGPSD-2 Alt. (slow sweep speed)
▪ For conducted measurement.
▪ If The EUT supports multiple transmit chains using options given below:
<input checked="" type="checkbox"/> Option 1: Measure and sum the spectra across the outputs. Refer as FCC KDB 662911, In-band power spectral density (PSD). Sample all transmit ports simultaneously using a spectrum analyzer for each transmit port. Where the trace bin-by-bin of each transmit port summing can be performed. (i.e., in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the NTX output to obtain the value for the first frequency bin of the summed spectrum.). Add up the amplitude (power) values for the different transmit chains and use this as the new data trace.
<input type="checkbox"/> Option 2: Measure and sum spectral maxima across the outputs. With this technique, spectra are measured at each output of the device at the required resolution bandwidth. The maximum value (peak) of each spectrum is determined. These maximum values are then summed mathematically in linear power units across the outputs. These operations shall be performed separately over frequency spans that have different out-of-band or spurious emission limits,
<input type="checkbox"/> Option 3: Measure and add $10 \log(N)$ dB, where N is the number of transmit chains. Refer as FCC KDB 662911, In-band power spectral density (PSD). Performed at each transmit chains and each transmit chains shall be compared with the limit have been reduced with $10 \log(N)$. Or each transmit chains shall be add $10 \log(N)$ to compared with the limit.



3.4.4 Test Setup



3.4.5 Test Result of Power Spectral Density

Refer as Appendix D



3.5 Emissions in Non-restricted Frequency Bands

3.5.1 Emissions in Non-restricted Frequency Bands Limit

Un-restricted Band Emissions Limit	
RF output power procedure	Limit (dB)
Peak output power procedure	20
Average output power procedure	30

Note 1: If the peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level.

Note 2: If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in-band average PSD level.

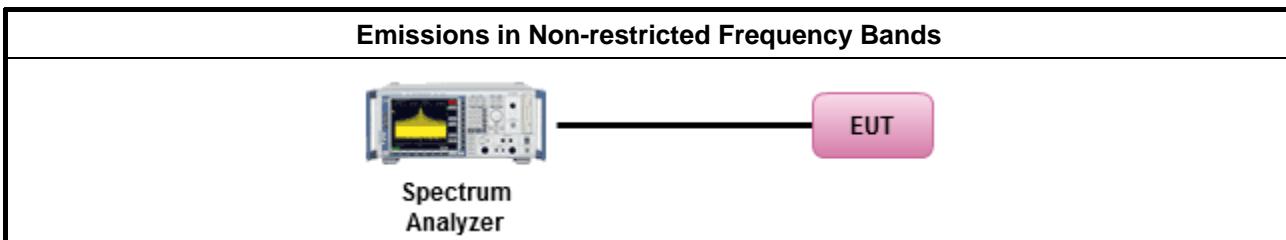
3.5.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.5.3 Test Procedures

Test Method
▪ Refer as FCC KDB 558074, clause 11 for unwanted emissions into non-restricted bands.

3.5.4 Test Setup



3.5.5 Test Result of Emissions in Non-restricted Frequency Bands

Refer as Appendix E



3.6 Emissions in Restricted Frequency Bands

3.6.1 Emissions in Restricted Frequency Bands Limit

Restricted Band Emissions Limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB / decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

Note 3: Using the distance of 1m during the test for above 18 GHz, and the test value to correct for the distance factor at 3m.

3.6.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

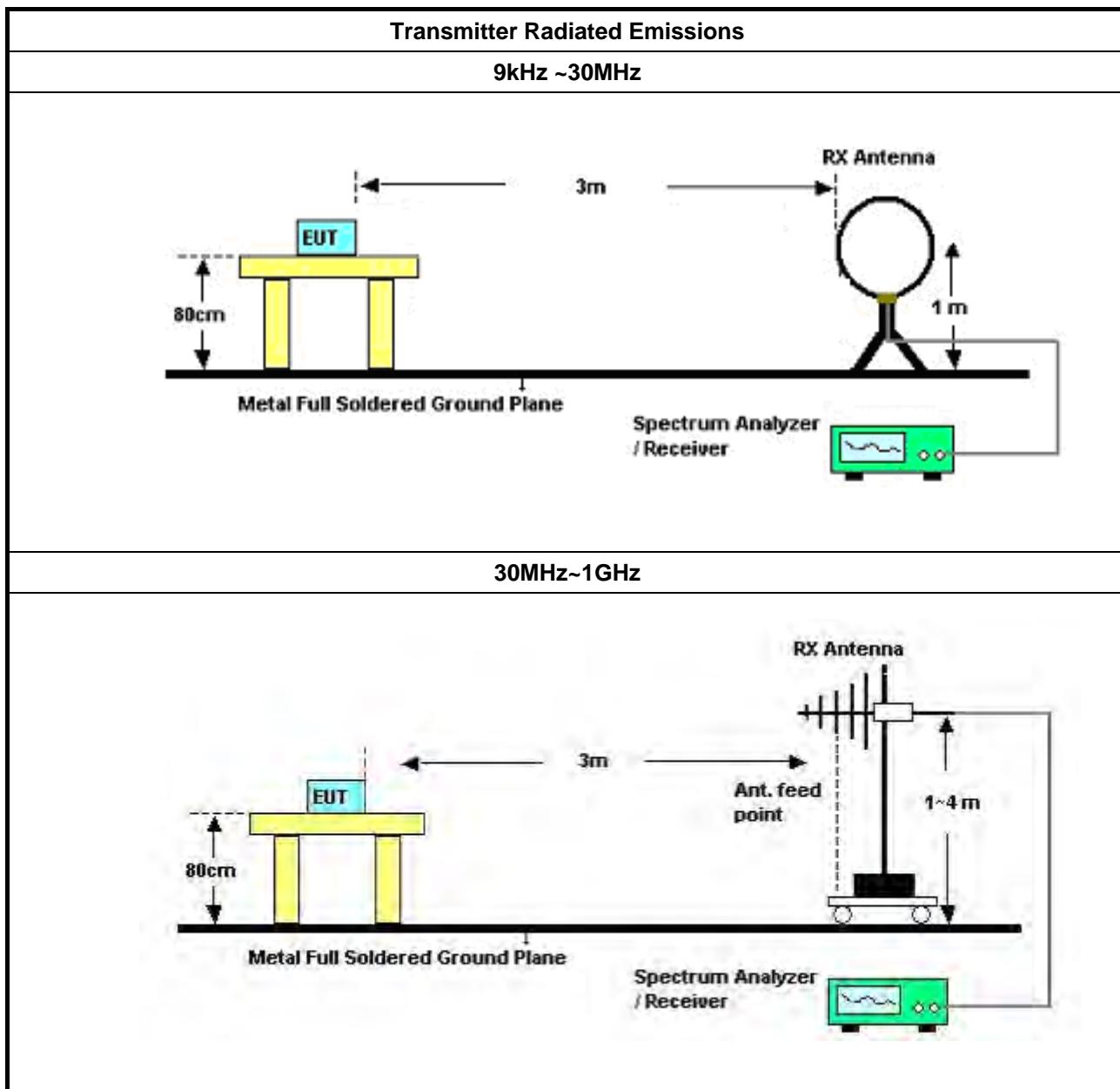


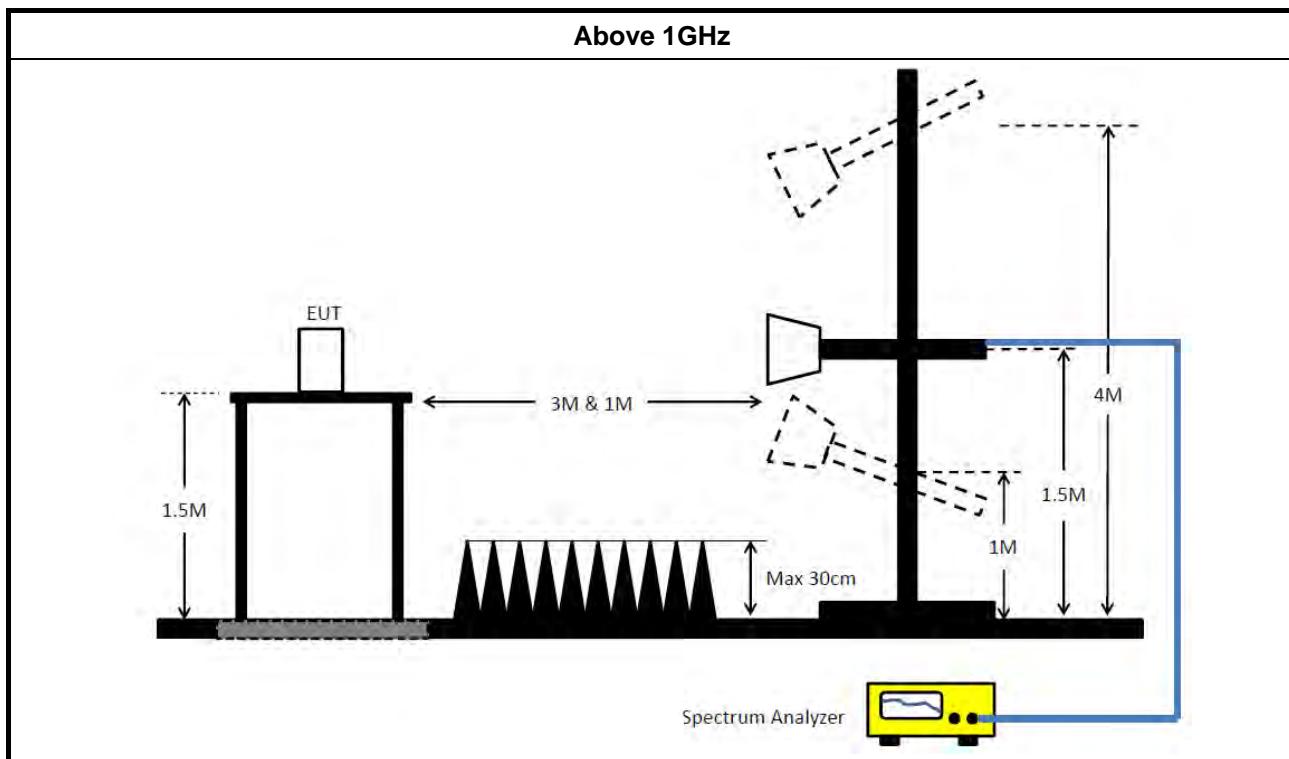
3.6.3 Test Procedures

Test Method	
▪ The average emission levels shall be measured in [duty cycle \geq 98 or duty factor].	
▪ Refer as ANSI C63.10, clause 6.9.2.2 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.	
▪ For the transmitter unwanted emissions shall be measured using following options below:	
	▪ Refer as FCC KDB 558074, clause 12 for unwanted emissions into restricted bands.
	<input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.1 Option 1 (trace averaging for duty cycle $\geq 98\%$)
	<input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.2 Option 2 (trace averaging + duty factor).
	<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.3 Option 3 (Reduced $VBW \geq 1/T$).
	<input type="checkbox"/> Refer as ANSI C63.10, clause 4.2.3.2.3 (Reduced VBW). $VBW \geq 1/T$, where T is pulse time.
	<input type="checkbox"/> Refer as ANSI C63.10, clause 4.2.3.2.4 average value of pulsed emissions.
	<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.4 measurement procedure peak limit.
▪ For the transmitter band-edge emissions shall be measured using following options below:	
	▪ Refer as FCC KDB 558074 clause 13.1, When the performing peak or average radiated measurements, emissions within 2 MHz of the authorized band edge may be measured using the marker-delta method described below.
	▪ Refer as FCC KDB 558074, clause 13.2 (ANSI C63.10, clause 6.9.3) for marker-delta method for band-edge measurements.
	▪ Refer as FCC KDB 558074, clause 13.3 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz).
▪ For conducted and cabinet radiation measurement, refer as FCC KDB 558074, clause 12.2.2.	
	▪ For conducted unwanted emissions into restricted bands (absolute emission limits). Devices with multiple transmit chains using options given below: (1) Measure and sum the spectra across the outputs or (2) Measure and add $10 \log(N)$ dB
	▪ For FCC KDB 662911 The methodology described here may overestimate array gain, thereby resulting in apparent failures to satisfy the out-of-band limits even if the device is actually compliant. In such cases, compliance may be demonstrated by performing radiated tests around the frequencies at which the apparent failures occurred.



3.6.4 Test Setup





3.6.5 Transmitter Radiated Unwanted Emissions (Below 30MHz)

All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

The radiated emissions were investigated from 9 kHz or the lowest frequency generated within the device, up to the 10 harmonic or 40 GHz, whichever is appropriate.

3.6.6 Transmitter Radiated Unwanted Emissions

Refer as Appendix F



4 Test Equipment and Calibration Data

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.45GHz	Jan. 31, 2018	Jan. 30, 2019	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Dec. 20, 2017	Dec. 19, 2018	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Dec. 29, 2017	Dec. 28, 2018	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150kHz ~ 30MHz	May 23, 2017	May 22, 2018	Conduction (CO01-CB)
Impulsbegrenzer Pulse Limiter	Rohde&Schwarz	ESH3-Z2	100430	9kHz ~ 30MHz	Feb. 06, 2018	Feb. 05, 2019	Conduction (CO01-CB)
Software	Audix	E3	6.120210n	-	N.C.R.	N.C.R.	Conduction (CO01-CB)
BILOG ANTENNA with 6dB Attenuator	TESEQ & EMCI	CBL6112D & N-6-06	37880 & AT-N0609	20MHz ~ 2GHz	Aug. 30, 2017	Aug. 29, 2018	Radiation (03CH01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Mar. 16, 2018	Mar. 15, 2019	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Nov. 20, 2017	Nov. 19, 2018	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 05, 2017	Jul. 04, 2018	Radiation (03CH01-CB)
Pre-Amplifier	EMCI	EMC330N	980332	20MHz ~ 3GHz	May 02, 2017	May 01, 2018	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 09, 2018	Jan. 08, 2019	Radiation (03CH01-CB)
Pre-Amplifier	MITEQ	TTA1840-35-H G	1864479	18GHz ~ 40GHz	Jul. 10, 2017	Jul. 09, 2018	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Nov. 23, 2017	Nov. 22, 2018	Radiation (03CH01-CB)
EMI Test	R&S	ESCS	100355	9kHz ~ 2.75GHz	May 06, 2017	May 05, 2018	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-16+17	N/A	30 MHz ~ 1 GHz	Oct. 11, 2017	Oct. 10, 2018	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16	N/A	1 GHz ~ 18 GHz	Oct. 11, 2017	Oct. 10, 2018	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16+17	N/A	1 GHz ~ 18 GHz	Oct. 11, 2017	Oct. 10, 2018	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#1	N/A	18GHz ~ 40 GHz	Oct. 11, 2017	Oct. 10, 2018	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#2	N/A	18GHz ~ 40 GHz	Oct. 11, 2017	Oct. 10, 2018	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSV40	100979	9kHz~40GHz	Dec. 21, 2017	Dec. 20, 2018	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-06	1 GHz – 26.5 GHz	Oct. 11, 2017	Oct. 10, 2018	Conducted (TH01-CB)

**FCC RADIO TEST REPORT****Report No. : FR832852AD**

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
RF Cable-high	Woken	RG402	High Cable-07	1 GHz –26.5 GHz	Oct. 11, 2017	Oct. 10, 2018	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-08	1 GHz –26.5 GHz	Oct. 11, 2017	Oct. 10, 2018	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-09	1 GHz –26.5 GHz	Oct. 11, 2017	Oct. 10, 2018	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz –26.5 GHz	Oct. 11, 2017	Oct. 10, 2018	Conducted (TH01-CB)
Power Sensor	Agilent	U2021XA	MY53410001	50MHz~18GHz	Nov. 20, 2017	Nov. 19, 2018	Conducted (TH01-CB)

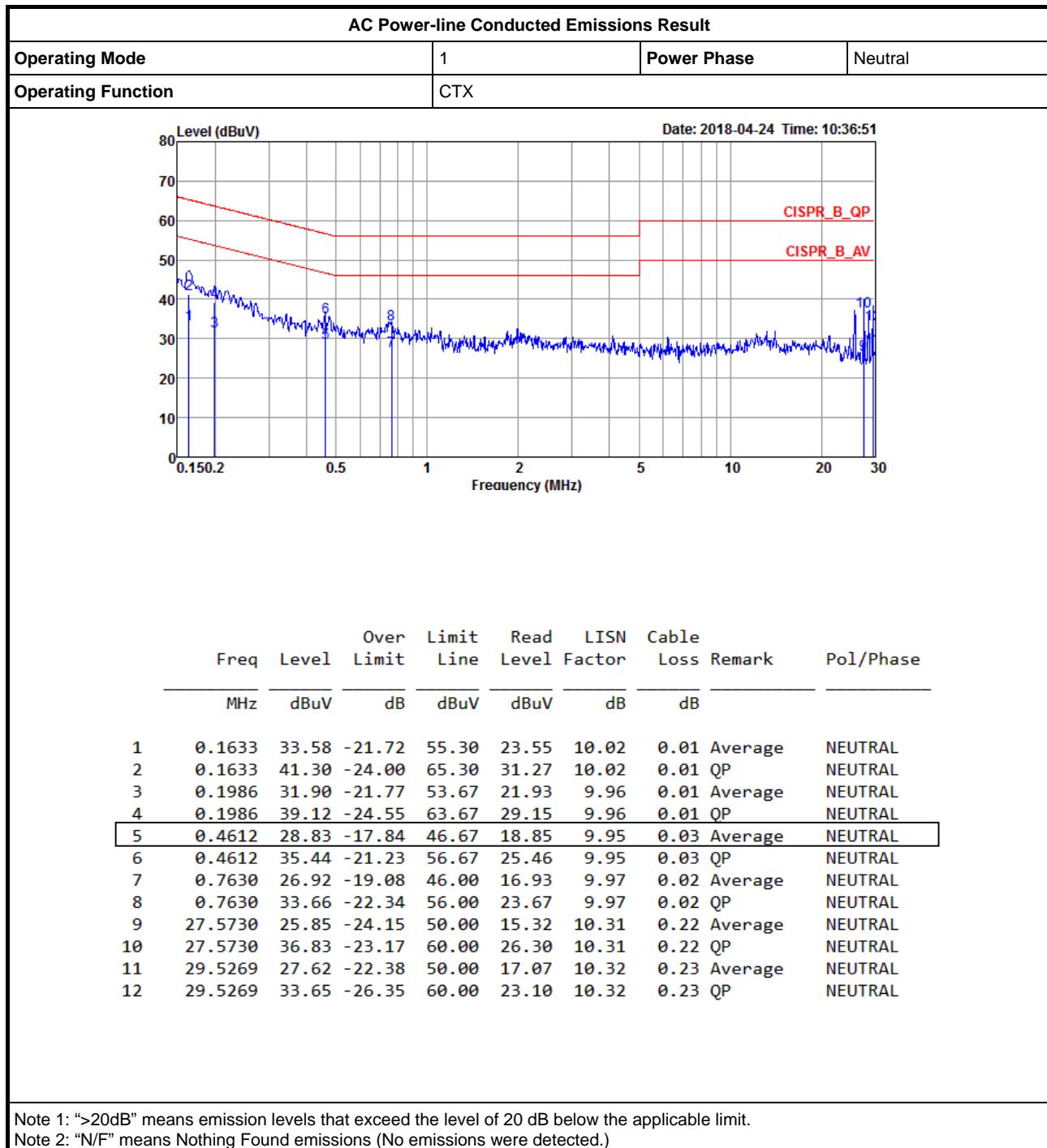
Note: Calibration Interval of instruments listed above is one year.

NCR means Non-Calibration required.



AC Power-line Conducted Emissions Result

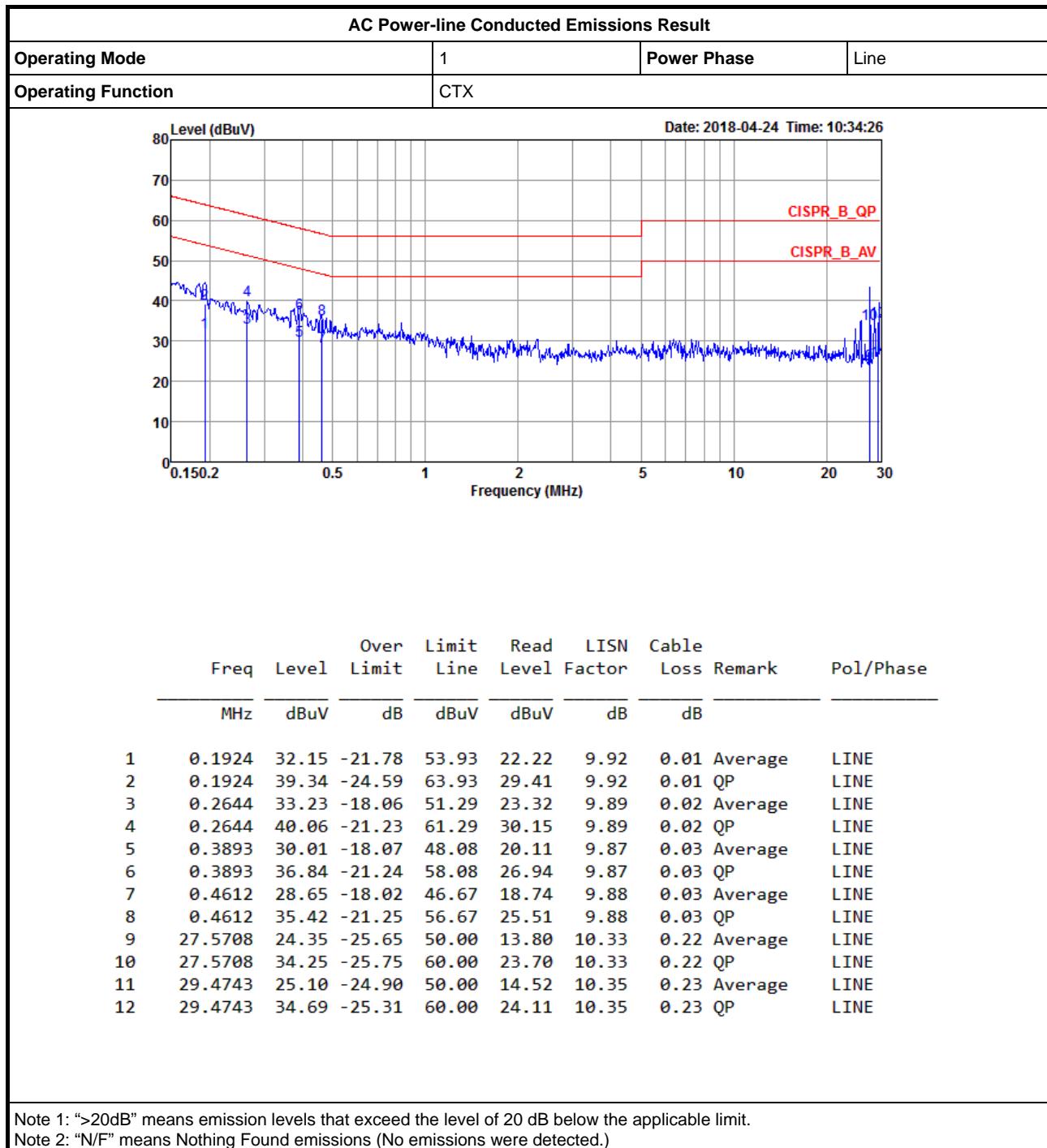
Appendix A





AC Power-line Conducted Emissions Result

Appendix A



**Summary**

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
2.4-2.4835GHz	-	-	-	-	-
BT5.0-LE_Nss1_1TX	722.5k	1.046M	1M05D1D	718.75k	1.044M

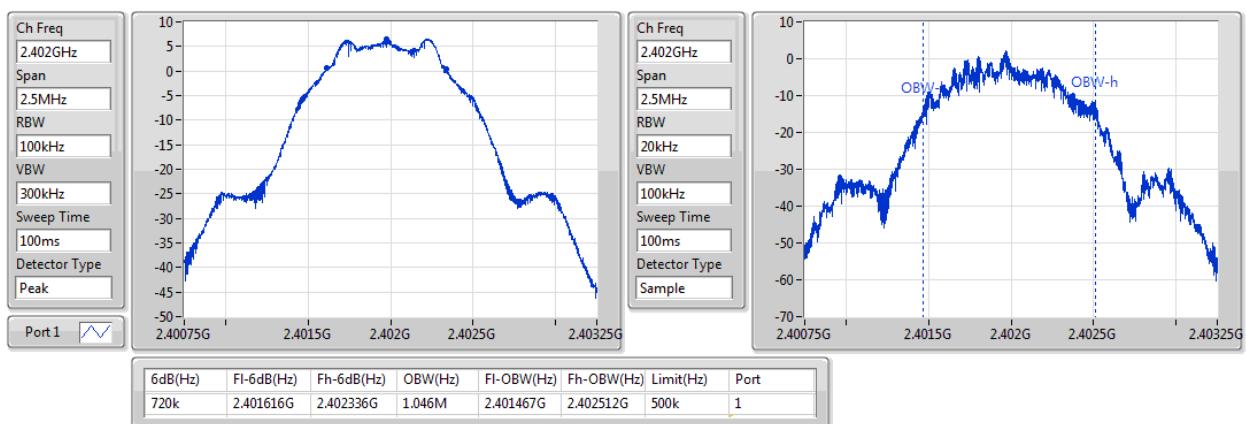
Max-N dB = Maximum 6dB down bandwidth; **Max-OBW** = Maximum 99% occupied bandwidth;**Min-N dB** = Minimum 6dB down bandwidth; **Min-OBW** = Minimum 99% occupied bandwidth;**Result**

Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
BT5.0-LE_Nss1_1TX	-	-	-	-
2402MHz	Pass	500k	720k	1.046M
2440MHz	Pass	500k	718.75k	1.044M
2480MHz	Pass	500k	722.5k	1.046M

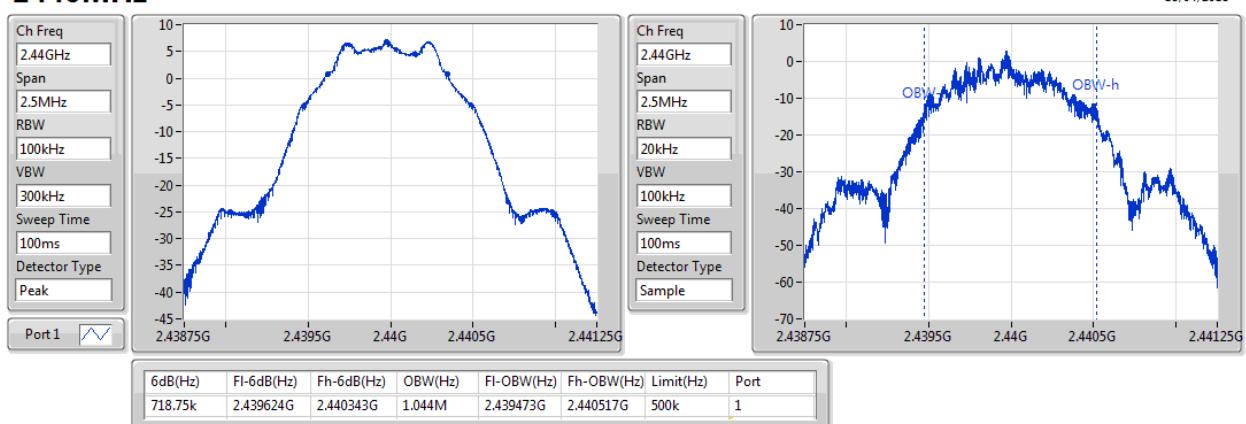
Port X-N dB = Port X 6dB down bandwidth; **Port X-OBW** = Port X 99% occupied bandwidth;

BT5.0-LE_Nss1_1TX
EBW
2402MHz

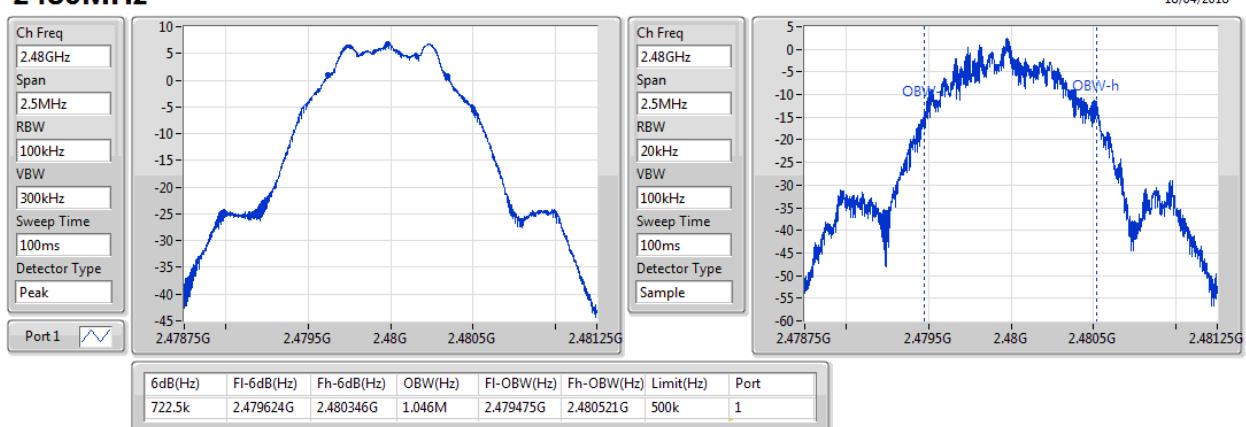
18/04/2018


BT5.0-LE_Nss1_1TX
EBW
2440MHz

18/04/2018


BT5.0-LE_Nss1_1TX
EBW
2480MHz

18/04/2018



**Summary**

Mode	Power (dBm)	Power (W)
2.4-2.4835GHz	-	-
BT5.0-LE_Nss1_1TX	7.00	0.00501

Result

Mode	Result	Gain (dBi)	Power (dBm)	Power Limit (dBm)
BT5.0-LE_Nss1_1TX	-	-	-	-
2402MHz	Pass	2.92	6.73	30.00
2440MHz	Pass	2.92	7.00	30.00
2480MHz	Pass	2.92	6.94	30.00

**Summary**

Mode	PD (dBm/RBW)
2.4-2.4835GHz	-
BT5.0-LE_Nss1_1TX	-7.11

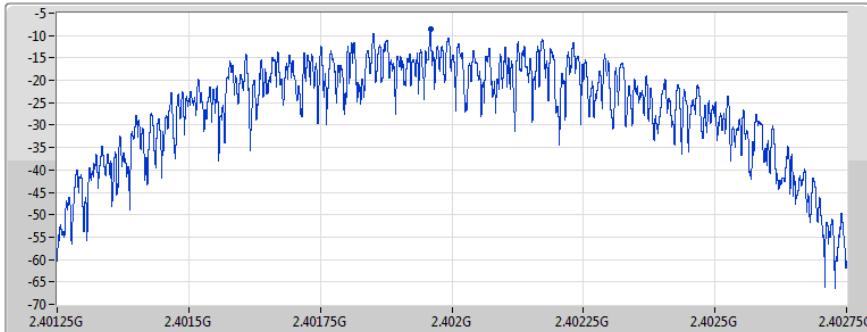
RBW=3kHz.

Result

Mode	Result	Gain (dBi)	PD (dBm/RBW)	PD Limit (dBm/RBW)
BT5.0-LE_Nss1_1TX	-	-	-	-
2402MHz	Pass	2.92	-8.55	8.00
2440MHz	Pass	2.92	-7.11	8.00
2480MHz	Pass	2.92	-10.22	8.00

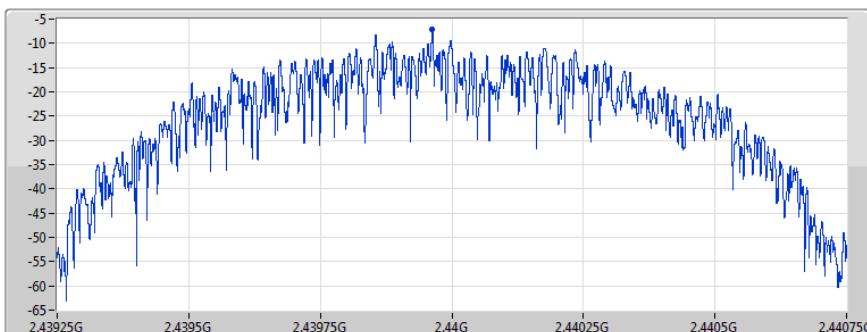
RBW=3kHz.

BT5.0-LE _Nss1_1TX
2402MHz

 Ch Freq
 2.402GHz
 Span
 1.5MHz
 RBW
 3kHz
 VBW
 10kHz
 Sweep Time
 32.1ms
 Detector Type
 Peak

PSD

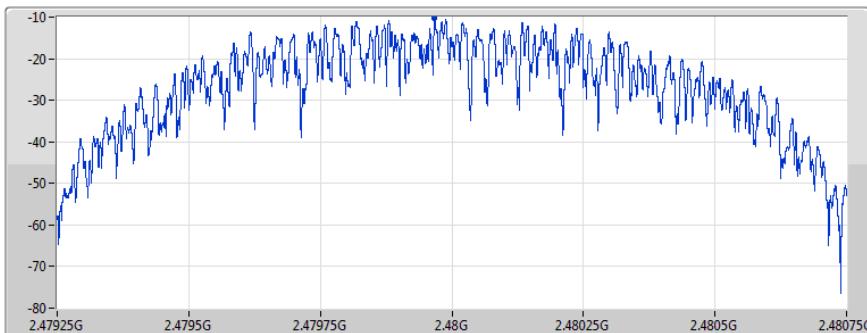
18/04/2018

 Port 1
BT5.0-LE _Nss1_1TX
2440MHz

 Ch Freq
 2.44GHz
 Span
 1.5MHz
 RBW
 3kHz
 VBW
 10kHz
 Sweep Time
 32.1ms
 Detector Type
 Peak

PSD

18/04/2018

 Port 1
BT5.0-LE _Nss1_1TX
2480MHz

 Ch Freq
 2.48GHz
 Span
 1.5MHz
 RBW
 3kHz
 VBW
 10kHz
 Sweep Time
 32.1ms
 Detector Type
 Peak

PSD

18/04/2018

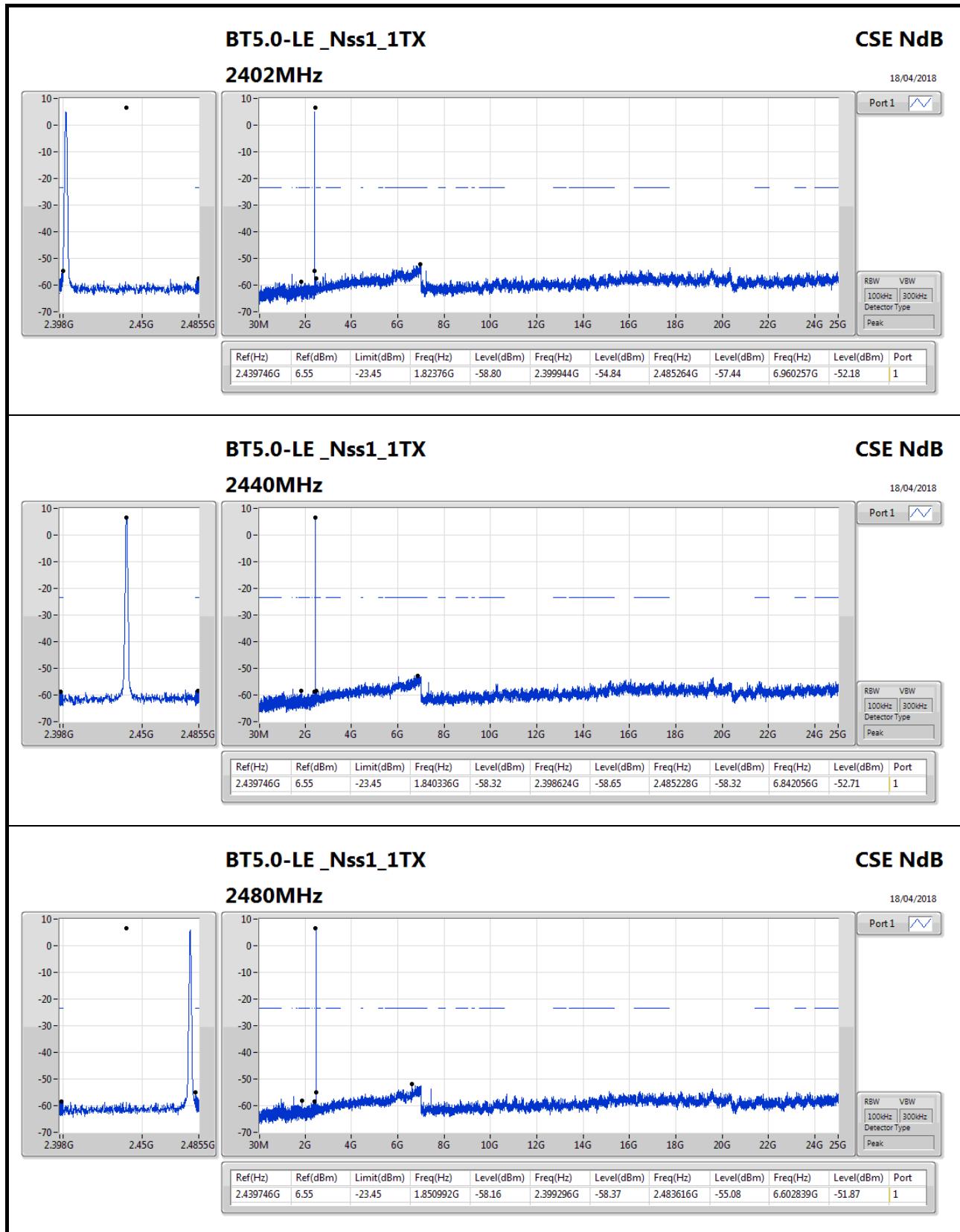
 Port 1

**Summary**

Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Port						
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-	-
BT5.0-LE_Nss1_1TX	Pass	2.439746G	6.55	-23.45	1.850992G	-58.16	2.399296G	-58.37	2.483616G	-55.08	6.602839G	-51.87	1

Result

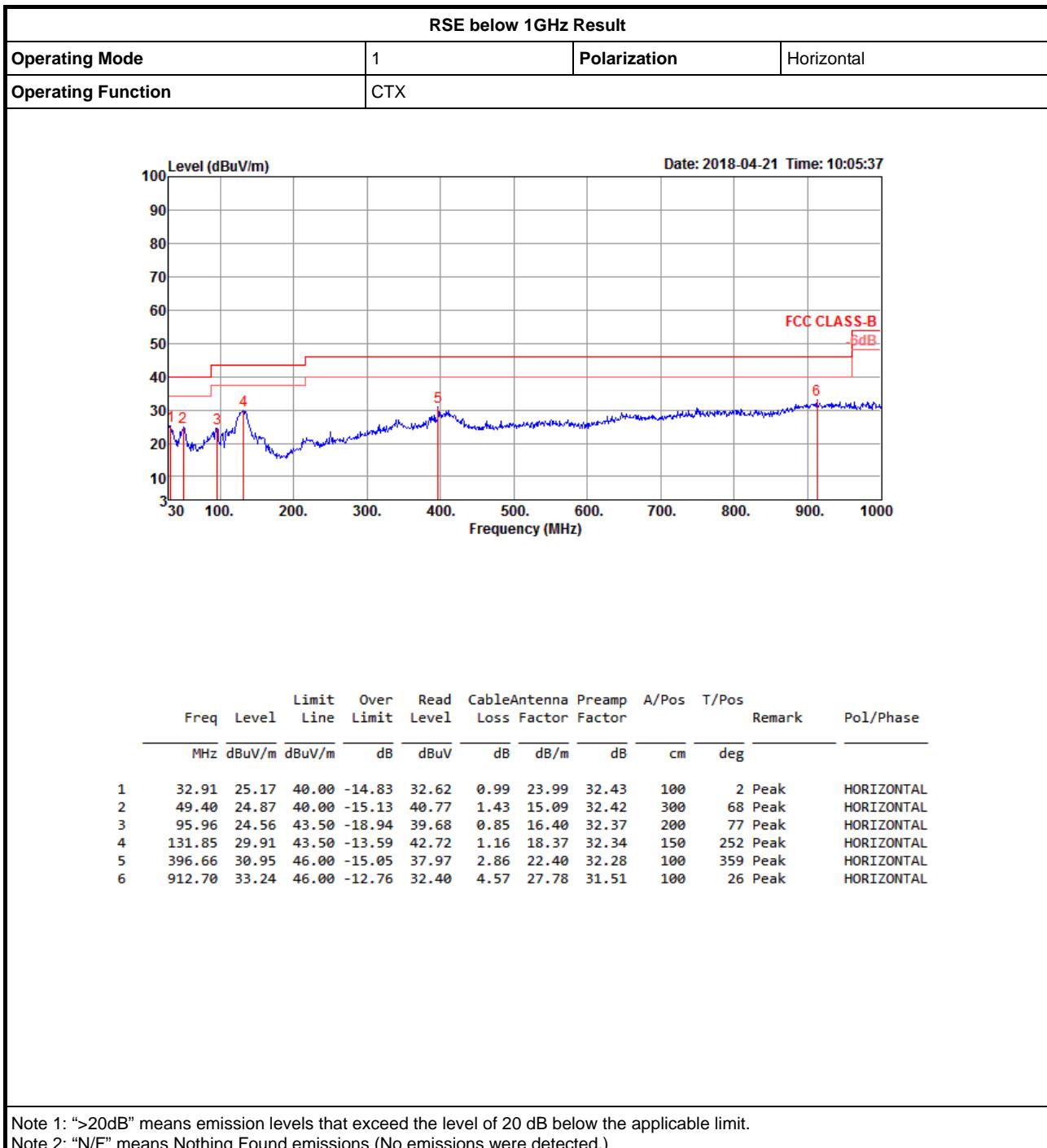
Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Port						
BT5.0-LE_Nss1_1TX	-	-	-	-	-	-	-	-	-	-	-	-	-
2402MHz	Pass	2.439746G	6.55	-23.45	1.82376G	-58.80	2.399944G	-54.84	2.485264G	-57.44	6.960257G	-52.18	1
2440MHz	Pass	2.439746G	6.55	-23.45	1.840336G	-58.32	2.398624G	-58.65	2.485228G	-58.32	6.842056G	-52.71	1
2480MHz	Pass	2.439746G	6.55	-23.45	1.850992G	-58.16	2.399296G	-58.37	2.483616G	-55.08	6.602839G	-51.87	1

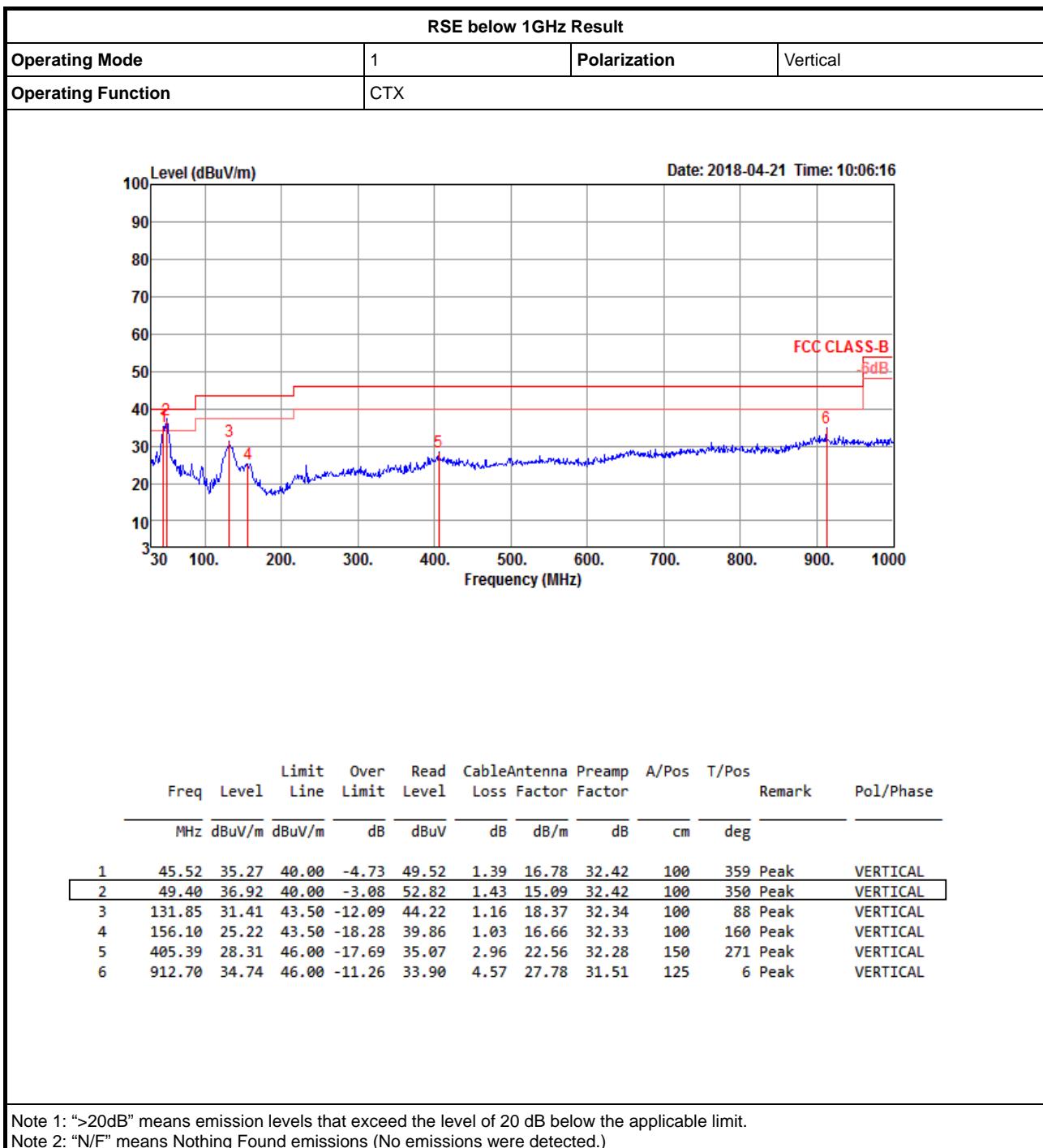




RSE below 1GHz Result

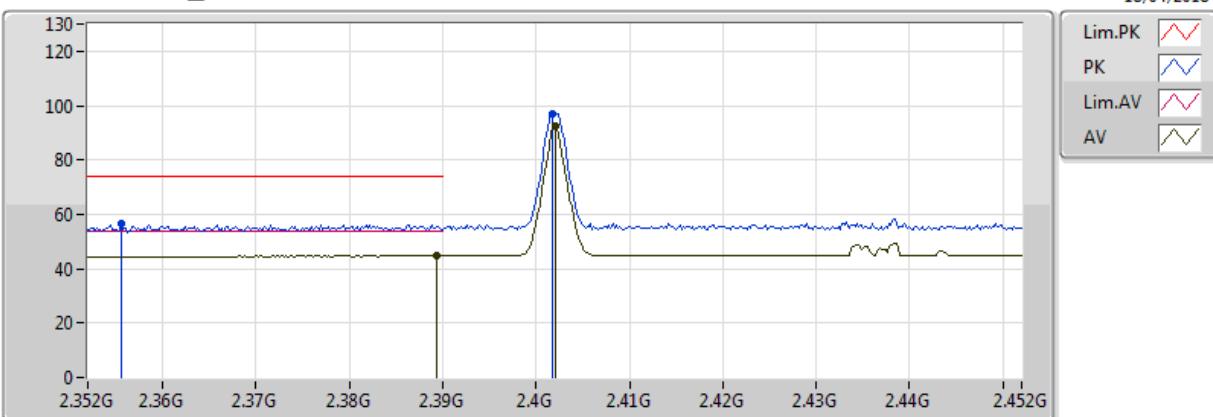
Appendix F.1





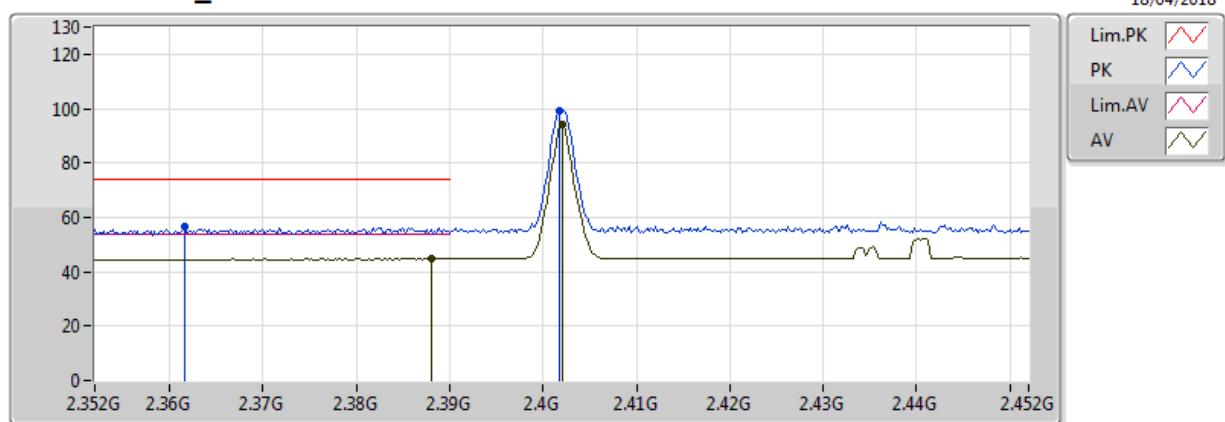
**Summary**

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-
BT5.0-LE_Nss1_1TX	Pass	AV	2.483502G	46.96	54.00	-7.04	32.42	3	Vertical	91	2.93	-

BT5.0-LE_Nss1_1TX
2402MHz_TX


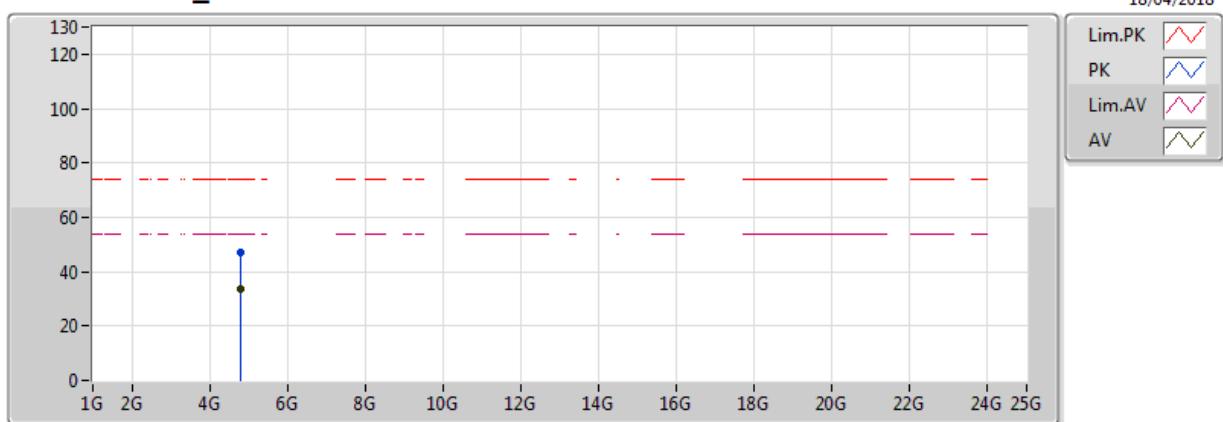
EUT Y_1TX
Setting Default Power
06-G-2
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
PK	2.3556G	56.33	74.00	-17.67	32.01	3	Vertical	87	2.54	-
AV	2.3894G	44.74	54.00	-9.26	32.11	3	Vertical	87	2.54	-
PK	2.4018G	96.85	Inf	-Inf	32.16	3	Vertical	87	2.54	-
AV	2.402G	92.27	Inf	-Inf	32.16	3	Vertical	87	2.54	-

BT5.0-LE_Nss1_1TX
2402MHz_TX


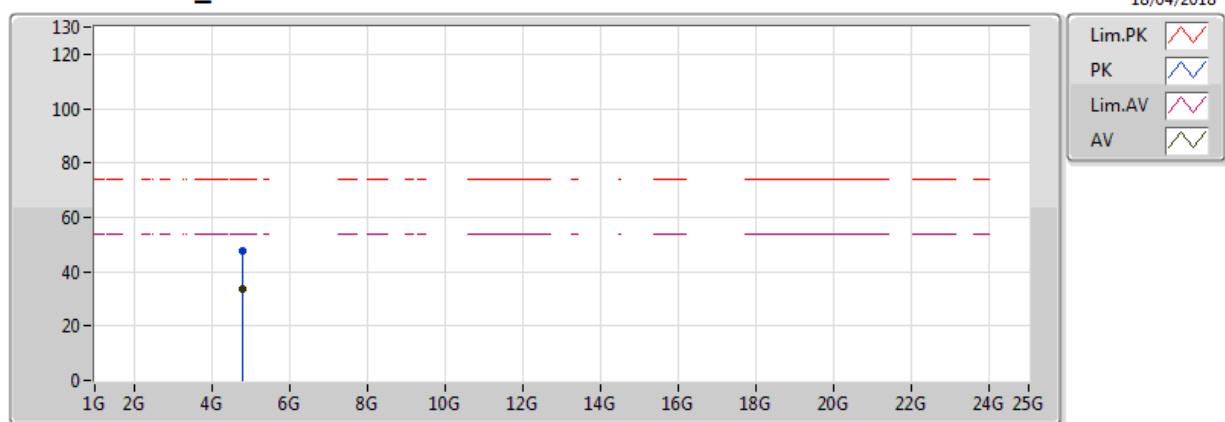
EUT Y_1TX
Setting Default Power
06-G-2
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
PK	2.3616G	56.43	74.00	-17.57	32.02	3	Horizontal	344	2.39	-
AV	2.388G	44.83	54.00	-9.17	32.11	3	Horizontal	344	2.39	-
PK	2.4018G	98.98	Inf	-Inf	32.16	3	Horizontal	344	2.39	-
AV	2.402G	94.29	Inf	-Inf	32.16	3	Horizontal	344	2.39	-

BT5.0-LE_Nss1_1TX
2402MHz_TX


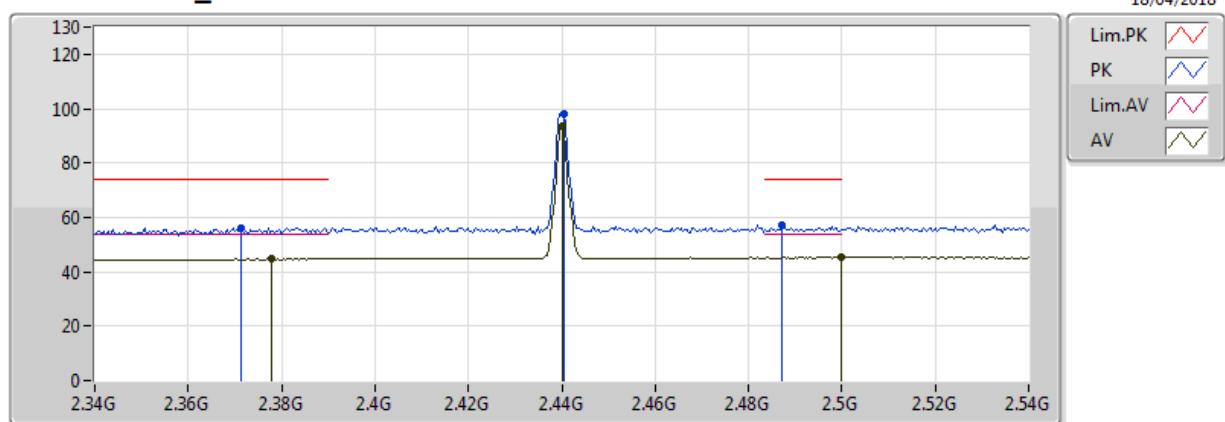
EUT Y_1TX
Setting Default Power
06-G-2
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
PK	4.804232G	47.22	74.00	-26.78	6.64	3	Vertical	257	1.48	-
AV	4.80312G	33.62	54.00	-20.38	6.64	3	Vertical	257	1.48	-

BT5.0-LE_Nss1_1TX
2402MHz_TX


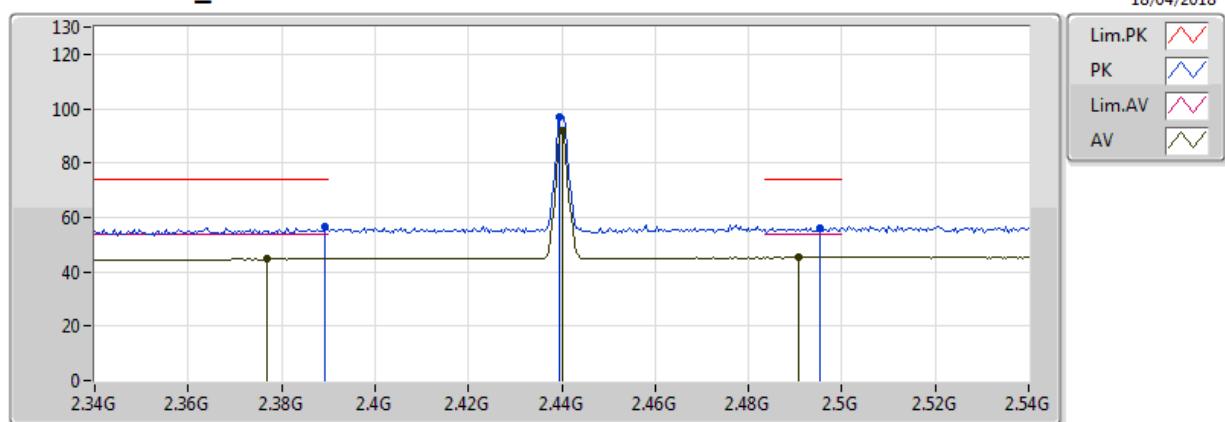
EUT Y_1TX
Setting Default Power
06-G-2
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
PK	4.803676G	47.55	74.00	-26.45	6.64	3	Horizontal	296	1.22	-
AV	4.804744G	33.90	54.00	-20.10	6.64	3	Horizontal	296	1.22	-

BT5.0-LE_Nss1_1TX
2440MHz_TX


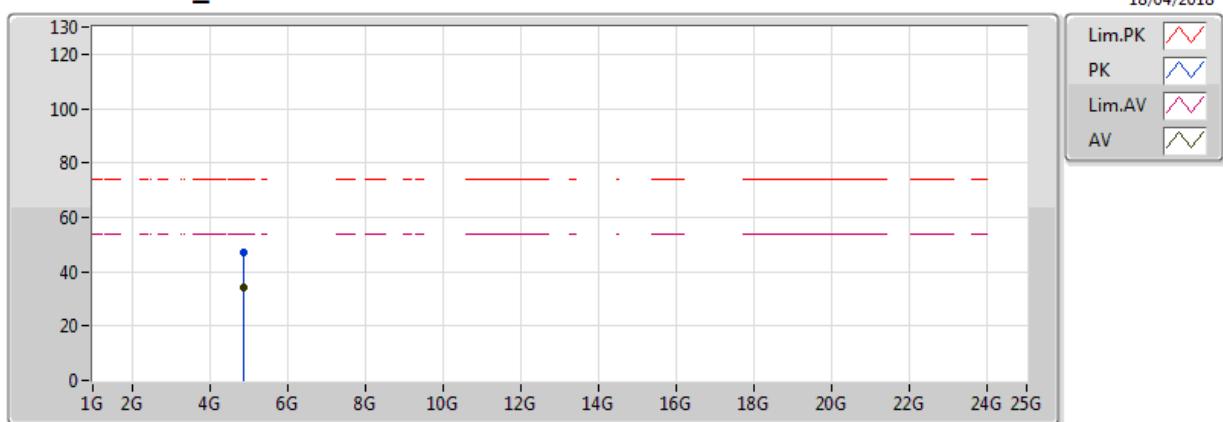
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Setting Default Power
06-G-2
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition (°)	Azimuth (m)	Height (m)	Comments
PK	2.3712G	56.18	74.00	-17.82	32.06	3	Vertical	94	2.98	-
AV	2.378G	44.75	54.00	-9.25	32.08	3	Vertical	94	2.98	-
PK	2.4404G	98.11	Inf	-Inf	32.28	3	Vertical	94	2.98	-
AV	2.44G	93.35	Inf	-Inf	32.28	3	Vertical	94	2.98	-
PK	2.4872G	57.09	74.00	-16.91	32.43	3	Vertical	94	2.98	-
AV	2.5G	45.30	54.00	-8.70	32.48	3	Vertical	94	2.98	-

BT5.0-LE_Nss1_1TX
2440MHz_TX


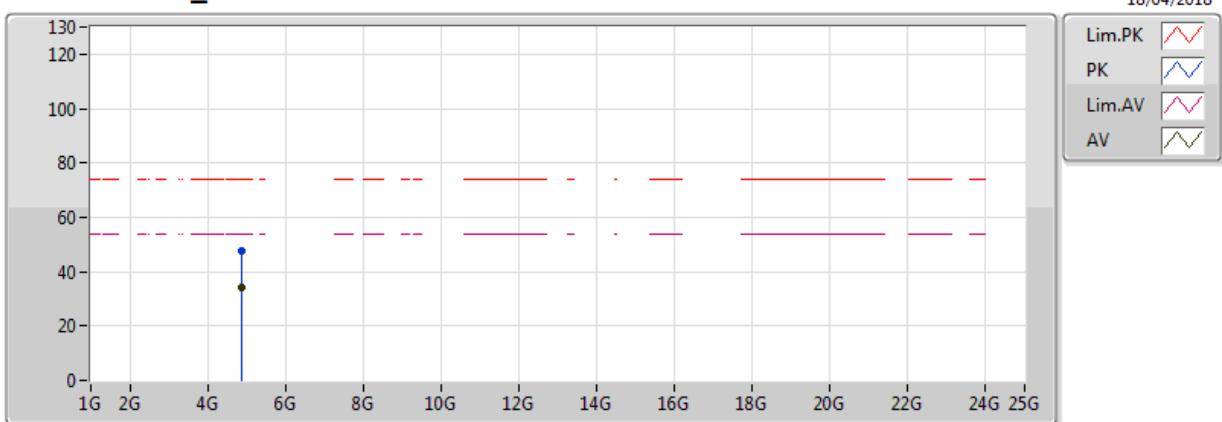
EUT Y_1TX
Setting Default Power
06-G-2
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
PK	2.3892G	56.37	74.00	-17.63	32.11	3	Horizontal	340	1.86	-
AV	2.3768G	44.82	54.00	-9.18	32.07	3	Horizontal	340	1.86	-
PK	2.4396G	96.94	Inf	-Inf	32.28	3	Horizontal	340	1.86	-
AV	2.44G	92.08	Inf	-Inf	32.28	3	Horizontal	340	1.86	-
PK	2.4952G	56.29	74.00	-17.71	32.46	3	Horizontal	340	1.86	-
AV	2.4908G	45.42	54.00	-8.58	32.45	3	Horizontal	340	1.86	-

BT5.0-LE_Nss1_1TX
2440MHz_TX


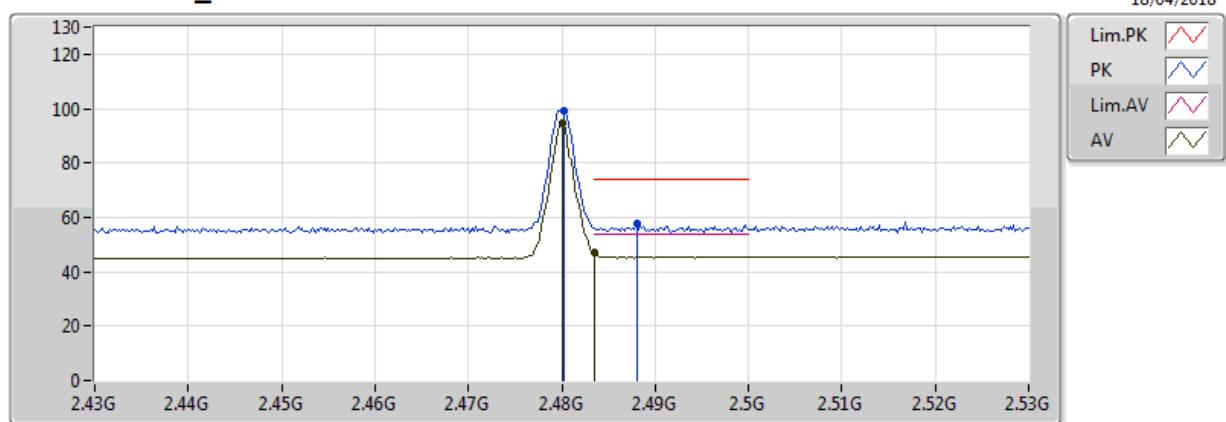
EUT Y_1TX
Setting Default Power
06-G-2
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
PK	4.880992G	47.25	74.00	-26.75	6.86	3	Vertical	286	1.37	-
AV	4.879036G	34.43	54.00	-19.57	6.85	3	Vertical	286	1.37	-

BT5.0-LE_Nss1_1TX
2440MHz_TX


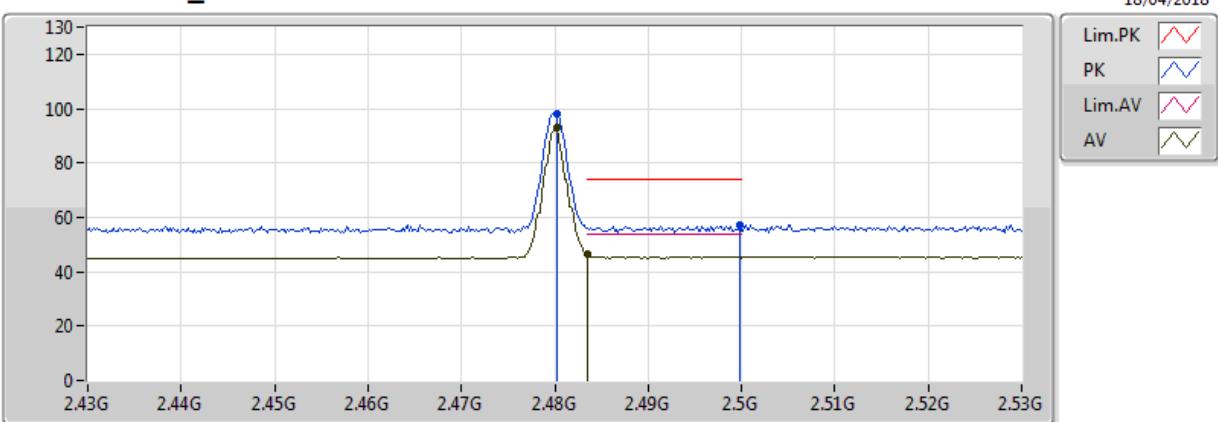
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Setting Default Power
06-G-2
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
PK	4.880864G	47.66	74.00	-26.34	6.86	3	Horizontal	275	1.48	-
AV	4.880608G	34.18	54.00	-19.82	6.86	3	Horizontal	275	1.48	-

BT5.0-LE_Nss1_1TX
2480MHz_TX


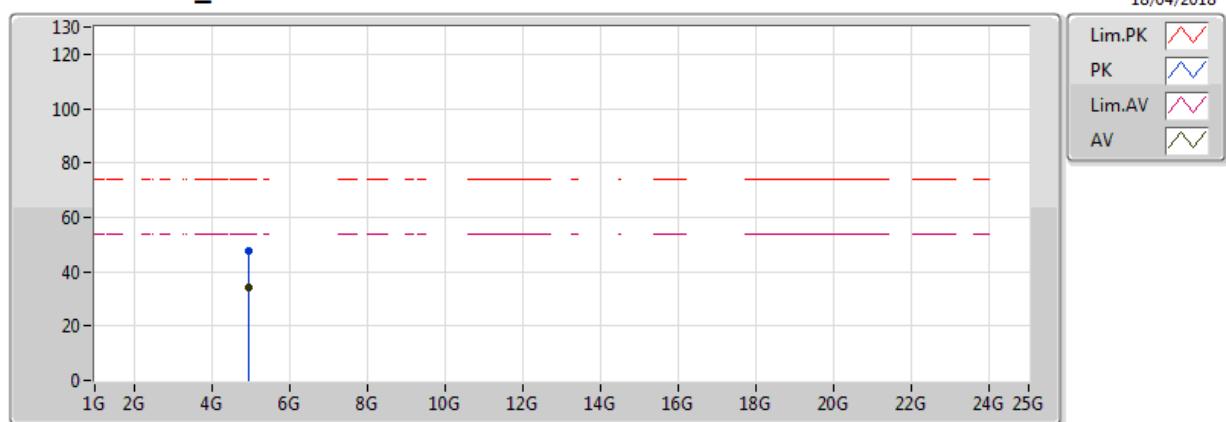
EUT Y_1TX
Setting Default Power
06-G-2
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition (°)	Azimuth (m)	Height (m)	Comments
PK	2.4802G	99.32	Inf	-Inf	32.41	3	Vertical	91	2.93	-
AV	2.48G	94.62	Inf	-Inf	32.41	3	Vertical	91	2.93	-
PK	2.488G	57.74	74.00	-16.26	32.43	3	Vertical	91	2.93	-
AV	2.483502G	46.96	54.00	-7.04	32.42	3	Vertical	91	2.93	-

BT5.0-LE_Nss1_1TX
2480MHz_TX


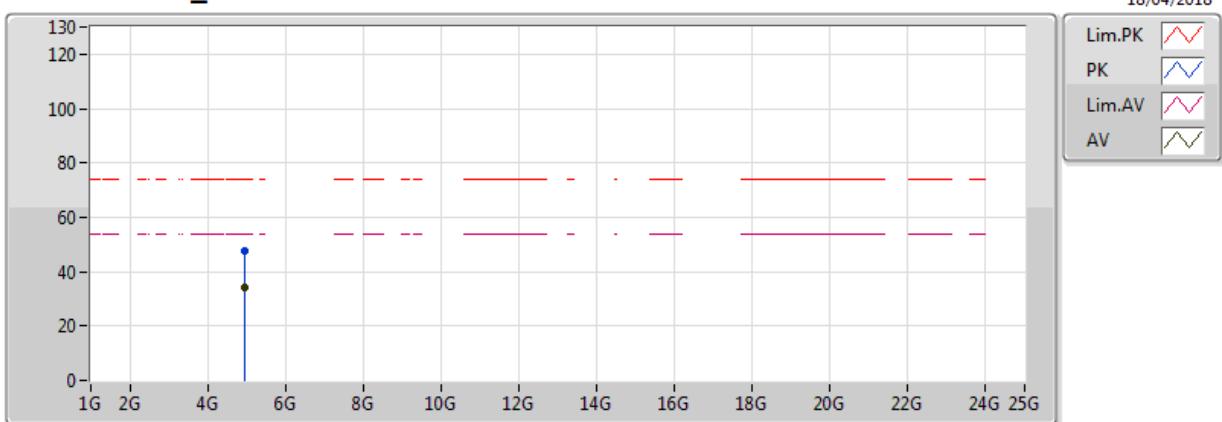
EUT Y_1TX
Setting Default Power
06-G-2
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
PK	2.4802G	97.83	Inf	-Inf	32.41	3	Horizontal	17	1.85	-
AV	2.4802G	92.84	Inf	-Inf	32.41	3	Horizontal	17	1.85	-
PK	2.4998G	56.91	74.00	-17.09	32.47	3	Horizontal	17	1.85	-
AV	2.483502G	46.46	54.00	-7.54	32.42	3	Horizontal	17	1.85	-

BT5.0-LE_Nss1_1TX
2480MHz_TX


EUT Y_1TX
Setting Default Power
06-G-2
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
PK	4.960808G	47.58	74.00	-26.42	7.08	3	Vertical	225	1.51	-
AV	4.960264G	34.43	54.00	-19.57	7.08	3	Vertical	225	1.51	-

BT5.0-LE_Nss1_1TX
2480MHz_TX


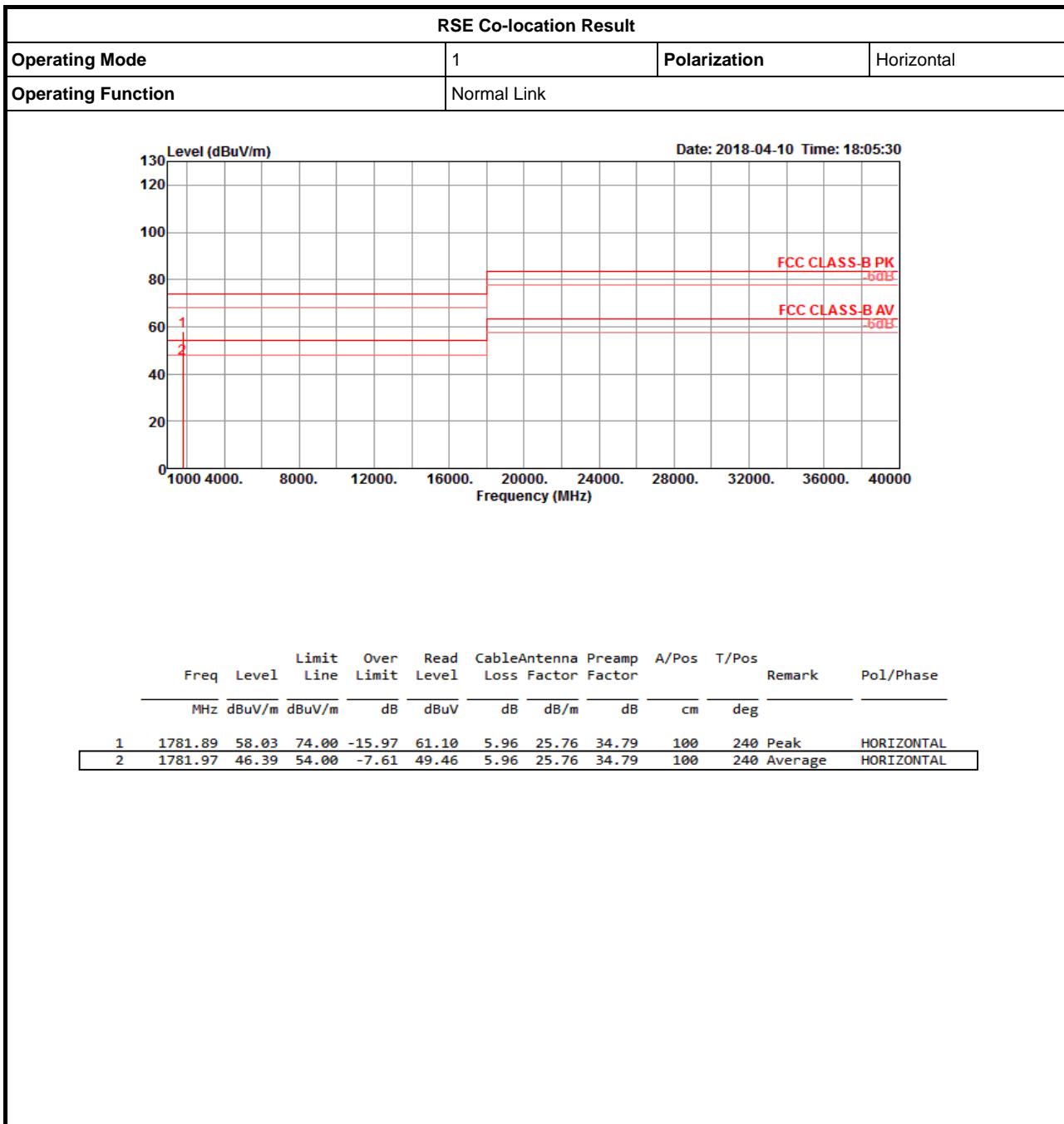
EUT Y_1TX
Setting Default Power
06-G-2
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
PK	4.959792G	47.80	74.00	-26.20	7.08	3	Horizontal	257	1.61	-
AV	4.960948G	34.34	54.00	-19.66	7.08	3	Horizontal	257	1.61	-



RSE Co-location Result

Appendix G





RSE Co-location Result

Appendix G

