



FCC RADIO TEST REPORT

FCC ID : NKR-SWA52
Equipment : Wireless Audio Module
Brand Name : WNC
Model Name : SWA52
Applicant : Wistron NeWeb Corporation
20 Park Avenue II, Hsinchu Science Park, Hsinchu 308 Taiwan
Manufacturer : Wistron NeWeb Corporation
20 Park Avenue II, Hsinchu Science Park, Hsinchu 308 Taiwan
Standard : 47 CFR FCC Part 15.407

The product was received on May 21, 2018, and testing was started from May 24, 2018 and completed on Jun. 07, 2018. We, SPORTON INTERNATIONAL 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 variant report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.


Approved by: Cliff Chang

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



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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	15.407(a)	Emission Bandwidth	PASS	-
3.2	15.407(a)	Maximum Conducted Output Power	PASS	-
3.3	15.407(a)	Peak Power Spectral Density	PASS	-
3.4	15.407(b)	Unwanted Emissions	PASS	-

Reviewed by: Sam Chen

Report Producer: Sandy Chuang



1 General Description

1.1 Information

1.1.1 RF General Information

Frequency Range (MHz)	Mode	Ch. Frequency (MHz)	Channel Number
5725-5850	pi 4-DQPSK	5730.35-5820.35	2-47 [46]

Band	Mode	BWch (MHz)	Nant
5.725-5.85GHz	pi 4-DQPSK	3	1TX

Note:

- Modulation type: pi 4-DQPSK.
- 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.	Brand	Model Name	P/N	Antenna Type	Connector	Gain (dBi)	Remark
1	WNC	WNC	-	Printed Antenna	N/A	4.9	Internal antenna
2	WNC	WNC	-	Printed Antenna	N/A	3.5	
3	ethertronics	-	5003321	PCB Antenna	I-PEX	4.35	External antenna

Note:

For EUT 1:

The EUT supports the antenna with TX and RX diversity functions.

Both Ant. 1(Port 1) and Ant. 2(Port 2) support transmit and receive functions, but only one of them will be used at one time.

The Ant. 1(Port 1) generated the worst case, so it was selected to test and record in the report.

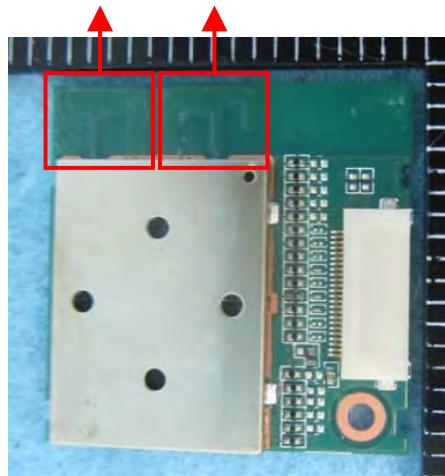
For EUT 2:

Ant. 3(Port 1) can be used as transmitting/receiving antenna.



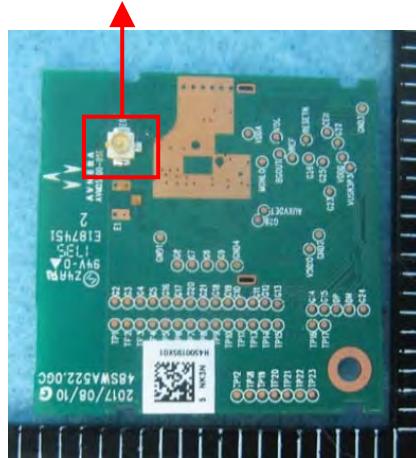
For EUT 1:

Ant. 1(Port 1) Ant. 2(Port 2)



For EUT 2:

Ant. 3(Port 1)





1.1.3 Mode Test Duty Cycle

Mode	DC	DCF(dB)	T(s)	VBW(Hz) ≥ 1/T
pi 4-DQPSK	1	0	n/a (DC>=0.98)	n/a (DC>=0.98)

1.1.4 EUT Operational Condition

EUT Power Type	From Power Adapter		
Beamforming Function	<input type="checkbox"/>	With beamforming	<input checked="" type="checkbox"/> Without beamforming
Function	<input type="checkbox"/>	Outdoor P2M	<input type="checkbox"/> Indoor P2M
	<input type="checkbox"/>	Fixed P2P	<input checked="" type="checkbox"/> Client
Test Software Version	vmxui		

1.1.5 Table for Multiple Listing

The difference for each EUT is shown as below:

Model Name	EUT	Internal antenna	External antenna
SWA52	1	V	X
	2	X	V

1.1.6 Table for Class II Change

This product is an extension of original one reported under Sporton project number: FR5N2023

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
1. Hardware change for original EUT (EUT 1), changes are (1) C30 change from 10uF to 22uF (2) Change RF matching circuit between RF PA and RF SW.	1. Unwanted Emissions (Below 1GHz / Above 1GHz: Chunnel 2_5730.35MHz)
2. Based on above change to add an external antenna (Brand Name: Ethertronics Inc, Part Number: 5003321) as EUT 2.	2. Emission Bandwidth 3. Maximum Conducted Output Power 4. Peak Power Spectral Density 5. Unwanted Emissions



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 789033 D02 v02r01

1.3 Testing Location Information

Testing Location				
<input type="checkbox"/>	HWA YA	ADD : No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL : 886-3-327-3456	FAX : 886-3-327-0973	
<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	Paul Chen & Justin Lin	22°C / 67%	May 24, 2018~Jun. 05, 2018
Radiated	03CH01-CB	RJ Huang & Lance Wu	22°C / 55%	Jun. 01, 2018~Jun. 07, 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
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	Power Setting
pi 4-DQPSK_Nss1_1TX	-
5730.35MHz	Default
5776.35MHz	Default
5820.35MHz	Default



2.2 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests	
Tests Item	Emission Bandwidth Maximum Conducted Output Power Peak Power Spectral Density
Test Condition	Conducted measurement at transmit chains
Test Mode	CTX
1	EUT 2

The Worst Case Mode for Following Conformance Tests	
Tests Item	Unwanted Emissions
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

The EUT was performed at X axis, Y axis and Z axis position for Radiated emission above 1GHz test, and the worst case was found at Z axis. So the measurement will follow this same test configuration for EUT 1. The EUT was performed at X axis, Y axis and Z axis position for Radiated emission above 1GHz test, and the worst case was found at Y axis. So the measurement will follow this same test configuration for EUT 2.

1	Place EUT 1 in Z axis
2	Place EUT 2 in Y axis

For operating mode 2 is the worst case and it was record in this test report.

Operating Mode > 1GHz	CTX
The EUT can be placed in X axis, Y axis and Z axis. After evaluating, Z axis was the worst case, so it's recorded in this report for EUT 1.	
The EUT can be placed in X axis, Y axis and Z axis. After evaluating, Y axis was the worst case, so it's recorded in this report for EUT 2.	

1	Place EUT 1 in Z axis
2	Place EUT 2 in Y axis

2.3 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.



2.4 Accessories

N/A

2.5 Support Equipment

For Test Site No: 03CH01-CB

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Fixture	WNC	48SWA524.SGB	N/A

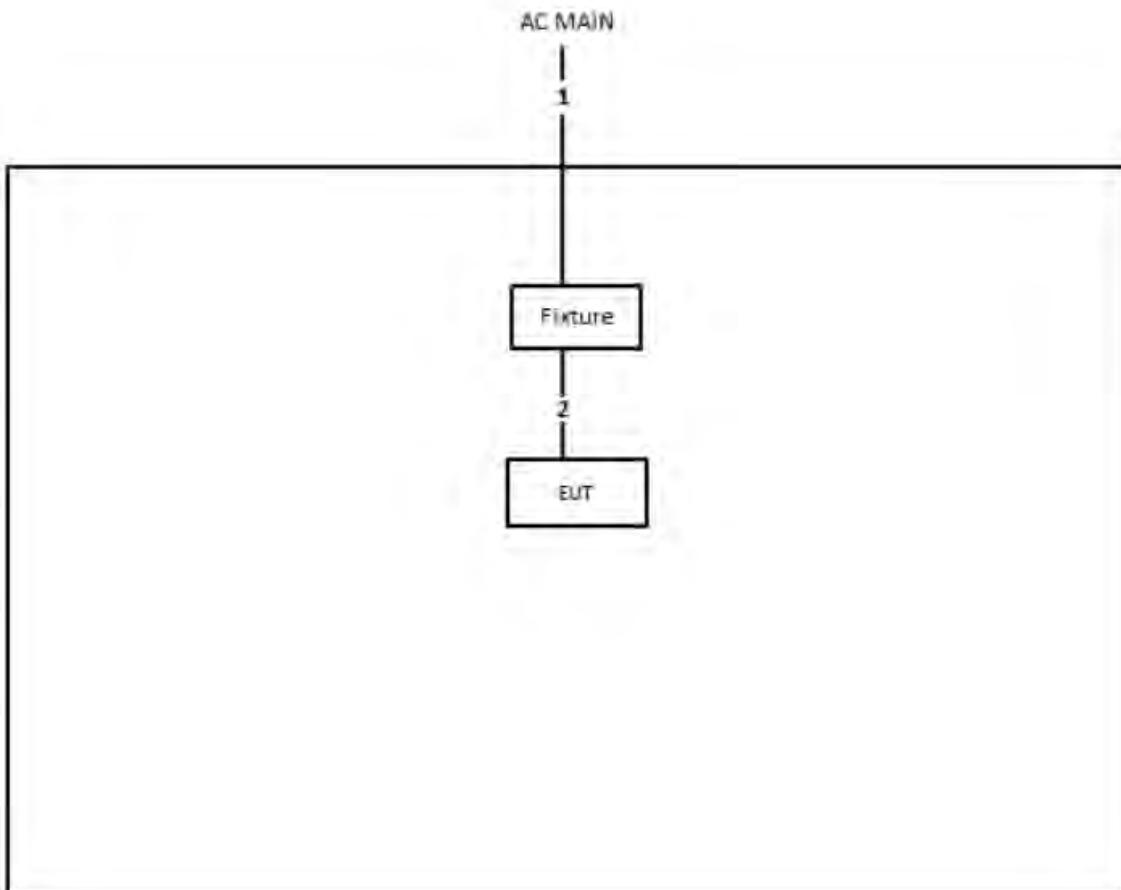
For Test Site No: TH01-CB

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Notebook	DELL	E4300	N/A
2	Fixture	WNC	48SWA524.SGB	N/A



2.6 Test Setup Diagram

Test Setup Diagram - Radiated Test



Item	Connection	Shielded	Length
1	Power cable	No	1.7m
2	Computer bus cable	No	0.1m



3 Transmitter Test Result

3.1 Emission Bandwidth

3.1.1 Emission Bandwidth Limit

Emission Bandwidth Limit	
UNII Devices	
<input type="checkbox"/>	For the 5.15-5.25 GHz band, N/A
<input type="checkbox"/>	For the 5.25-5.35 GHz band, the maximum conducted output power shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in MHz.
<input type="checkbox"/>	For the 5.47-5.725 GHz band, the maximum conducted output power shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in MHz.
<input checked="" type="checkbox"/>	For the 5.725-5.85 GHz band, 6 dB emission bandwidth $\geq 500\text{kHz}$.
LE-LAN Devices	
<input type="checkbox"/>	For the band 5.15-5.25 GHz, the maximum e.i.r.p. shall not exceed 200 mW or $10 + 10 \log B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.
<input type="checkbox"/>	For the 5.25-5.35 GHz band, the maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz
<input type="checkbox"/>	For the 5.47-5.6 GHz band and 5.65-5.725 GHz band, the maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz
<input type="checkbox"/>	For the 5.725-5.85 GHz band, 6 dB emission bandwidth $\geq 500\text{kHz}$.

3.1.2 Measuring Instruments

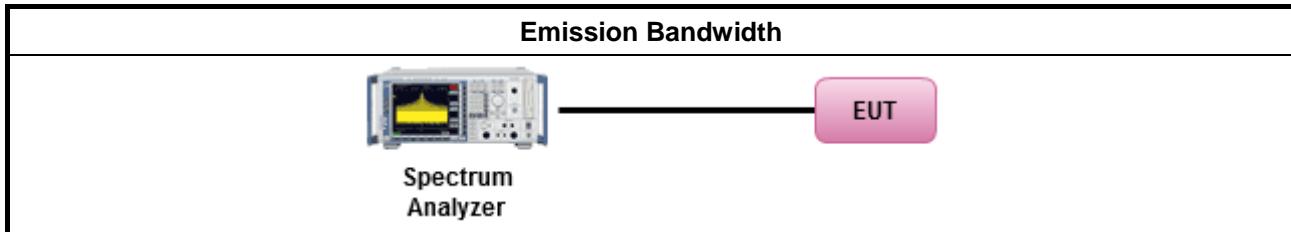
Refer a test equipment and calibration data table in this test report.

3.1.3 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 789033, clause C for EBW and clause D for OBW measurement.
<input type="checkbox"/>	Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.
<input type="checkbox"/>	Refer as IC RSS-Gen, clause 4.6 for bandwidth testing.



3.1.4 Test Setup



3.1.5 Test Result of Emission Bandwidth

Refer as Appendix A



3.2 Maximum Conducted Output Power

3.2.1 Maximum Conducted Output Power Limit

Maximum Conducted Output Power Limit	
UNII Devices	
<input type="checkbox"/> For the 5.15-5.25 GHz band:	<ul style="list-style-type: none">Outdoor AP: the maximum conducted output power (P_{out}) shall not exceed the lesser of 1 W. If $G_{TX} > 6$ dBi, then $P_{out} = 30 - (G_{TX} - 6)$. e.i.r.p. at any elevation angle above 30 degrees ≤ 125 mW [21 dBm]Indoor AP: the maximum conducted output power (P_{out}) shall not exceed the lesser of 1 W. If $G_{TX} > 6$ dBi, then $P_{out} = 30 - (G_{TX} - 6)$Point-to-point AP: the maximum conducted output power (P_{out}) shall not exceed the lesser of 1 W. If $G_{TX} > 23$ dBi, then $P_{out} = 30 - (G_{TX} - 23)$.Mobile or Portable Client: the maximum conducted output power (P_{out}) shall not exceed the lesser of 250 mW. If $G_{TX} > 6$ dBi, then $P_{out} = 24 - (G_{TX} - 6)$.
<input type="checkbox"/> For the 5.25-5.35 GHz band, the maximum conducted output power (P_{out}) shall not exceed the lesser of 250 mW or 11 dBm + $10 \log B$, where B is the 26 dB emission bandwidth in MHz. If $G_{TX} > 6$ dBi, then $P_{out} = 24 - (G_{TX} - 6)$.	
<input type="checkbox"/> For the 5.47-5.725 GHz band, the maximum conducted output power (P_{out}) shall not exceed the lesser of 250 mW or 11 dBm + $10 \log B$, where B is the 26 dB emission bandwidth in MHz. If $G_{TX} > 6$ dBi, then $P_{out} = 24 - (G_{TX} - 6)$.	
<input checked="" type="checkbox"/> For the 5.725-5.85 GHz band:	<ul style="list-style-type: none">Point-to-multipoint systems (P2M): the maximum conducted output power (P_{out}) shall not exceed the lesser of 1 W. If $G_{TX} > 6$ dBi, then $P_{out} = 30 - (G_{TX} - 6)$.Point-to-point systems (P2P): the maximum conducted output power (P_{out}) shall not exceed the lesser of 1 W.
LE-LAN Devices	
<input type="checkbox"/> For the 5.15-5.25 GHz band, the maximum e.i.r.p. shall not exceed 200 mW or $10 + 10 \log B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.	
<input type="checkbox"/> For the 5.25-5.35 GHz band, the maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz	
<input type="checkbox"/> For the 5.47-5.6 GHz band and 5.65-5.725 GHz band, the maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz	
<input type="checkbox"/> For the 5.725-5.85 GHz band:	<ul style="list-style-type: none">Point-to-multipoint systems (P2M): the maximum conducted output power (P_{out}) shall not exceed the lesser of 1 W. If $G_{TX} > 6$ dBi, then $P_{out} = 30 - (G_{TX} - 6)$.Point-to-point systems (P2P): the maximum conducted output power (P_{out}) shall not exceed the lesser of 1 W.
P_{out} = maximum conducted output power in dBm, G_{TX} = the maximum transmitting antenna directional gain in dBi.	



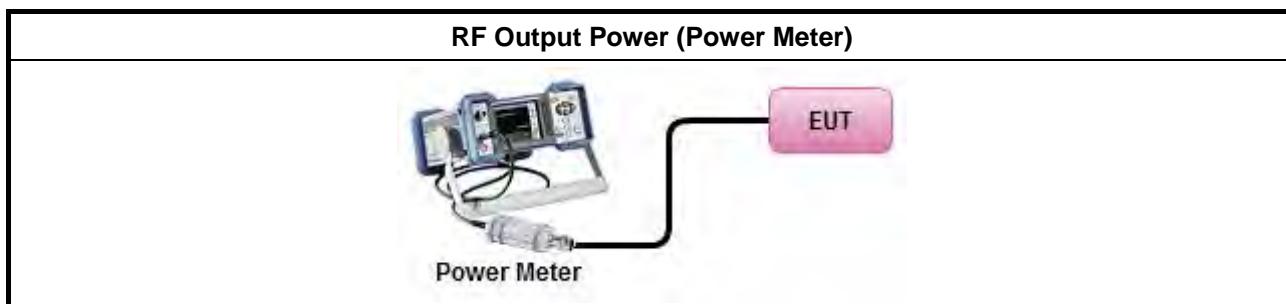
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

Test Method	
▪ Maximum Conducted Output Power	
	Average over on/off periods with duty factor
	<input type="checkbox"/> Refer as FCC KDB 789033, clause E Method SA-2 (spectral trace averaging).
	<input type="checkbox"/> Refer as FCC KDB 789033, clause E Method SA-2 Alt. (RMS detection with slow sweep speed)
	Wideband RF power meter and average over on/off periods with duty factor
	<input checked="" type="checkbox"/> Refer as FCC KDB 789033, clause E Method PM-G (using an 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]) $EIRP_{total} = P_{total} + DG$

3.2.4 Test Setup



3.2.5 Test Result of Maximum Conducted Output Power

Refer as Appendix B



3.3 Peak Power Spectral Density

3.3.1 Peak Power Spectral Density Limit

Peak Power Spectral Density Limit	
UNII Devices	
<input type="checkbox"/> For the 5.15-5.25 GHz band:	<ul style="list-style-type: none">Outdoor AP: the peak power spectral density (PPSD) shall not exceed the lesser of 17dBm/MHz. If $G_{TX} > 6$ dBi, then $P_{Out} = 17 - (G_{TX} - 6)$.Indoor AP: the peak power spectral density (PPSD) shall not exceed the lesser of 17dBm/MHz. If $G_{TX} > 6$ dBi, then $P_{Out} = 17 - (G_{TX} - 6)$.Point-to-point AP: the peak power spectral density (PPSD) shall not exceed the lesser of 17dBm/MHz. If $G_{TX} > 23$ dBi, then $P_{Out} = 17 - (G_{TX} - 23)$.Mobile or Portable Client: the peak power spectral density (PPSD) ≤ 11 dBm/MHz. If $G_{TX} > 6$ dBi, then $PPSD = 11 - (G_{TX} - 6)$.
<input type="checkbox"/> For the 5.25-5.35 GHz band, the peak power spectral density (PPSD) ≤ 11 dBm/MHz. If $G_{TX} > 6$ dBi, then $PPSD = 11 - (G_{TX} - 6)$.	
<input type="checkbox"/> For the 5.47-5.725 GHz band, the peak power spectral density (PPSD) ≤ 11 dBm/MHz. If $G_{TX} > 6$ dBi, then $PPSD = 11 - (G_{TX} - 6)$.	
<input checked="" type="checkbox"/> For the 5.725-5.85 GHz band:	<ul style="list-style-type: none">Point-to-multipoint systems (P2M): the peak power spectral density (PPSD) ≤ 30 dBm/500kHz. If $G_{TX} > 6$ dBi, then $PPSD = 30 - (G_{TX} - 6)$.Point-to-point systems (P2P): the peak power spectral density (PPSD) ≤ 30 dBm/500kHz.
LE-LAN Devices	
<input type="checkbox"/> For the 5.15-5.25 GHz band, the peak power spectral density (PPSD) ≤ 4 dBm/MHz and the e.i.r.p. peak power spectral density (PPSD) ≤ 10 dBm/MHz.	
<input type="checkbox"/> For the 5.25-5.35 GHz band, the peak power spectral density (PPSD) ≤ 11 dBm/MHz and the e.i.r.p. peak power spectral density (PPSD) ≤ 17 dBm/MHz.	
<input type="checkbox"/> e.i.r.p. greater than 200 mW shall comply with the following e.i.r.p. at different elevations, where θ is the angle above the local horizontal plane (of the Earth) as shown below: -13 dBW/MHz for $0^\circ \leq \theta < 8^\circ$; -13 - 0.716 (θ -8) dBW/MHz for $8^\circ \leq \theta < 40^\circ$ -35.9 - 1.22 (θ -40) dBW/MHz for $40^\circ \leq \theta \leq 45^\circ$; -42 dBW/MHz for $\theta > 45^\circ$	
<input type="checkbox"/> For the 5.47-5.6 GHz band and 5.65-5.725 GHz band, the peak power spectral density (PPSD) ≤ 11 dBm/MHz and the e.i.r.p. peak power spectral density (PPSD) ≤ 17 dBm/MHz.	
<input type="checkbox"/> For the 5.725-5.85 GHz band:	<ul style="list-style-type: none">Point-to-multipoint systems (P2M): the peak power spectral density (PPSD) ≤ 30 dBm/500kHz. If $G_{TX} > 6$ dBi, then $PPSD = 30 - (G_{TX} - 6)$.Point-to-point systems (P2P): the peak power spectral density (PPSD) ≤ 30 dBm/500kHz.
PPSD = peak power spectral density that the same method as used to determine the conducted output power shall be used to determine the power spectral density. And power spectral density in dBm/MHz G_{TX} = the maximum transmitting antenna directional gain in dBi.	



3.3.2 Measuring Instruments

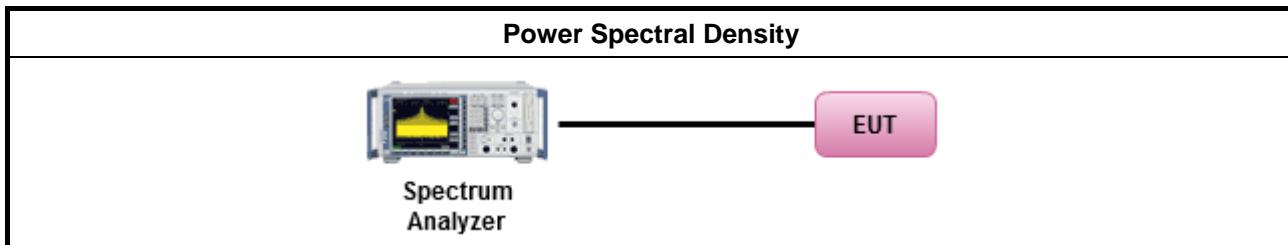
Refer a test equipment and calibration data table in this test report.

3.3.3 Test Procedures

Test Method	
<ul style="list-style-type: none">Peak power spectral density procedures that the same method as used to determine the conducted output power shall be used to determine the peak power spectral density and use the peak search function on the spectrum analyzer to find the peak of the spectrum. For the peak power spectral density shall be measured using below options:	
<input type="checkbox"/> Refer as FCC KDB 789033, F5) power spectral density can be measured using resolution bandwidths < 1 MHz provided that the results are integrated over 1 MHz bandwidth	[duty cycle \geq 98% or external video / power trigger]
<input checked="" type="checkbox"/> Refer as FCC KDB 789033, clause E Method SA-1 (spectral trace averaging).	
<input type="checkbox"/> Refer as FCC KDB 789033, clause E Method SA-1 Alt. (RMS detection with slow sweep speed)	duty cycle < 98% and average over on/off periods with duty factor
<input checked="" type="checkbox"/> Refer as FCC KDB 789033, clause E Method SA-2 (spectral trace averaging).	
<input type="checkbox"/> Refer as FCC KDB 789033, clause E Method SA-2 Alt. (RMS detection with slow sweep speed)	
<ul style="list-style-type: none">For conducted measurement.	
<ul style="list-style-type: none">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.
	<ul style="list-style-type: none">If multiple transmit chains, EIRP PPSD calculation could be following as methods: $PPSD_{total} = PPSD_1 + PPSD_2 + \dots + PPSD_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $EIRP_{total} = PPSD_{total} + DG$



3.3.4 Test Setup



3.3.5 Test Result of Peak Power Spectral Density

Refer as Appendix C



3.4 Unwanted Emissions

3.4.1 Transmitter Radiated Unwanted Emissions Limit

Unwanted emissions below 1 GHz and restricted band emissions above 1GHz 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.



Un-restricted band emissions above 1GHz Limit	
Operating Band	Limit
<input type="checkbox"/> 5.15 - 5.25 GHz	e.i.r.p. -27 dBm [68.2 dBuV/m@3m]
<input type="checkbox"/> 5.25 - 5.35 GHz	e.i.r.p. -27 dBm [68.2 dBuV/m@3m]
<input type="checkbox"/> 5.47 - 5.725 GHz	e.i.r.p. -27 dBm [68.2 dBuV/m@3m]
<input checked="" type="checkbox"/> 5.725 - 5.85 GHz	all emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Note 1: 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).

3.4.2 Measuring Instruments

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

3.4.3 Test Procedures

Test Method	
▪ 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. Measurements shall not be performed at a distance greater than 30 m for frequencies above 30 MHz, unless it can be further demonstrated that measurements at a distance of 30 m or less are impractical. 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).	
▪ The average emission levels shall be measured in [duty cycle \geq 98 or duty factor].	
▪ For the transmitter unwanted emissions shall be measured using following options below:	
▪ <input type="checkbox"/> Refer as FCC KDB 789033, clause H)2) for unwanted emissions into non-restricted bands.	
	<input type="checkbox"/> Refer as FCC KDB 789033, clause H)1) for unwanted emissions into restricted bands.
	<input type="checkbox"/> Refer as FCC KDB 789033, H)6) Method AD (Trace Averaging).
	<input checked="" type="checkbox"/> Refer as FCC KDB 789033, H)6) Method VB (Reduced VBW).
	<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 789033, clause H)5) measurement procedure peak limit.
	<input type="checkbox"/> Refer as ANSI C63.10, clause 4.2.3.2.2 measurement procedure peak limit.
▪ For radiated measurement.	



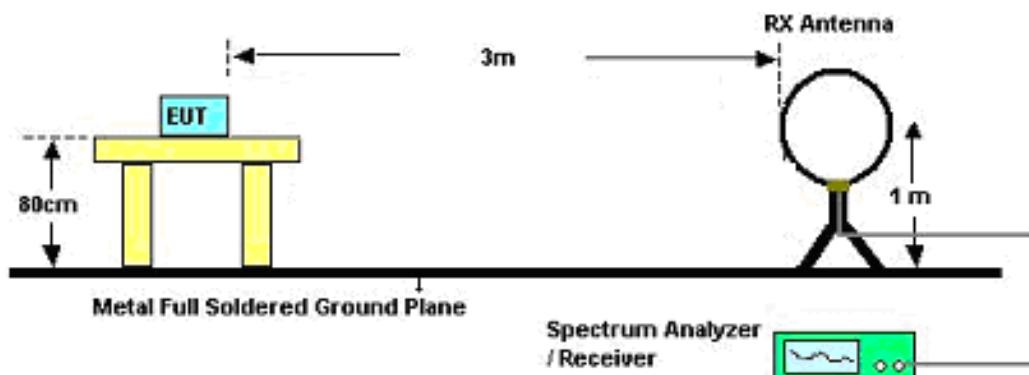
Test Method	
	▪ Refer as ANSI C63.10, clause 6.4 for radiated emissions below 30 MHz and test distance is 3m.
	▪ Refer as ANSI C63.10, clause 6.5 for radiated emissions 30 MHz to 1 GHz and test distance is 3m.
	▪ Refer as ANSI C63.10, clause 6.6 for radiated emissions above 1GHz.
	▪ The any unwanted emissions level shall not exceed the fundamental emission level.
	▪ All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.



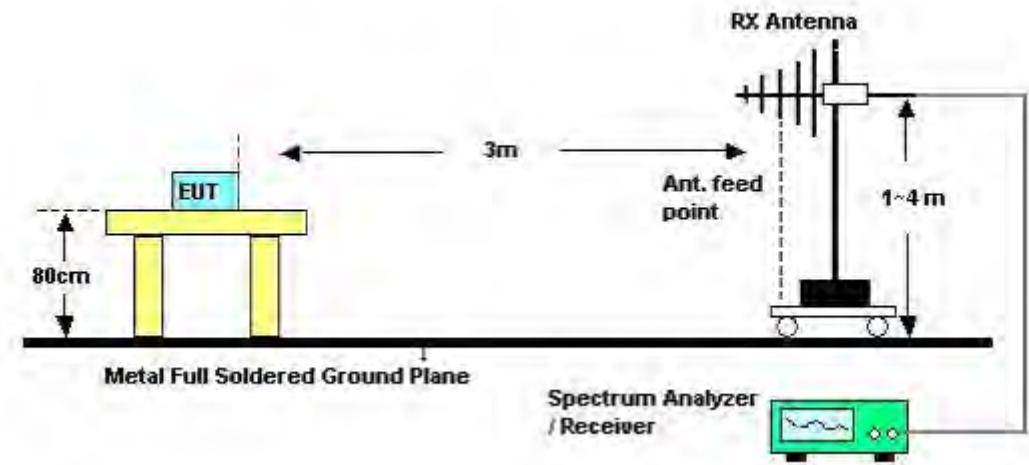
3.4.4 Test Setup

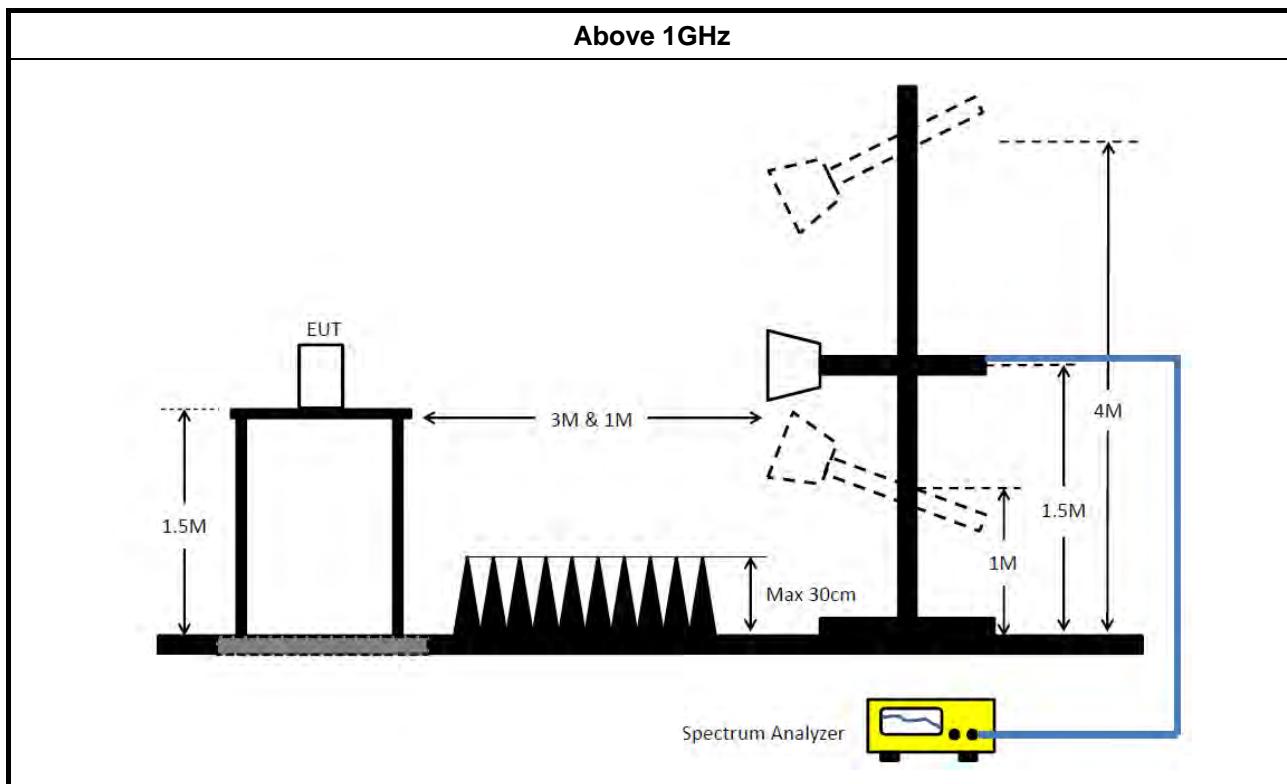
Transmitter Radiated Unwanted Emissions

9kHz ~30MHz



30MHz~1GHz





3.4.5 Transmitter 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.

3.4.6 Test Result of Transmitter Unwanted Emissions

Refer as Appendix D



4 Test Equipment and Calibration Data

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
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, 2018	May 01, 2019	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	100354	9kHz ~ 2.75GHz	Dec. 08, 2017	Dec. 07, 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)
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.

**<For EUT 2>****Summary**

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
5.725-5.85GHz	-	-	-	-	-
pi 4-DQPSK_Nss1_1TX	1.665M	1.897M	1M90G7D	1.65M	1.893M

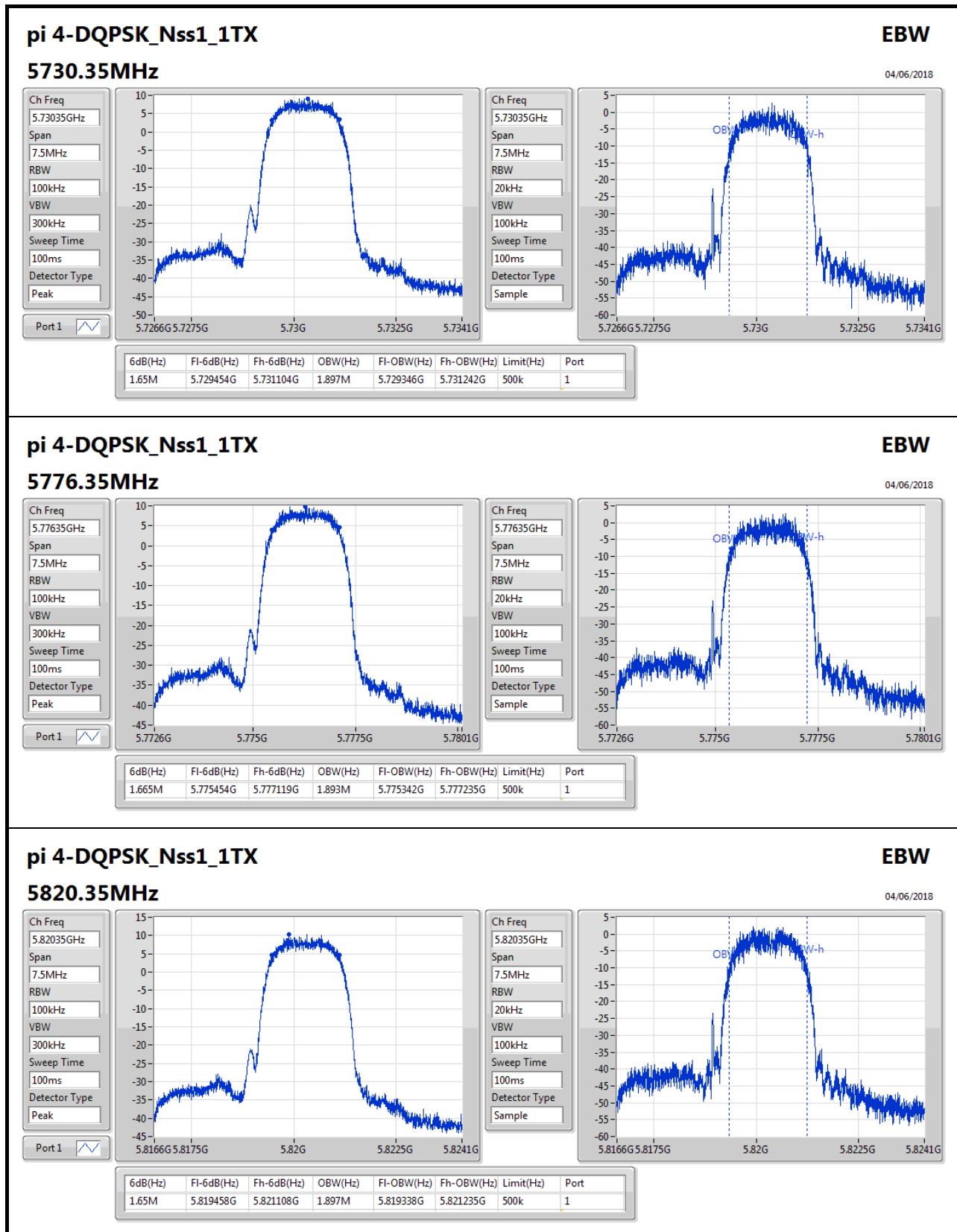
Max-N dB = Maximum 6dB down bandwidth for 5.725-5.85GHz band / Maximum 26dB down bandwidth for other band;**Max-OBW** = Maximum 99% occupied bandwidth;**Min-N dB** = Minimum 6dB down bandwidth for 5.725-5.85GHz band / Maximum 26dB down bandwidth for other band;**Min-OBW** = Minimum 99% occupied bandwidth;

**Result**

Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
pi 4-DQPSK_Nss1_1TX	-	-	-	-
5730.35MHz	Pass	500k	1.65M	1.897M
5776.35MHz	Pass	500k	1.665M	1.893M
5820.35MHz	Pass	500k	1.65M	1.897M

Port X-N dB = Port X 6dB down bandwidth for 5.725-5.85GHz band / 26dB down bandwidth for other band

Port X-OBW = Port X 99% occupied bandwidth;





<For EUT 2>

Summary

Mode	Total Power (dBm)	Total Power (W)
5.725-5.85GHz	-	-
pi 4-DQPSK_Nss1_1TX	12.22	0.01667

**Result**

Mode	Result	DG (dBi)	Port 1 (dBm)	Total Power (dBm)	Power Limit (dBm)
pi 4-DQPSK_Nss1_1TX	-	-	-	-	-
5730.35MHz	Pass	4.35	12.22	12.22	30.00
5776.35MHz	Pass	4.35	12.18	12.18	30.00
5820.35MHz	Pass	4.35	12.19	12.19	30.00

DG = Directional Gain; **Port X** = Port X output power



<For EUT 2>

Summary

Mode	PD (dBm/RBW)
5.725-5.85GHz	-
pi 4-DQPSK_Nss1_1TX	7.78

RBW = 500kHz for 5.725-5.85GHz band / 1MHz for other band;

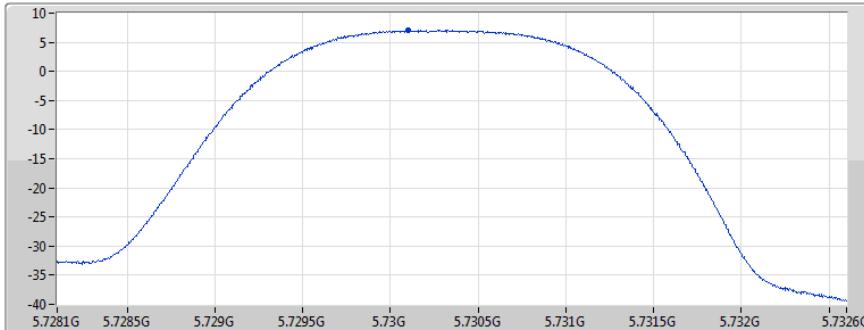
**Result**

Mode	Result	DG (dBi)	Port 1 (dBm/RBW)	PD (dBm/RBW)	PD Limit (dBm/RBW)
pi 4-DQPSK_Nss1_1TX	-	-	-	-	-
5730.35MHz	Pass	4.35	7.06	7.06	30.00
5776.35MHz	Pass	4.35	7.67	7.67	30.00
5820.35MHz	Pass	4.35	7.78	7.78	30.00

DG = Directional Gain; **RBW** = 500kHz for 5.725-5.85GHz band / 1MHz for other band;

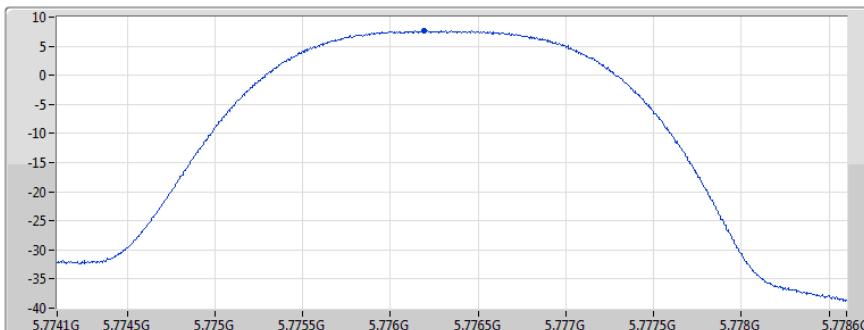
PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; **Port X** = Port Xpower density;

pi 4-DQPSK_Nss1_1TX
5730.35MHz

 Ch Freq
 5.73035GHz
 Span
 4.5MHz
 RBW
 500kHz
 VBW
 3MHz
 Sweep Time
 20ms
 Detector Type
 RMS

PSD

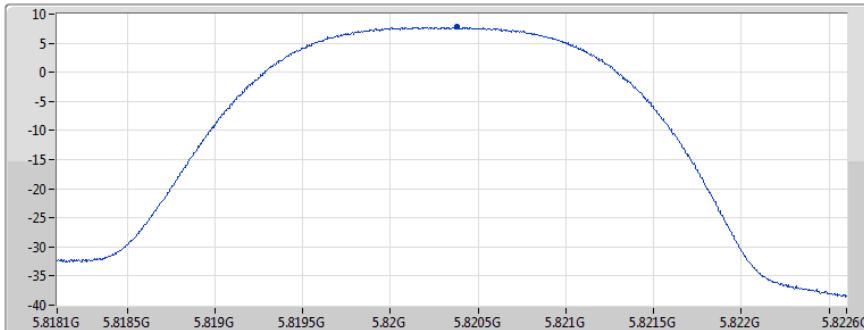
04/06/2018

 Port 1 
pi 4-DQPSK_Nss1_1TX
5776.35MHz

 Ch Freq
 5.77635GHz
 Span
 4.5MHz
 RBW
 500kHz
 VBW
 3MHz
 Sweep Time
 20ms
 Detector Type
 RMS

PSD

04/06/2018

 Port 1 
pi 4-DQPSK_Nss1_1TX
5820.35MHz

 Ch Freq
 5.82035GHz
 Span
 4.5MHz
 RBW
 500kHz
 VBW
 3MHz
 Sweep Time
 20ms
 Detector Type
 RMS

PSD

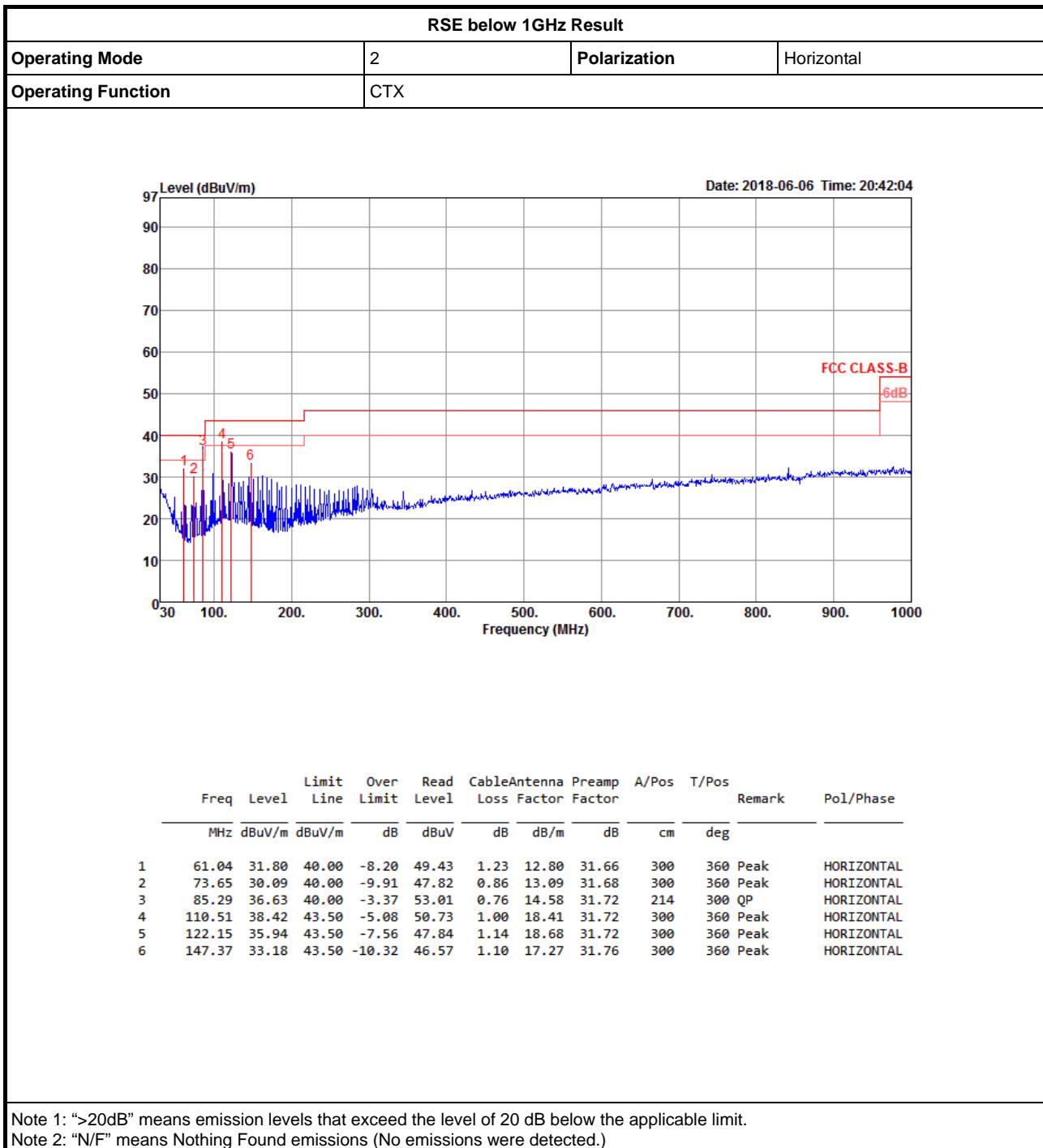
04/06/2018

 Port 1 



RSE below 1GHz Result

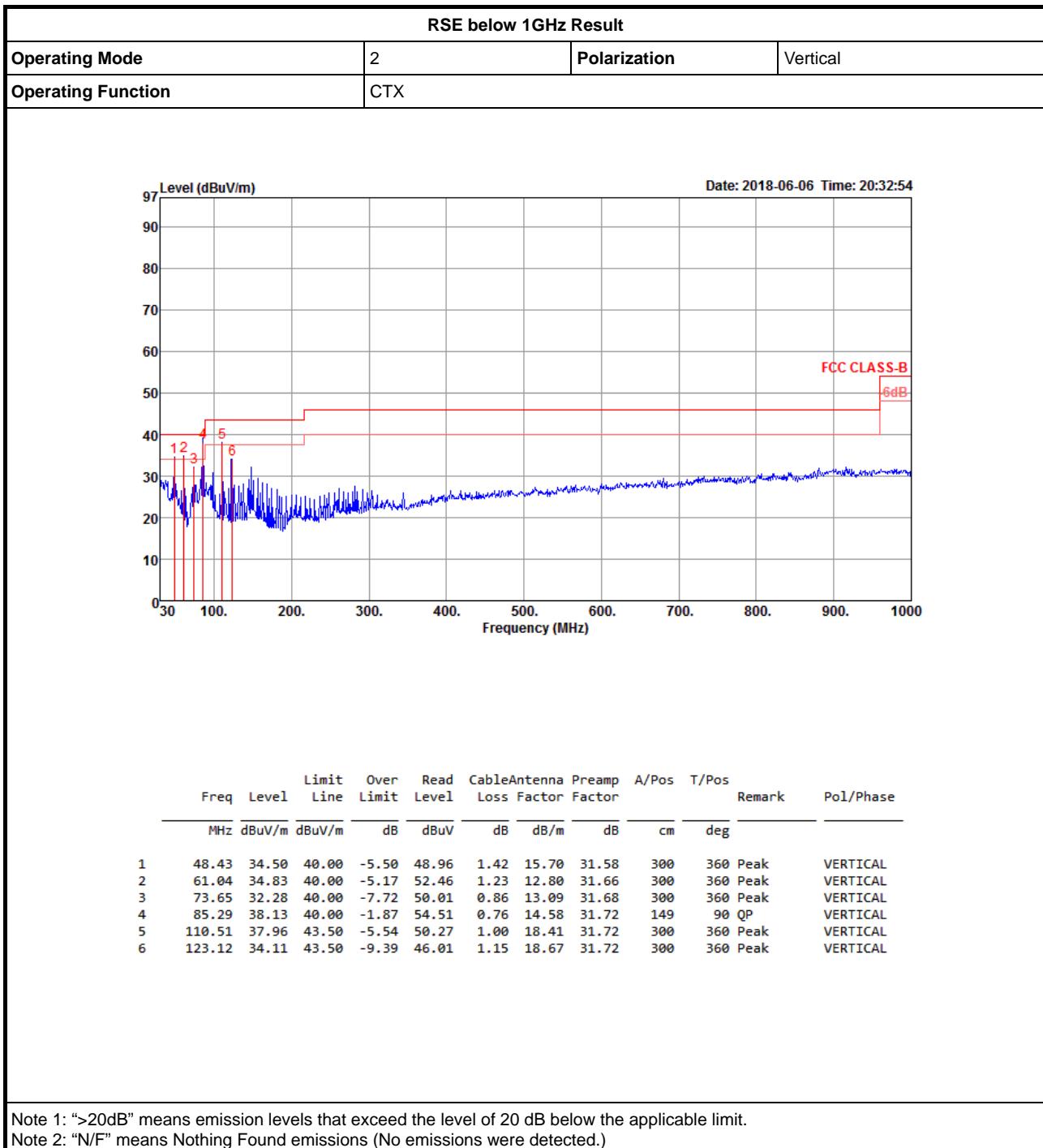
Appendix D.1





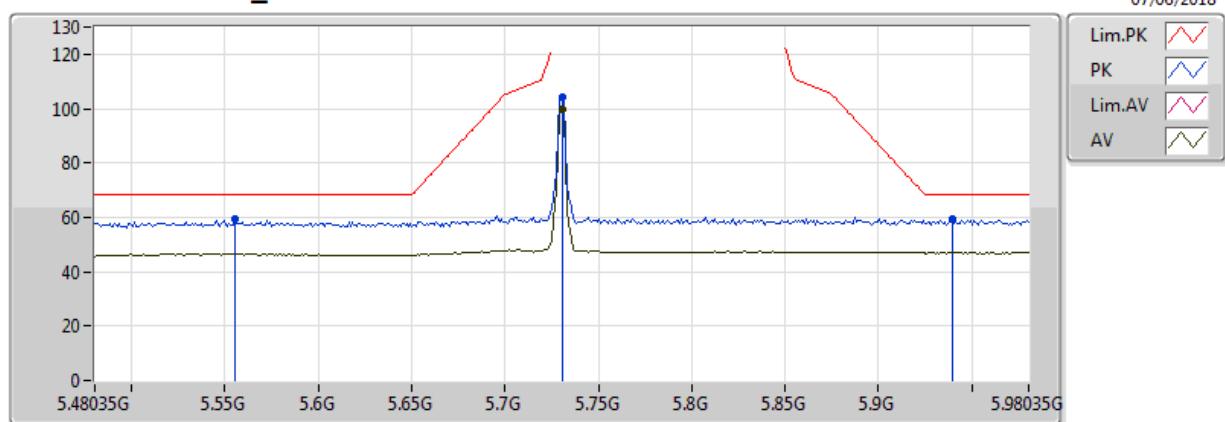
RSE below 1GHz Result

Appendix D.1



**<For EUT 1>****Summary**

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
5.725-5.85GHz	-	-	-	-	-	-	-	-	-	-	-	-
pi 4-DQPSK_Nss1_1TX	Pass	AV	11.45792G	52.69	54.00	-1.31	13.32	3	Vertical	353	1.01	-

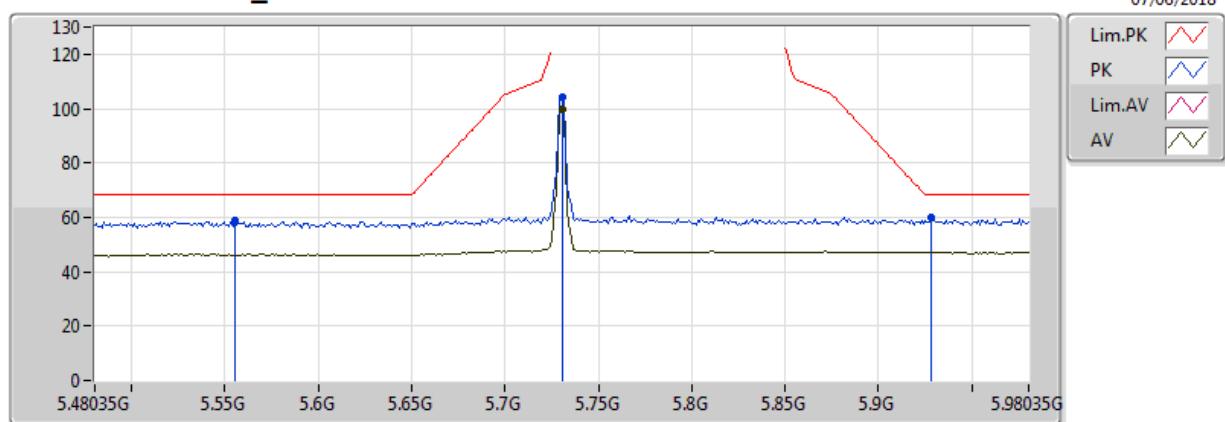
pi 4-DQPSK_Nss1_1TX
5730.35MHz_TX

EUT Z_1TX_ANT 0

Setting : Default

01-L-3-10

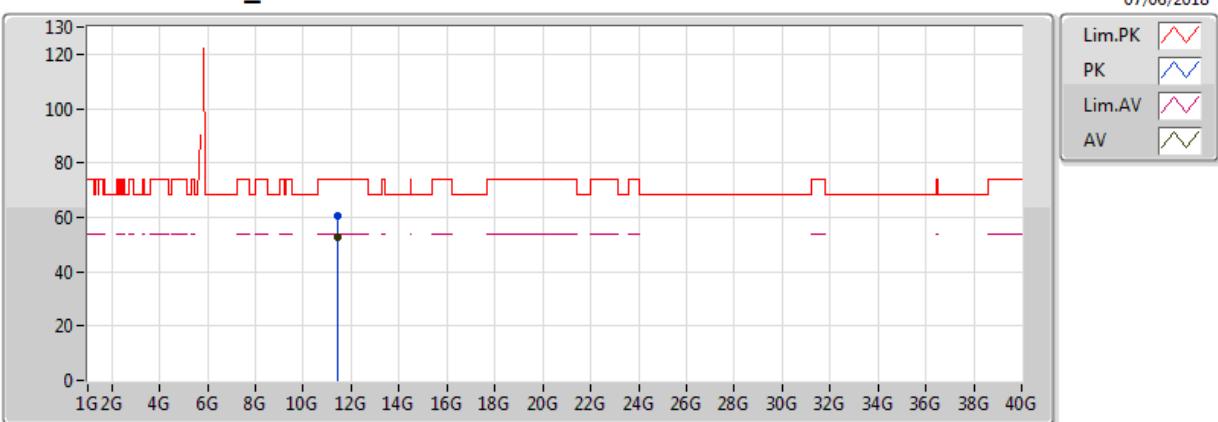
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)
PK	5.55535G	59.26	68.20	-8.94	6.15	3	Vertical	69	1.50
PK	5.73035G	104.50	Inf	-Inf	6.81	3	Vertical	69	1.50
AV	5.73035G	99.77	Inf	-Inf	6.81	3	Vertical	69	1.50
PK	5.93935G	59.25	68.20	-8.95	7.36	3	Vertical	69	1.50

pi 4-DQPSK_Nss1_1TX
5730.35MHz_TX


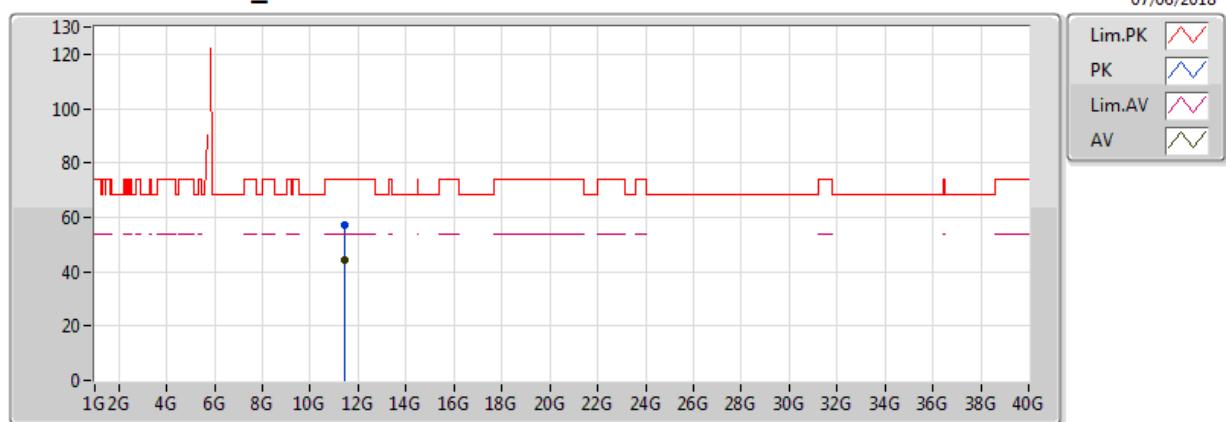
EUT Z_1TX_ANT 0
 Setting : Default
 01-L-3-10
 FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	
PK	5.55535G	58.89	68.20	-9.31	6.15	3	Horizontal	195	1.02	
PK	5.73035G	104.45	Inf	-Inf	6.81	3	Horizontal	195	1.02	
AV	5.73035G	99.64	Inf	-Inf	6.81	3	Horizontal	195	1.02	
PK	5.92835G	59.96	68.20	-8.24	7.34	3	Horizontal	195	1.02	

pi 4-DQPSK_Nss1_1TX
5730.35MHz_TX


EUT Z_1TX_ANT 0
Setting : Default
01-L-3
FSP(100080)

Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	
PK	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)	
PK	11.46024G	60.67	74.00	-13.33	13.32	3	Vertical	353	1.01	
AV	11.45792G	52.69	54.00	-1.31	13.32	3	Vertical	353	1.01	

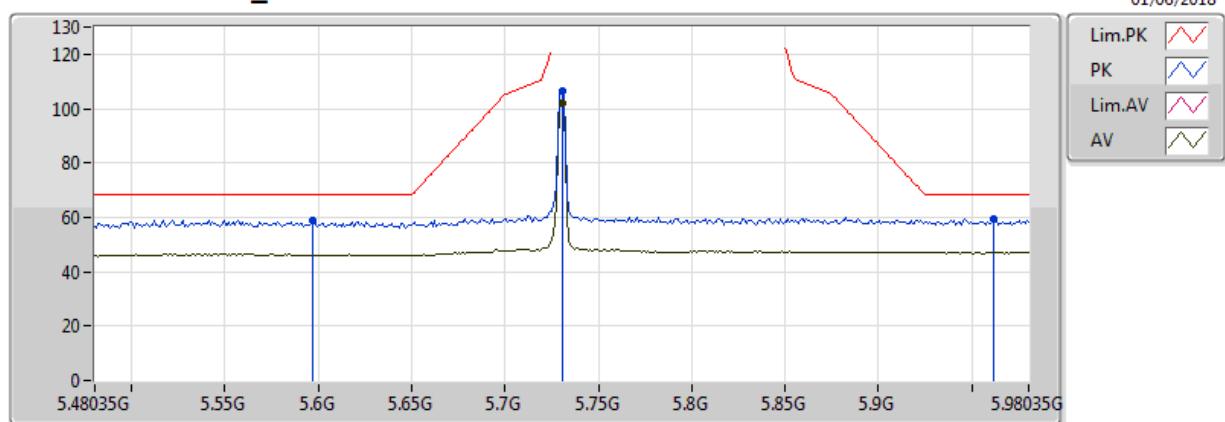
pi 4-DQPSK_Nss1_1TX
5730.35MHz_TX


EUT Z_1TX_ANT 0
Setting : Default
01-L-3
FSP(100080)

Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	
PK	11.461G	57.39	74.00	-16.61	13.32	3	Horizontal	267	1.24	
AV	11.4606G	44.49	54.00	-9.51	13.32	3	Horizontal	267	1.24	

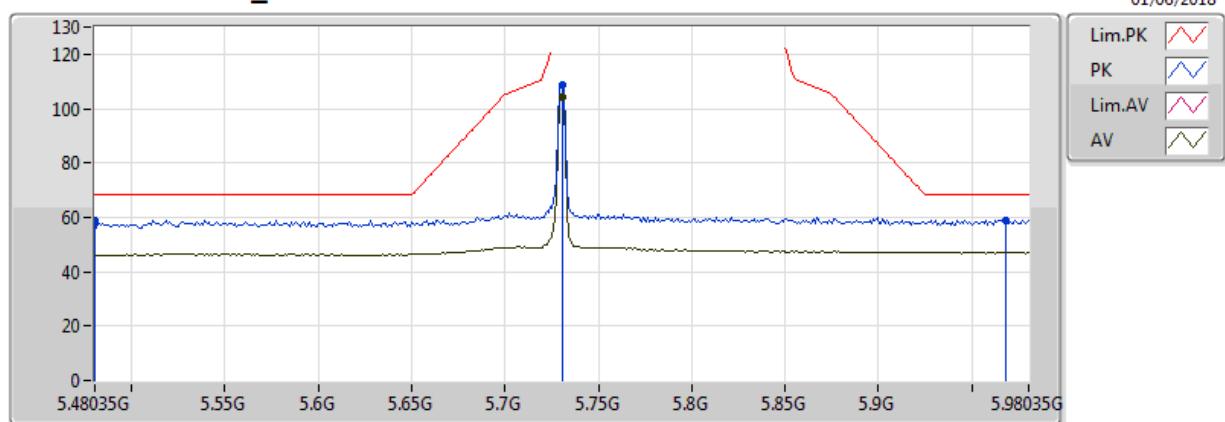
**<For EUT 2>****Summary**

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	Comments
5.725-5.85GHz	-	-	-	-	-	-	-	-	-	-	-	-
pi 4-DQPSK_Nss1_1TX	Pass	AV	11.63788G	51.93	54.00	-2.07	13.34	3	Horizontal	62	1.65	-

pi 4-DQPSK_Nss1_1TX
5730.35MHz_TX


EUT Y_1TX_External
 Setting : Default
 01-L-3-10
 FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	
PK	5.59735G	59.08	68.20	-9.12	6.26	3	Vertical	277	2.50	
PK	5.73035G	106.55	Inf	-Inf	6.81	3	Vertical	277	2.50	
AV	5.73035G	101.84	Inf	-Inf	6.81	3	Vertical	277	2.50	
PK	5.96135G	59.23	68.20	-8.97	7.41	3	Vertical	277	2.50	

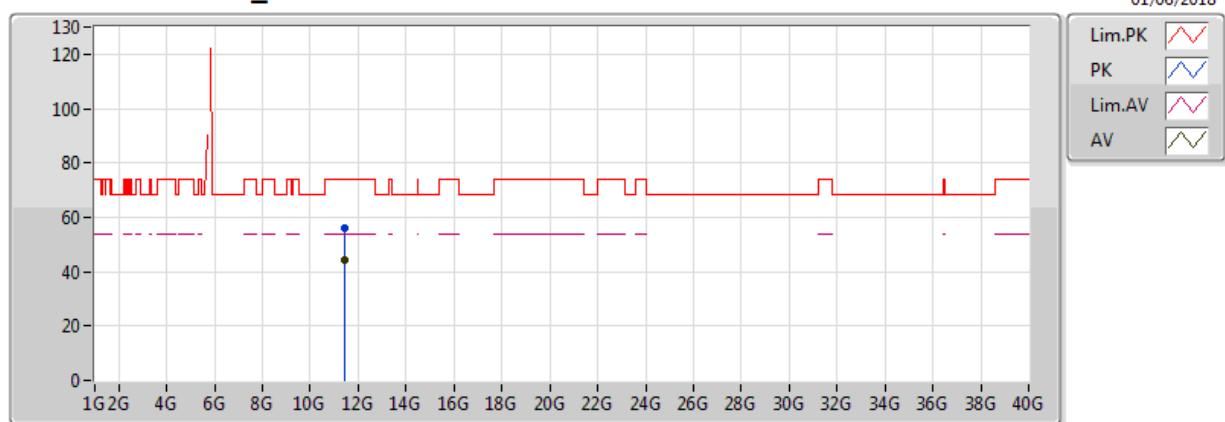
pi 4-DQPSK_Nss1_1TX
5730.35MHz_TX

EUT Y_1TX_External

Setting : Default

01-L-3-10

FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	
PK	5.48035G	58.91	68.20	-9.29	5.96	3	Horizontal	355	2.02	
PK	5.73035G	108.64	Inf	-Inf	6.81	3	Horizontal	355	2.02	
AV	5.73035G	104.01	Inf	-Inf	6.81	3	Horizontal	355	2.02	
PK	5.96835G	59.10	68.20	-9.10	7.42	3	Horizontal	355	2.02	

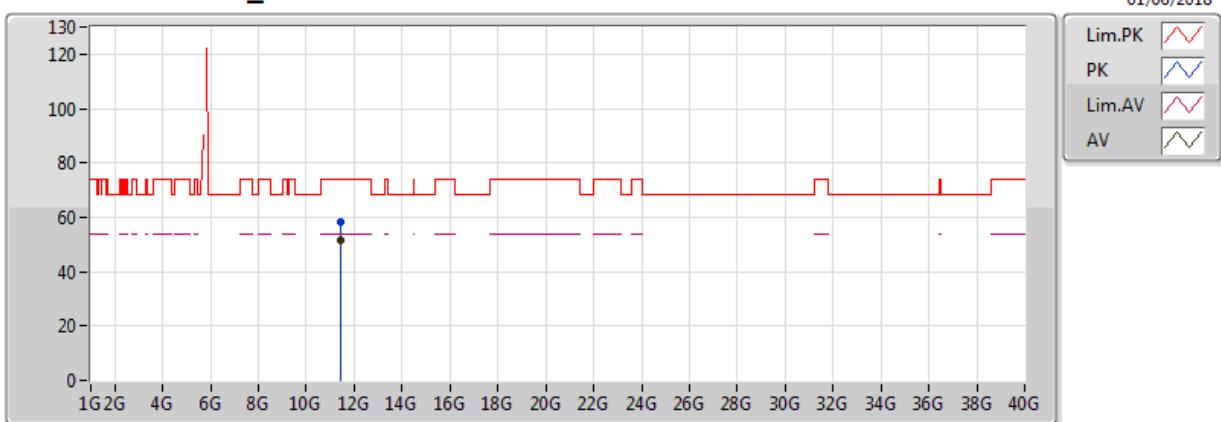
pi 4-DQPSK_Nss1_1TX
5730.35MHz_TX


EUT Y_1TX_External
Setting : Default
01-L-3
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	
PK	11.45802G	55.85	74.00	-18.15	13.32	3	Vertical	320	1.95	
AV	11.45794G	44.47	54.00	-9.53	13.32	3	Vertical	320	1.95	

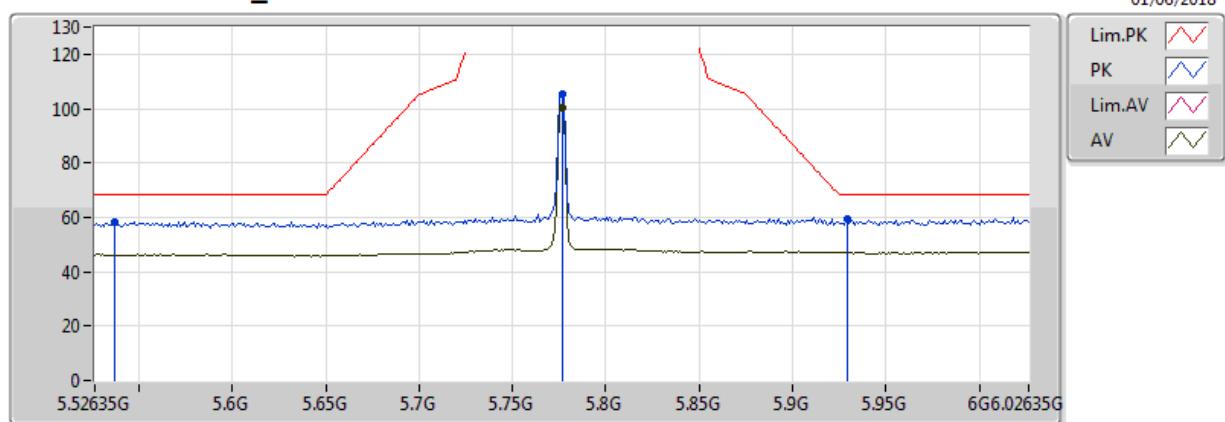
pi 4-DQPSK_Nss1_1TX

5730.35MHz_TX



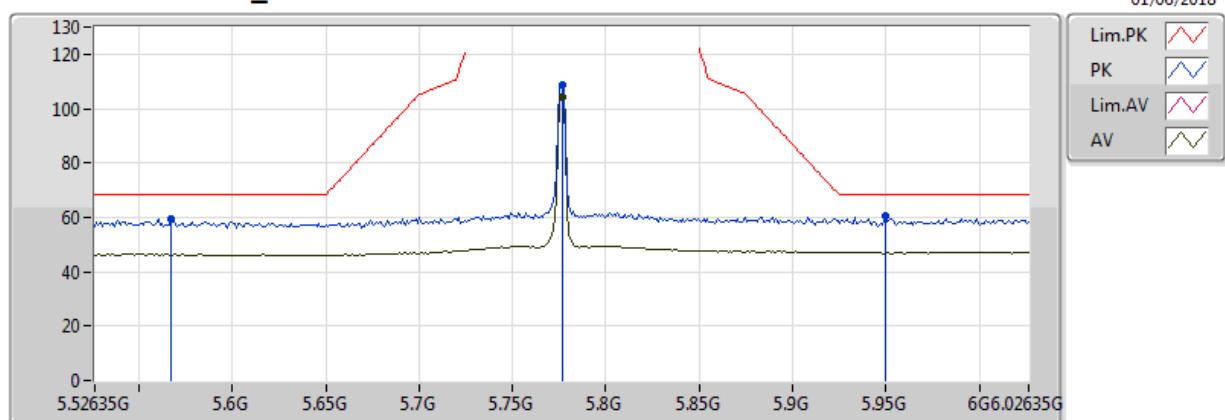
EUT Y_1TX_External
Setting : Default
01-L-3
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	
PK	11.45798G	58.35	74.00	-15.65	13.32	3	Horizontal	58	2.35	
AV	11.45792G	51.31	54.00	-2.69	13.32	3	Horizontal	58	2.35	

pi 4-DQPSK_Nss1_1TX
5776.35MHz_TX


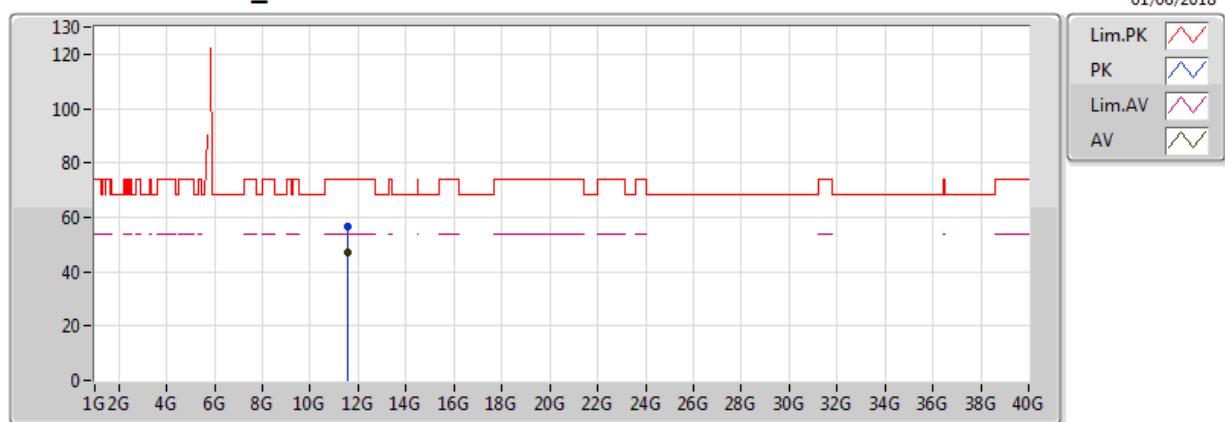
EUT Y_1TX_External
 Setting : Default
 01-L-3-10
 FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	
PK	5.53735G	58.33	68.20	-9.87	6.09	3	Vertical	110	1.12	
PK	5.77635G	105.09	Inf	-Inf	7.00	3	Vertical	110	1.12	
AV	5.77635G	100.41	Inf	-Inf	7.00	3	Vertical	110	1.12	
PK	5.92935G	59.18	68.20	-9.02	7.34	3	Vertical	110	1.12	

pi 4-DQPSK_Nss1_1TX
5776.35MHz_TX


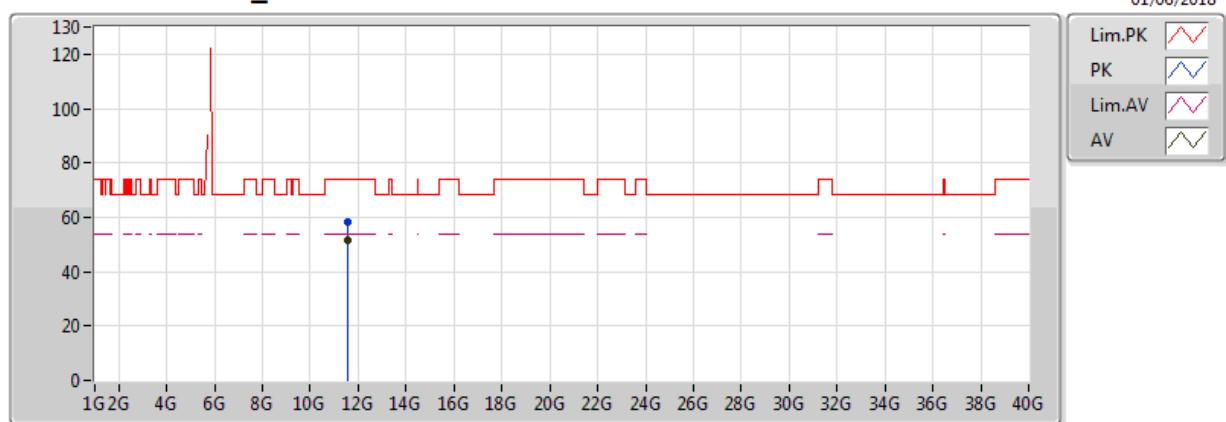
EUT Y_1TX_External
Setting : Default
01-L-3-10
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	
PK	5.56735G	59.49	68.20	-8.71	6.19	3	Horizontal	355	2.06	
PK	5.77635G	108.84	Inf	-Inf	7.00	3	Horizontal	355	2.06	
AV	5.77635G	103.96	Inf	-Inf	7.00	3	Horizontal	355	2.06	
PK	5.94935G	60.75	68.20	-7.45	7.39	3	Horizontal	355	2.06	

pi 4-DQPSK_Nss1_1TX
5776.35MHz_TX


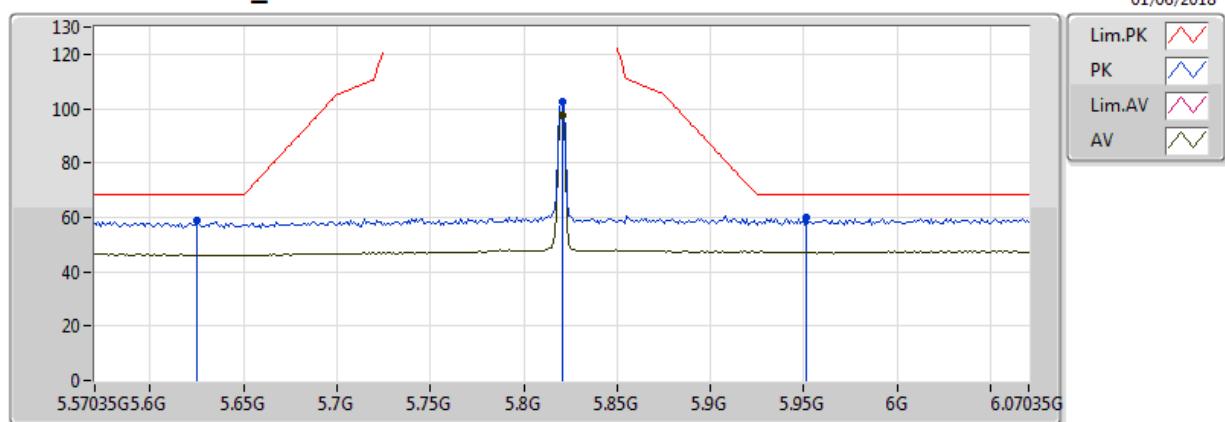
EUT Y_1TX_External
Setting : Default
01-L-3
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	
PK	11.54968G	56.46	74.00	-17.54	13.33	3	Vertical	312	1.83	
AV	11.54994G	46.81	54.00	-7.19	13.33	3	Vertical	312	1.83	

pi 4-DQPSK_Nss1_1TX
5776.35MHz_TX


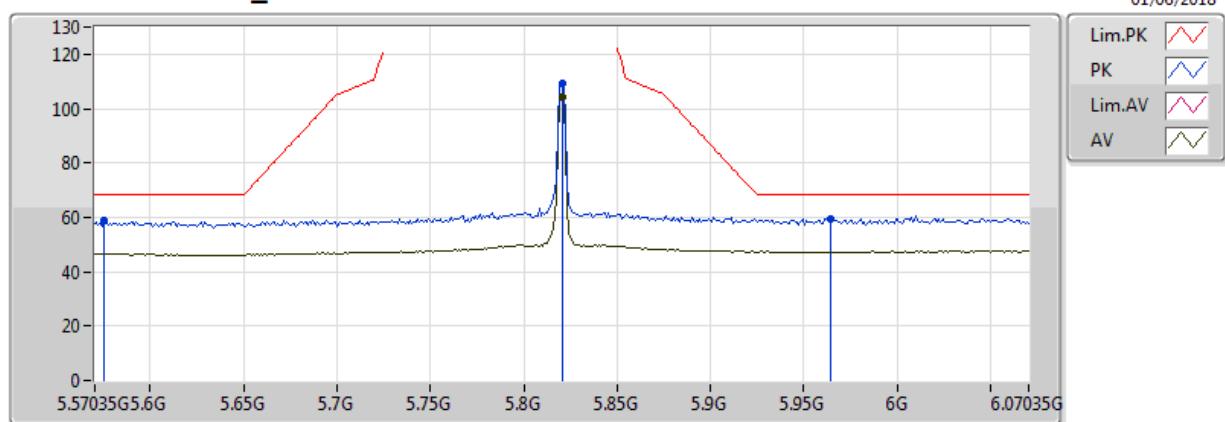
EUT Y_1TX_External
Setting : Default
01-L-3
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	
PK	11.5499G	58.43	74.00	-15.57	13.33	3	Horizontal	65	1.59	
AV	11.54992G	51.81	54.00	-2.19	13.33	3	Horizontal	65	1.59	

pi 4-DQPSK_Nss1_1TX
5820.35MHz_TX


EUT Y_1TX_External
Setting : Default
01-L-3-10
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	
PK	5.62535G	58.62	68.20	-9.58	6.37	3	Vertical	78	1.04	
PK	5.82035G	102.49	Inf	-Inf	7.14	3	Vertical	78	1.04	
AV	5.82035G	97.51	Inf	-Inf	7.14	3	Vertical	78	1.04	
PK	5.95135G	60.05	68.20	-8.15	7.38	3	Vertical	78	1.04	

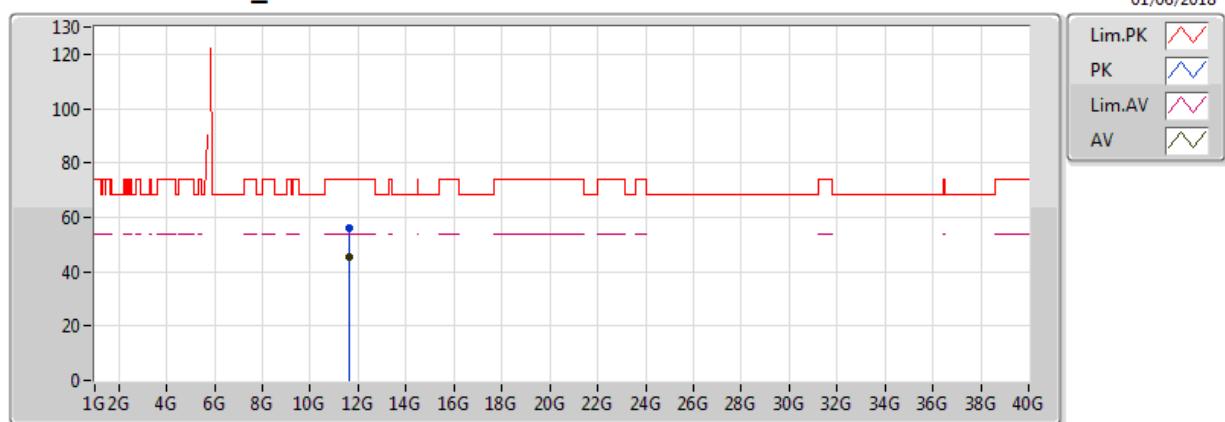
pi 4-DQPSK_Nss1_1TX
5820.35MHz_TX

EUT Y_1TX_External

Setting : Default

01-L-3-10

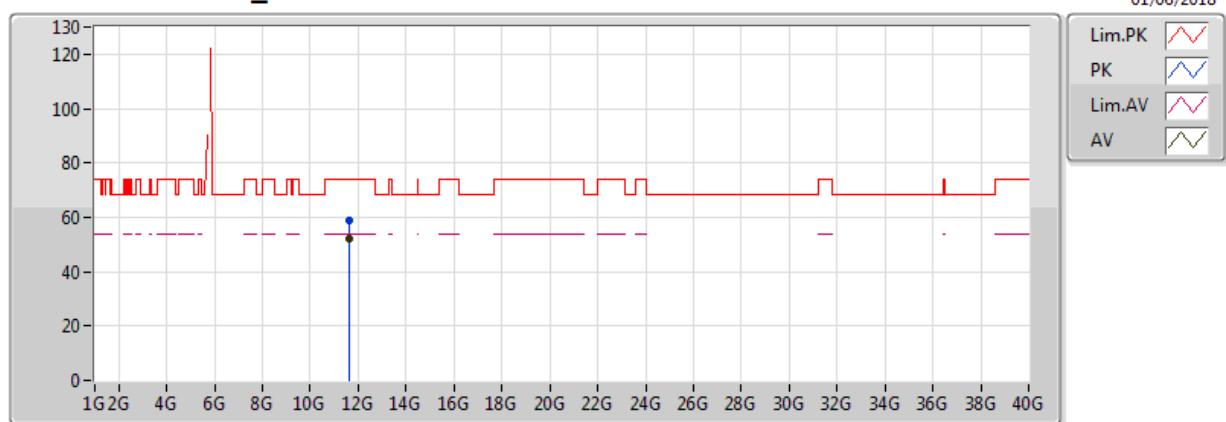
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)
PK	5.57535G	58.57	68.20	-9.63	6.20	3	Horizontal	0	2.03
PK	5.82035G	109.25	Inf	-Inf	7.14	3	Horizontal	0	2.03
AV	5.82035G	104.46	Inf	-Inf	7.14	3	Horizontal	0	2.03
PK	5.96435G	59.53	68.20	-8.67	7.41	3	Horizontal	0	2.03

pi 4-DQPSK_Nss1_1TX
5820.35MHz_TX


EUT Y_1TX_External
Setting : Default
01-L-3
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	
PK	11.63792G	56.13	74.00	-17.87	13.34	3	Vertical	113	1.50	
AV	11.63788G	45.16	54.00	-8.84	13.34	3	Vertical	113	1.50	

pi 4-DQPSK_Nss1_1TX
5820.35MHz_TX


EUT Y_1TX_External
Setting : Default
01-L-3
FSP(100080)

Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Condition	Azimuth (°)	Height (m)	
PK	11.6378G	58.62	74.00	-15.38	13.34	3	Horizontal	62	1.65	
AV	11.63788G	51.93	54.00	-2.07	13.34	3	Horizontal	62	1.65	