

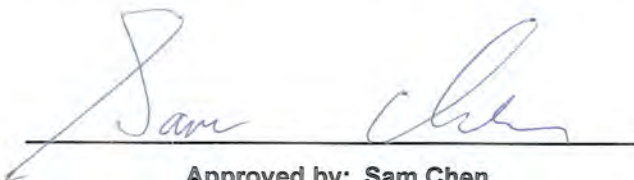


NCC RADIO TEST REPORT

Equipment : Radar Sensor
Brand Name : APTIV
Model Name : B4TR
Applicant : Aptiv Services Deutschland GmbH
Am Technologiepark 1, 42119 Wuppertal, Germany
Manufacturer : Aptiv Services Deutschland GmbH
Am Technologiepark 1, 42119 Wuppertal, Germany
Standard : LP0002 Section 4.14 (2020-07-01)

The product was received on Sep. 22, 2020, and testing was started from Oct. 15, 2020 and completed on Nov. 19, 2020. 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 test results in this 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: Sam Chen

SPORTON INTERNATIONAL 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 Photos

Photographs of EUT v01



TEL : 886-3-656-9065
FAX : 886-3-656-9085
Report Template No.: CB-B3_3 Ver1.3



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	3.3	AC Power-line Conducted Emissions	PASS	-
3.2	C63.10 Clause 6.9	Occupied Bandwidth	PASS	-
3.3	4.14.1.2	Radiated E.I.R.P Power / E.I.R.P Power Density	PASS	-
3.4	4.14.1.3	Transmitter Radiated Unwanted Emissions	PASS	-
3.5	4.14.1.4	Frequency Stability	PASS	-

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Sam Chen

Report Producer: Cindy Peng



1 General Description

1.1 Information

1.1.1 RF General Information

RF General Information				
Bandwidth (MHz)	Frequency Range (GHz)	Operating Frequency Range (GHz)	Test Frequency (GHz)	Modulation
175	76-77	76.152-76.861	76.152	FMCW
			76.531	
			76.861	
300	76-77	76.235-76.780	76.235	FMCW
			76.556	
			76.780	
425	76-77	76.322-76.686	76.322	FMCW
			76.579	
			76.686	

1.1.2 Antenna Information

Ant.	Brand	Model Name	Type	Connector	Boresight Gain (One Way) (dBi)	60 Deg Gain (One Way) (dBi)
1	APTIV	B4TR	Integral Planar Array	N/A	13.6	14.4

Note: The above information was declared by manufacturer.

1.1.3 EUT Operational Condition

EUT Power Type	From DC power supply			
Supply Voltage	☐	AC	State AC voltage	-
Supply Voltage	☒	DC	State DC voltage	12V
Test Software Version	Vector CANoe Version 11.0.81 (SP3) - 64bit			

1.1.4 Duty Cycle

Bandwidth (MHz)	T (ms)	TX-on+TX-off (ms)	Duty Cycle	Duty Cycle Factor (dB)
175	14.35	50.00	0.287	5.42
300	14.348	50.145	0.286	5.43
425	14.493	50.145	0.289	5.39



1.2 Applicable Standards

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

- ♦ LP0002 Section 4.14 (2020-07-01)
- ♦ ANSI C63.10 - Testing Unlicensed Wireless Devices
- ♦ KDB653005 D01 76-81 GHz Radars v01r01

The following reference test guidance is not within the scope of accreditation of TAF.

- ♦ FCC KDB 414788 D01 v01r01

1.3 Testing Location Information

Testing Location				
☐	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
☒	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
Radiated	TH03-CB	Jay Luo	24~26°C / 49~53%	Oct. 19, 2020
Radiated Below 1GHz	03CH05-CB	Jay Luo	23~24°C / 54~58%	Oct. 15, 2020~Oct. 19, 2020
Radiated 1GHz~40GHz	03CH01-CB	Jay Luo	23~24°C / 54~58%	Oct. 15, 2020~Oct. 19, 2020
Radiated Above 40GHz	03CH05-CB	Jay Luo	23~24°C / 54~58%	Oct. 15, 2020~Oct. 19, 2020
AC Conduction	CO01-CB	Ryo Fan	24~25°C / 60~61%	Nov. 19, 2020

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)	2.0 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	5.6 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	4.9 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	4.6 dB	Confidence levels of 95%
Radiated Emission (40GHz ~ 60GHz)	3.9 dB	Confidence levels of 95%
Radiated Emission (60GHz ~ 90GHz)	4.5 dB	Confidence levels of 95%
Radiated Emission (90GHz ~ 200GHz)	5.3 dB	Confidence levels of 95%
Radiated Emission (200GHz ~ 280GHz)	5.6 dB	Confidence levels of 95%
Temperature	0.9°C	Confidence levels of 95%

2 Test Configuration of EUT

2.1 Test Channel Frequencies Configuration

Test Bandwidth: 175 MHz

Test Frequencies (GHz)	76.152	76.531	76.861
Software Setting	Default	Default	Default

Test Bandwidth: 300 MHz

Test Frequencies (GHz)	76.235	76.556	76.780
Software Setting	Default	Default	Default

Test Bandwidth: 425 MHz

Test Frequencies (GHz)	76.322	76.579	76.686
Software Setting	Default	Default	Default



2.2 Conformance Tests and Related Test Frequencies

Test Item	Test Bandwidth (MHz)	Test Frequencies (GHz)
AC Power-line Conducted Emissions Intentional – CTX	300	76.780
AC Power-line Conducted Emissions Unintentional – CRX	300	76.780
Occupied Bandwidth	175	76.152, 76.531, 76.861
	300	76.235, 76.556, 76.780
	425	76.322, 76.579, 76.686
Radiated E.I.R.P Power / E.I.R.P Power Density	175	76.152, 76.531, 76.861
	300	76.235, 76.556, 76.780
	425	76.322, 76.579, 76.686
Transmitter Spurious Emissions (below 1 GHz)	175	76.861
	300	76.780
	425	76.686
Transmitter Spurious Emissions (1 GHz-40 GHz)	175	76.152, 76.531, 76.861
	300	76.235, 76.556, 76.780
	425	76.322, 76.579, 76.686
Transmitter Spurious Emissions (above 40 GHz)	175	76.152, 76.531, 76.861
	300	76.235, 76.556, 76.780
	425	76.322, 76.579, 76.686
Receiver Radiated Unwanted Emissions (below 1 GHz)	175	76.861
	300	76.780
	425	76.686
Receiver Radiated Unwanted Emissions (1 GHz-40 GHz)	175	76.152, 76.531, 76.861
	300	76.235, 76.556, 76.780
	425	76.322, 76.579, 76.686
Frequency Stability	175	76.152, 76.531, 76.861
	300	76.235, 76.556, 76.780
	425	76.322, 76.579, 76.686

2.3 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	Intentional - CTX
"Test Bandwidth: 300 MHz - 76.556 GHz" generated the worst test result for Transmitter Radiated Unwanted Emissions Below 1GHz test, thus the measurement for AC Power-line Conducted Emissions Intentional – CTX test will follow this same test configuration.	
1	Test Bandwidth: 300 MHz - 76.556 GHz
Operating Mode	Unintentional - CRX
"Test Bandwidth: 425 MHz - 76.579 GHz" generated the worst test result for Receiver Radiated Unwanted Emissions Below 1GHz test, thus the measurement for AC Power-line Conducted Emissions Unintentional - CRX test will follow this same test configuration.	
1	Test Bandwidth: 425 MHz - 76.579 GHz

The Worst Case Mode for Following Conformance Tests	
Tests Item	Occupied Bandwidth Radiated E.I.R.P / Power Density Frequency Stability
Test Condition	Radiated measurement
Operating Mode	CTX
1	Test Bandwidth: 175 MHz - 76.152 GHz
2	Test Bandwidth: 175 MHz - 76.531 GHz
3	Test Bandwidth: 175 MHz - 76.861 GHz
4	Test Bandwidth: 300 MHz - 76.235 GHz
5	Test Bandwidth: 300 MHz - 76.556 GHz
6	Test Bandwidth: 300 MHz - 76.780 GHz
7	Test Bandwidth: 425 MHz - 76.322 GHz
8	Test Bandwidth: 425 MHz - 76.579 GHz
9	Test Bandwidth: 425 MHz - 76.686 GHz

The Worst Case Mode for Following Conformance Tests	
Tests Item	Transmitter Radiated Unwanted Emissions
Test Condition	Radiated measurement
Operating Mode < 1GHz	CTX
The EUT was performed at X axis, Y axis and Z axis position for Radiated Emissions test. "EUT in Y axis" generated the worst test result for Transmitter Radiated Unwanted Emissions Above 1GHz test, thus the measurement for Transmitter Radiated Unwanted Emissions Below 1GHz test will follow this same test configuration.	
The below frequencies generated the maximum power from Radiated E.I.R.P. test. So the measurement will follow this same test configuration.	
1	EUT in Y axis_Test Bandwidth: 175 MHz - 76.861 GHz
2	EUT in Y axis_Test Bandwidth: 300 MHz - 76.780 GHz
3	EUT in Y axis_Test Bandwidth: 425 MHz - 76.686 GHz
For operating mode 2 is the worst case and it was record in this test report.	
Operating Mode > 1GHz	CTX
The EUT was performed at X axis, Y axis and Z axis position for Transmitter Radiated Unwanted Emissions Above 1GHz test, and the worst case was found at Y axis. So the measurement will follow this same test configuration.	
1	EUT in Y axis_Test Bandwidth: 175 MHz - 76.152 GHz
2	EUT in Y axis_Test Bandwidth: 175 MHz - 76.531 GHz
3	EUT in Y axis_Test Bandwidth: 175 MHz - 76.861 GHz
4	EUT in Y axis_Test Bandwidth: 300 MHz - 76.235 GHz
5	EUT in Y axis_Test Bandwidth: 300 MHz - 76.556 GHz
6	EUT in Y axis_Test Bandwidth: 300 MHz - 76.780 GHz
7	EUT in Y axis_Test Bandwidth: 425 MHz - 76.322 GHz
8	EUT in Y axis_Test Bandwidth: 425 MHz - 76.579 GHz
9	EUT in Y axis_Test Bandwidth: 425 MHz - 76.686 GHz

The Worst Case Mode for Following Conformance Tests	
Tests Item	Unintentional Radiated Emissions
Test Condition	Radiated measurement
Operating Mode < 1GHz	CRX
The EUT was performed at X axis, Y axis and Z axis position for Radiated Emissions test. "EUT in Y axis" generated the worst test result for Transmitter Radiated Unwanted Emissions Above 1GHz test, thus the measurement for Unintentional Radiated Emissions Below 1GHz test will follow this same test configuration.	
The below frequencies generated the maximum power from Radiated E.I.R.P. test. So the measurement will follow this same test configuration.	
1	EUT in Y axis_Test Bandwidth: 175 MHz - 76.861 GHz
2	EUT in Y axis_Test Bandwidth: 300 MHz - 76.780 GHz
3	EUT in Y axis_Test Bandwidth: 425 MHz - 76.686 GHz
For operating mode 3 is the worst case and it was record in this test report.	
Operating Mode > 1GHz	CRX
The EUT was performed at X axis, Y axis and Z axis position for Radiated Emissions test. "EUT in Y axis" generated the worst test result for Transmitter Radiated Unwanted Emissions Above 1GHz test, thus the measurement for Unintentional Radiated Emissions Above 1GHz test will follow this same test configuration.	
1	EUT in Y axis_Test Bandwidth: 175 MHz - 76.152 GHz
2	EUT in Y axis_Test Bandwidth: 175 MHz - 76.531 GHz
3	EUT in Y axis_Test Bandwidth: 175 MHz - 76.861 GHz
4	EUT in Y axis_Test Bandwidth: 300 MHz - 76.235 GHz
5	EUT in Y axis_Test Bandwidth: 300 MHz - 76.556 GHz
6	EUT in Y axis_Test Bandwidth: 300 MHz - 76.780 GHz
7	EUT in Y axis_Test Bandwidth: 425 MHz - 76.322 GHz
8	EUT in Y axis_Test Bandwidth: 425 MHz - 76.579 GHz
9	EUT in Y axis_Test Bandwidth: 425 MHz - 76.686 GHz

Note1: The applicant declared that the accessories of this case were for measurement only and it would not be marketed. The accessories will be provided and inspected by the laboratory (or the applicant).

2.4 EUT Operation during Test

The EUT was programmed to be in continuously transmitting/receiving mode.

2.5 Accessories

N/A

2.6 Support Equipment

For AC power-line conducted emissions test:

Support Equipment					
No.	Equipment	Brand Name	Model Name	FCC ID	Remark
A	Power Supply	Advanced	LPS-305	N/A	Provided by Lab.
B	NB	DELL	Latitude E5470	N/A	Provided by applicant.
C	Earphone	e-Power	S90W	N/A	Provided by Lab.
D	Mouse	HP	FM100	N/A	Provided by Lab.
E	Flash disk	VECTOR	Keyman	N/A	Provided by applicant.
F	Netzwerk-Interfaces	VECTOR	VN1640A	N/A	Provided by applicant.

For Occupied Bandwidth, Radiated E.I.R.P / Power Density and Frequency Stability tests:

Support Equipment					
No.	Equipment	Brand Name	Model Name	FCC ID	Remark
A	Power Supply	Advanced	LPS-305	N/A	Provided by Lab.
B	Notebook	Dell	Latitude 5480	N/A	Provided by applicant.
C	Netzwerk-Interfaces	VECTOR	VN1640A	N/A	Provided by applicant.
D	Flash disk	VECTOR	Keyman	N/A	Provided by applicant.

For Transmitter Radiated Unwanted Emissions and Unintentional Radiated Emissions test:

Support Equipment					
No.	Equipment	Brand Name	Model Name	FCC ID	Remark
A	Power Supply	Advanced	LPS-305	N/A	Provided by Lab.
B	Notebook	Dell	Latitude 5480	N/A	Provided by applicant.
C	Netzwerk-Interfaces	VECTOR	VN1640A	N/A	Provided by applicant.
D	Flash disk	VECTOR	Keyman	N/A	Provided by applicant.

2.7 Far Field Boundary Calculations

The far-field boundary is given as:

$$\text{far field} = (2 * L^2) / \lambda$$

where:

L = Largest Antenna Dimension, including the reflector, in meters

λ = wavelength in meters

Test Bandwidth: 175 MHz

Far Field (m)				
Frequency (GHz)	L (m)	Lambda (m)	d(Far Field) (m)	d(Far Field) (cm)
76.152	0.04	0.0039395	0.812	81.23
76.531	0.04	0.0039200	0.816	81.63
76.861	0.04	0.0039031	0.820	81.99

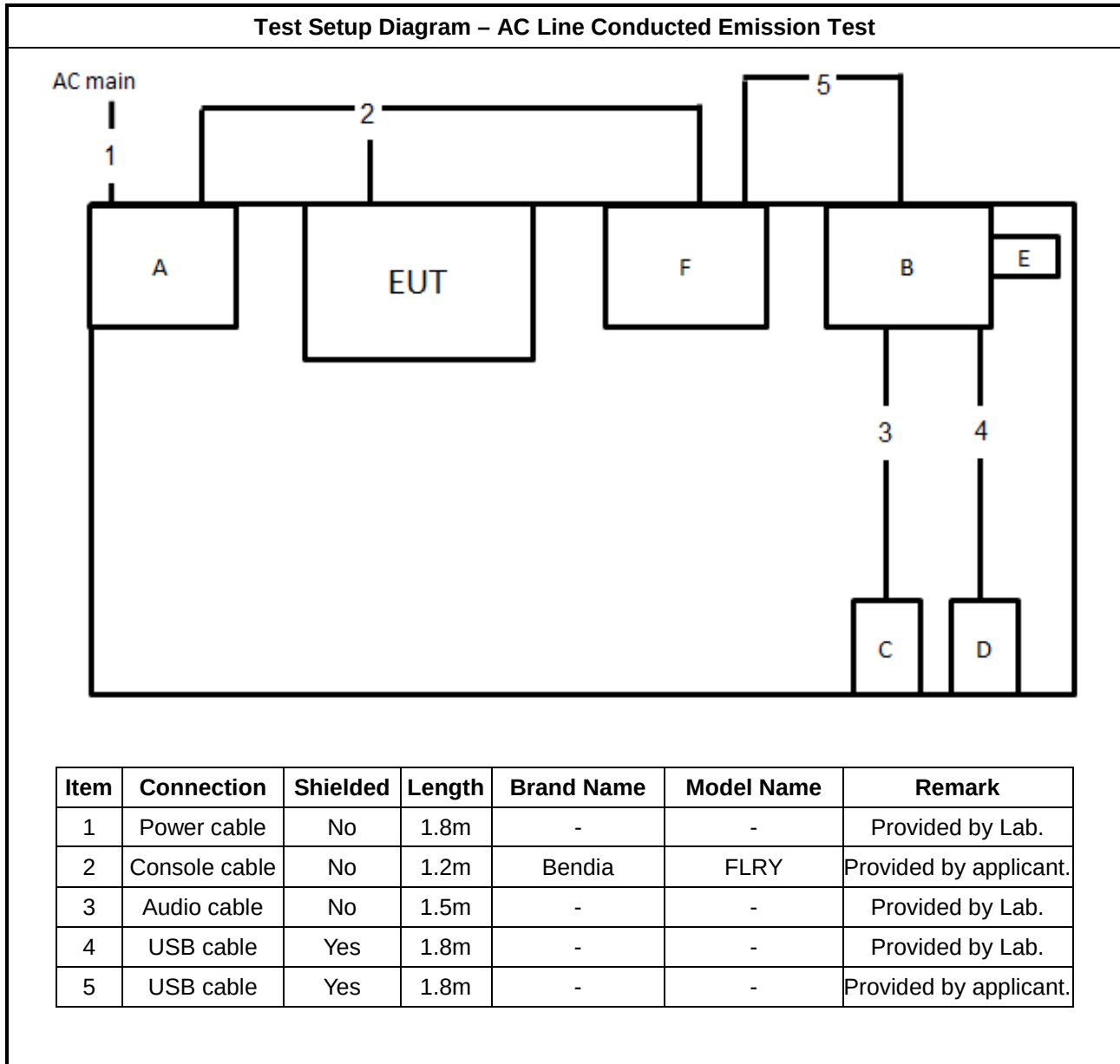
Test Bandwidth: 300 MHz

Far Field (m)				
Frequency (GHz)	L (m)	Lambda (m)	d(Far Field) (m)	d(Far Field) (cm)
76.235	0.04	0.0039352	0.813	81.32
76.556	0.04	0.0039187	0.817	81.66
76.780	0.04	0.0039073	0.819	81.90

Test Bandwidth: 425 MHz

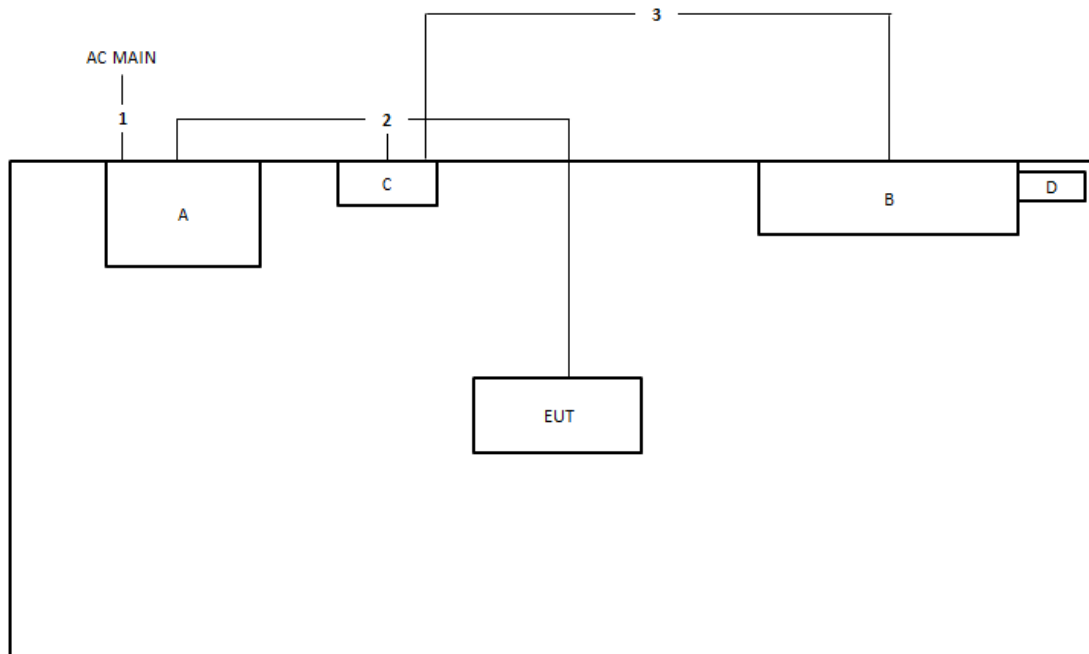
Far Field (m)				
Frequency (GHz)	L (m)	Lambda (m)	d(Far Field) (m)	d(Far Field) (cm)
76.322	0.04	0.0039307	0.814	81.41
76.579	0.04	0.0039175	0.817	81.68
76.686	0.04	0.0039121	0.818	81.80

2.8 Test Setup Diagram



Test Setup Diagram - Radiated Test

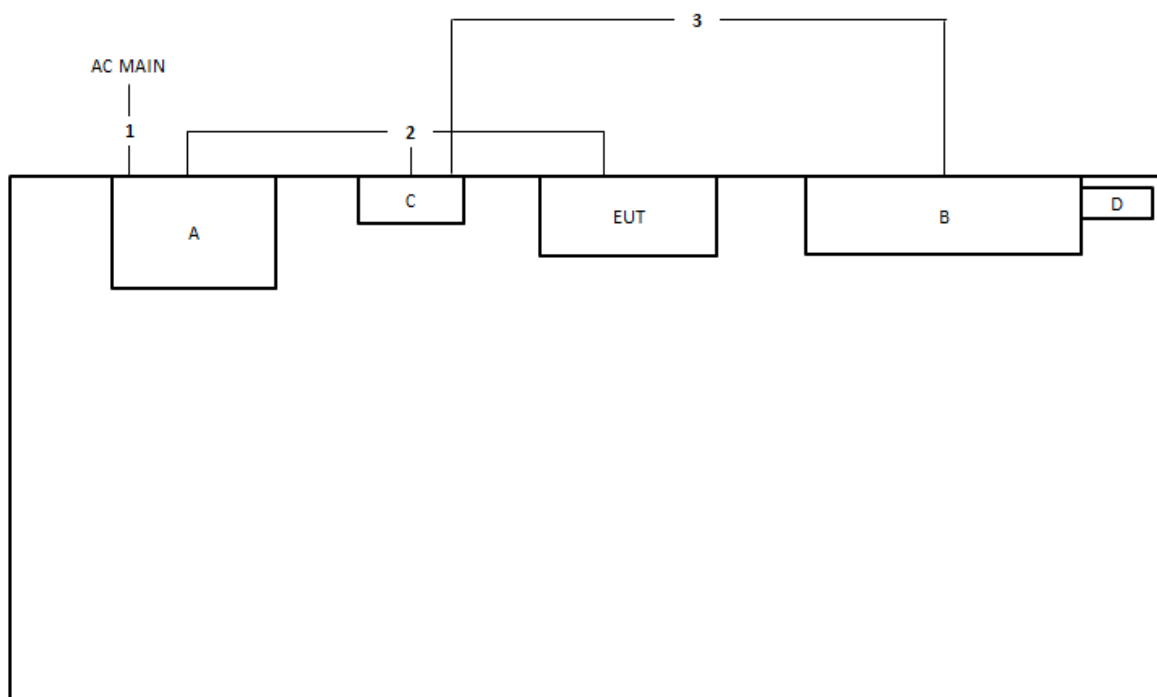
CTX mode



Item	Connection	Shielded	Length	Brand Name	Model Name	Remark
1	Power cable	No	1.2m	-	-	Provided by Lab.
2	Console cable	No	1.2m	Bendia	FLRY	Provided by applicant.
3	USB cable	Yes	1.8m	-	-	Provided by applicant.

Test Setup Diagram - Radiated Test

CRX mode



Item	Connection	Shielded	Length	Brand Name	Model Name	Remark
1	Power cable	No	1.2m	-	-	Provided by Lab.
2	Console cable	No	1.2m	Bendia	FLRY	Provided by applicant.
3	USB cable	Yes	1.8m	-	-	Provided by applicant.

3 Transmitter Test Result

3.1 AC Power-line Conducted Emissions

3.1.1 Limit of AC Power-line Conducted Emissions

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: * Decreases with the logarithm of the frequency.

Note: * Decreases with the logarithm of the frequency.

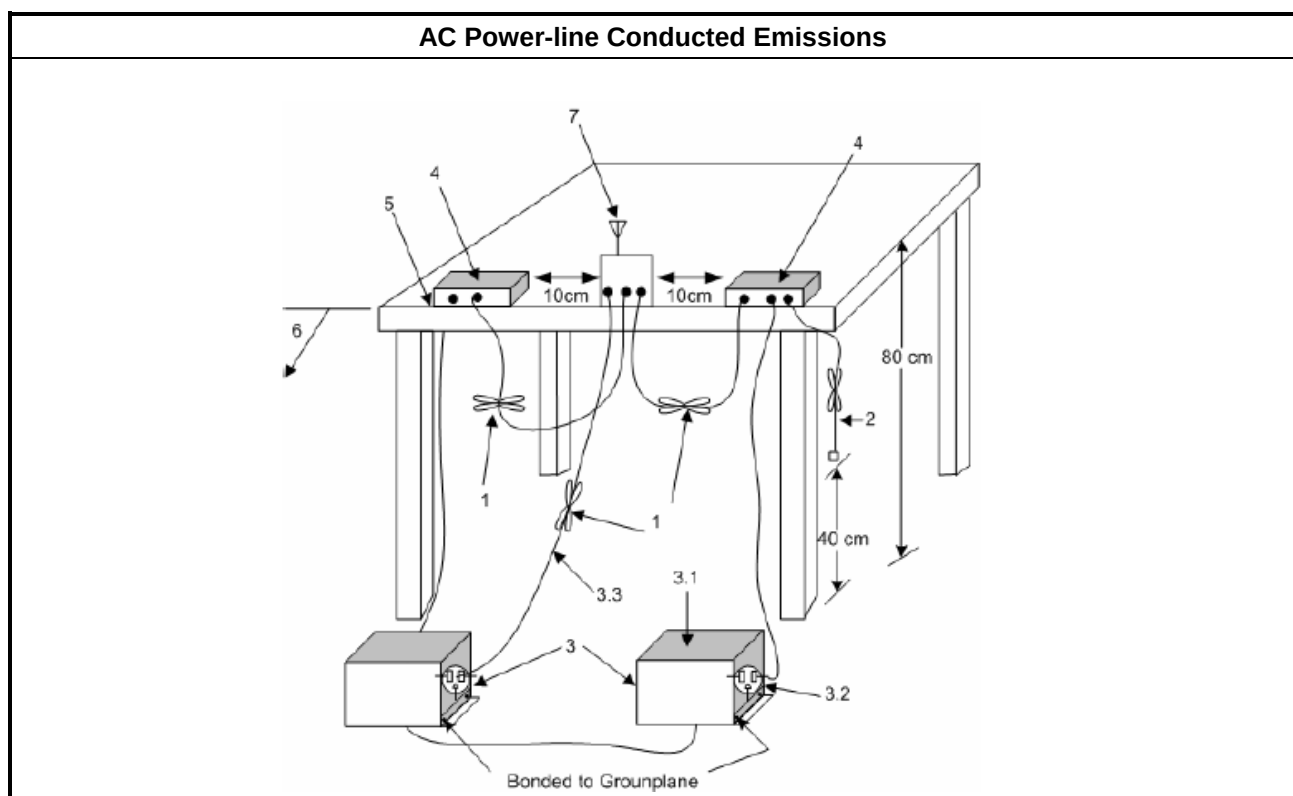
3.1.2 Measuring Instruments

Refer a measuring instruments list in this test report.

3.1.3 Test Procedures

Method of measurement: Refer as ANSI C63.10, clause 6.2.

3.1.4 Test Setup



3.1.5 Measurement Results Calculation

The measured Level is calculated using:

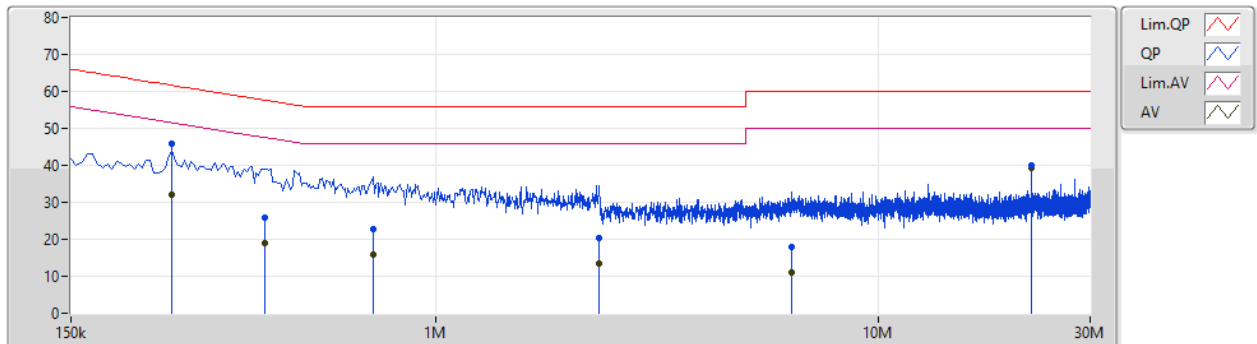
- a. Corrected Reading: LISN Factor (LISN) + Attenuator (AT/AUX) + Cable Loss (CL) + Read Level (Raw) = Level
b. Margin = -Limit + Level

3.1.6 Test Result of AC Power-line Conducted Emissions

Intentional – CTX

Test Mode	Mode 1	Phase	Line
Test Bandwidth (MHz)	300 MHz	Test Freq. (GHz)	76.780

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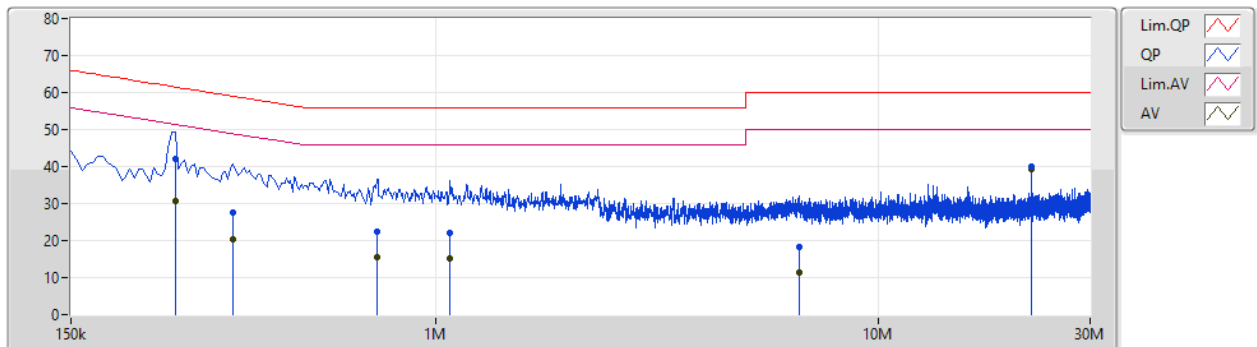


Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Condition	Comment	Raw (dBuV)	LISN (dB)	CL (dB)	AT (dB)			
QP	253.5k	45.78	61.64	-15.86	9.89	Line	-	35.89	0.04	0.03	9.82			
AV	253.5k	31.95	51.64	-19.69	9.89	Line	-	22.06	0.04	0.03	9.82			
QP	411k	25.78	57.63	-31.85	9.90	Line	-	15.88	0.04	0.03	9.83			
AV	411k	19.03	47.63	-28.60	9.90	Line	-	9.13	0.04	0.03	9.83			
QP	721.5k	22.66	56.00	-33.34	9.92	Line	-	12.74	0.05	0.04	9.83			
AV	721.5k	15.81	46.00	-30.19	9.92	Line	-	5.89	0.05	0.04	9.83			
QP	2.333M	20.27	56.00	-35.73	10.01	Line	-	10.26	0.07	0.08	9.86			
AV	2.333M	13.48	46.00	-32.52	10.01	Line	-	3.47	0.07	0.08	9.86			
QP	6.347M	17.80	60.00	-42.20	10.15	Line	-	7.65	0.13	0.14	9.88			
AV	6.347M	10.93	50.00	-39.07	10.15	Line	-	0.78	0.13	0.14	9.88			
QP	22.119M	40.02	60.00	-19.98	10.59	Line	-	29.43	0.25	0.33	10.01			
AV	22.119M	39.15	50.00	-10.85	10.59	Line	"Worst"	28.56	0.25	0.33	10.01			



Test Mode	Mode 1	Phase	Neutral
Test Bandwidth (MHz)	300	Test Freq. (GHz)	76.780

19/11/2020



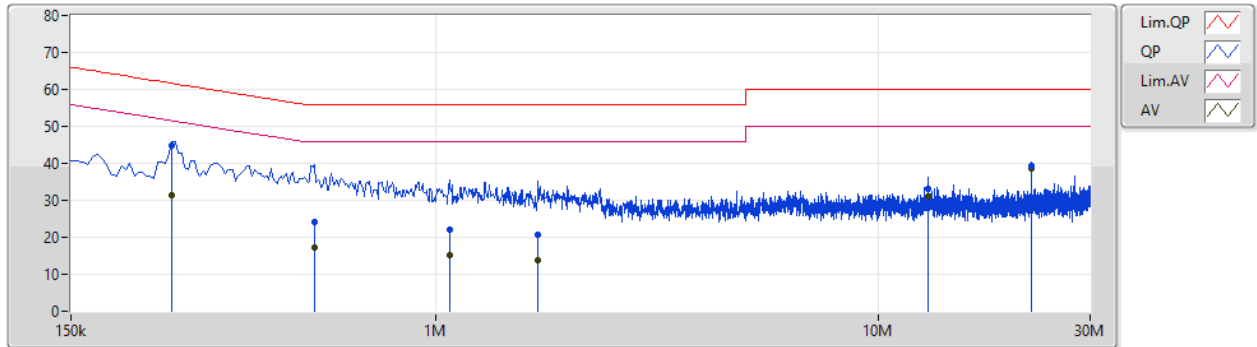
Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Condition	Comment	Raw (dBuV)	LISN (dB)	CL (dB)	AT (dB)			
QP	258k	42.05	61.49	-19.44	9.89	Neutral	-	32.16	0.04	0.03	9.82			
AV	258k	30.75	51.49	-20.74	9.89	Neutral	-	20.86	0.04	0.03	9.82			
QP	348k	27.45	59.00	-31.55	9.90	Neutral	-	17.55	0.04	0.03	9.83			
AV	348k	20.43	49.00	-28.57	9.90	Neutral	-	10.53	0.04	0.03	9.83			
QP	735k	22.45	56.00	-33.55	9.92	Neutral	-	12.53	0.05	0.04	9.83			
AV	735k	15.59	46.00	-30.41	9.92	Neutral	-	5.67	0.05	0.04	9.83			
QP	1.077M	22.11	56.00	-33.89	9.93	Neutral	-	12.18	0.06	0.04	9.83			
AV	1.077M	15.33	46.00	-30.67	9.93	Neutral	-	5.40	0.06	0.04	9.83			
QP	6.617M	18.19	60.00	-41.81	10.15	Neutral	-	8.04	0.13	0.14	9.88			
AV	6.617M	11.35	50.00	-38.65	10.15	Neutral	-	1.20	0.13	0.14	9.88			
QP	22.119M	40.06	60.00	-19.94	10.58	Neutral	-	29.48	0.24	0.33	10.01			
AV	22.119M	39.18	50.00	-10.82	10.58	Neutral	"Worst"	28.60	0.24	0.33	10.01			



Unintentional – CRX

Test Mode	Mode 1	Phase	Line
Test Bandwidth (MHz)	300	Test Freq. (GHz)	76.780

19/11/2020

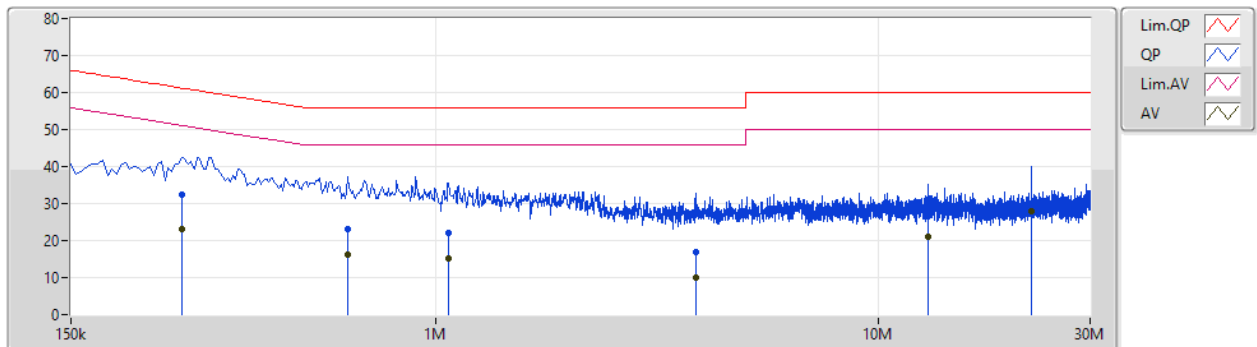


Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Condition	Comment	Raw (dBuV)	LISN (dB)	CL (dB)	AT (dB)			
QP	253.5k	44.95	61.64	-16.69	9.89	Line	-	35.06	0.04	0.03	9.82			
AV	253.5k	31.36	51.64	-20.28	9.89	Line	-	21.47	0.04	0.03	9.82			
QP	532.5k	24.07	56.00	-31.93	9.90	Line	-	14.17	0.04	0.03	9.83			
AV	532.5k	17.29	46.00	-28.71	9.90	Line	-	7.39	0.04	0.03	9.83			
QP	1.073M	22.05	56.00	-33.95	9.92	Line	-	12.13	0.05	0.04	9.83			
AV	1.073M	15.11	46.00	-30.89	9.92	Line	-	5.19	0.05	0.04	9.83			
QP	1.698M	20.54	56.00	-35.46	9.97	Line	-	10.57	0.06	0.06	9.85			
AV	1.698M	13.65	46.00	-32.35	9.97	Line	-	3.68	0.06	0.06	9.85			
QP	12.903M	32.94	60.00	-27.06	10.31	Line	-	22.63	0.20	0.20	9.91			
AV	12.903M	30.99	50.00	-19.01	10.31	Line	-	20.68	0.20	0.20	9.91			
QP	22.119M	39.39	60.00	-20.61	10.59	Line	-	28.80	0.25	0.33	10.01			
AV	22.119M	38.64	50.00	-11.36	10.59	Line	"Worst"	28.05	0.25	0.33	10.01			



Test Mode	Mode 1	Phase	Neutral
Test Bandwidth (MHz)	300	Test Freq. (GHz)	76.780

19/11/2020



Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Factor (dB)	Condition	Comment	Raw (dBuV)	LISN (dB)	CL (dB)	AT (dB)			
QP	267k	32.31	61.20	-28.89	9.89	Neutral	-	22.42	0.04	0.03	9.82			
AV	267k	23.19	51.20	-28.01	9.89	Neutral	-	13.30	0.04	0.03	9.82			
QP	631.5k	23.11	56.00	-32.89	9.91	Neutral	-	13.20	0.05	0.03	9.83			
AV	631.5k	16.36	46.00	-29.64	9.91	Neutral	-	6.45	0.05	0.03	9.83			
QP	1.068M	22.15	56.00	-33.85	9.93	Neutral	-	12.22	0.06	0.04	9.83			
AV	1.068M	15.26	46.00	-30.74	9.93	Neutral	-	5.33	0.06	0.04	9.83			
QP	3.854M	16.94	56.00	-39.06	10.06	Neutral	-	6.88	0.09	0.13	9.84			
AV	3.854M	10.07	46.00	-35.93	10.06	Neutral	-	0.01	0.09	0.13	9.84			
QP	12.908M	26.42	60.00	-33.58	10.29	Neutral	-	16.13	0.18	0.20	9.91			
AV	12.908M	20.98	50.00	-29.02	10.29	Neutral	-	10.69	0.18	0.20	9.91			
QP	22.124M	29.88	60.00	-30.12	10.58	Neutral	-	19.30	0.24	0.33	10.01			
AV	22.124M	27.77	50.00	-22.23	10.58	Neutral	"Worst"	17.19	0.24	0.33	10.01			

3.2 Occupied Bandwidth

3.2.1 Occupied Bandwidth (OBW) Limit

Occupied Bandwidth (EBW) Limit
Information only

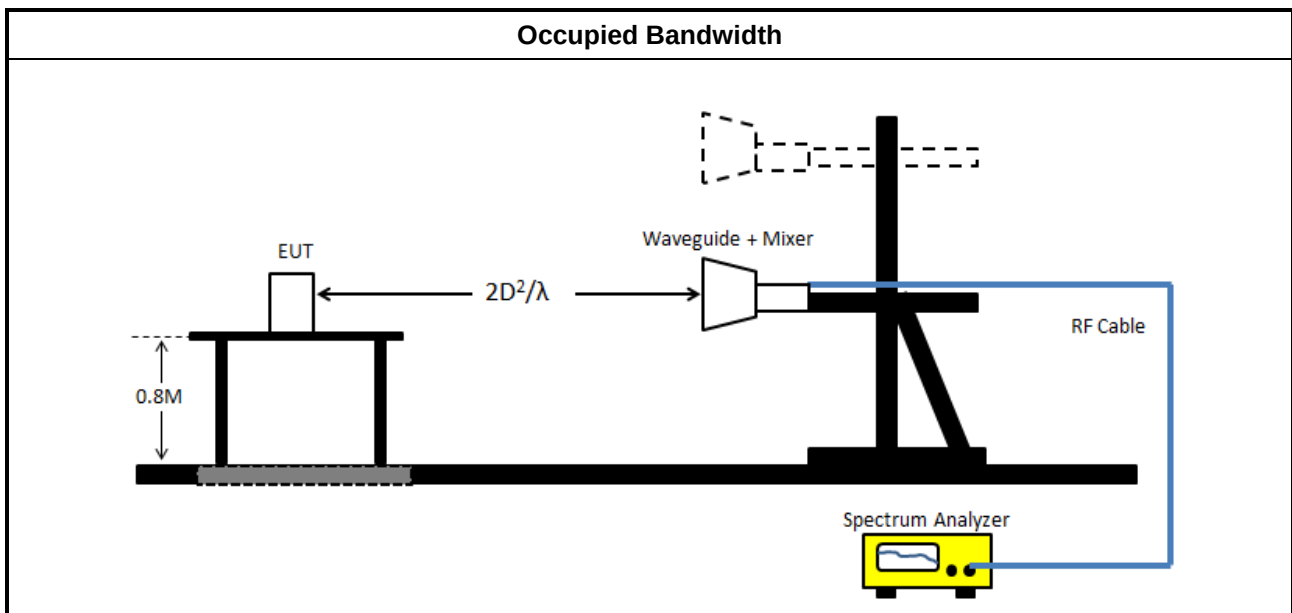
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

Test Method
☒ For the Occupied bandwidth shall be measured using one of the options below:
☒ Refer as ANSI C63.10, clause 7.8.7 for EBW measurement.
☐ Refer as ANSI C63.10, clause 6.9.2 for occupied bandwidth testing.
☒ Refer as ANSI C63.10, clause 9 for radiated measurement.
☒ Radiated test was conducted at far-field distance. the distance from the radiating element of the EUT to the edge of the far field may be calculated from $[r \geq 2D^2/\lambda]$ r is the distance from the radiating element of the EUT to the edge of the far field, in m D is the largest dimension of both the radiating element and the test antenna (horn), in m λ is the wavelength of the emission under investigation $[300/f \text{ (MHz)}]$, in m

3.2.4 Test Setup





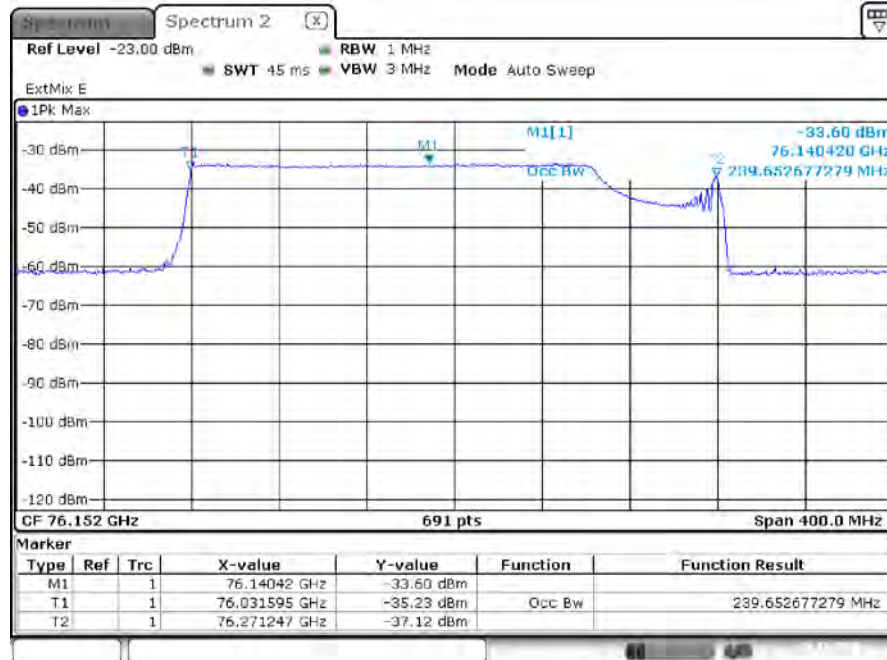
3.2.5 Test Result of Occupied Bandwidth

Test Bandwidth: 175 MHz

Test Results		
Test Freq. (GHz)	99% Occupied Bandwidth (MHz)	Limit (MHz)
76.152	239.652	N/A
76.531	239.652	N/A
76.861	239.652	N/A

Occupied Bandwidth Plots

Test Frequency: 76.152 GHz



Date: 16.OCT.2020 10:00:42

Test Frequency: 76.531 GHz



Date: 16.OCT.2020 10:06:13



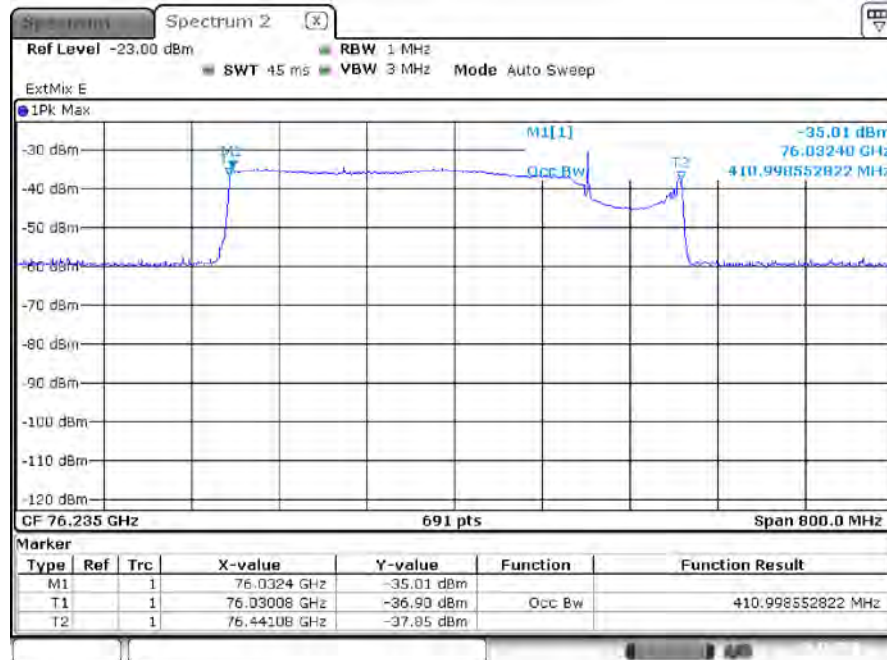
Test Frequency: 76.861 GHz



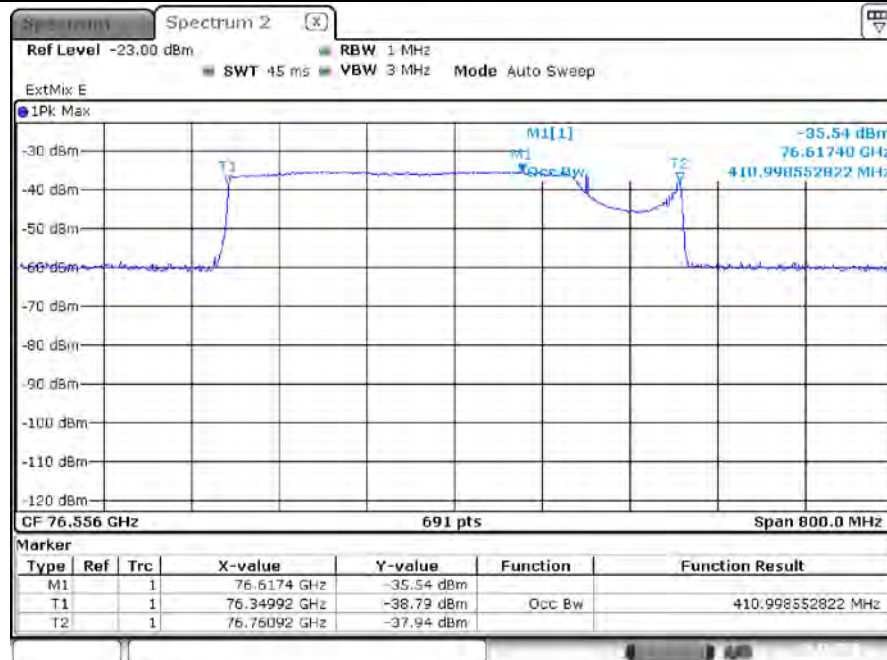
Date: 16.OCT.2020 10:13:36

**Test Bandwidth: 300 MHz**

Test Results		
Test Freq. (GHz)	99% Occupied Bandwidth (MHz)	Limit (MHz)
76.235	410.998	N/A
76.556	410.998	N/A
76.780	410.998	N/A

Occupied Bandwidth Plots
Test Frequency: 76.235 GHz


Date: 16.OCT.2020 10:18:56

Test Frequency: 76.556 GHz


Date: 16.OCT.2020 10:24:57



Test Frequency: 76.780 GHz



Date: 16.OCT.2020 10:36:20

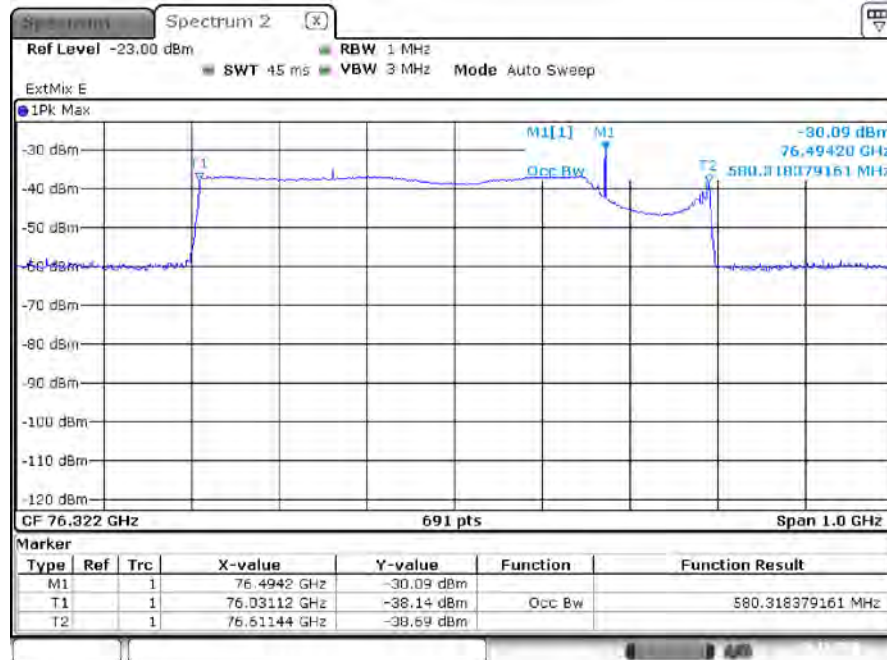
**Test Bandwidth: 425 MHz**

Test Results		
Test Freq. (GHz)	99% Occupied Bandwidth (MHz)	Limit (MHz)
76.322	580.318	N/A
76.579	580.318	N/A
76.686	580.318	N/A



Occupied Bandwidth Plots

Test Frequency: 76.322 GHz



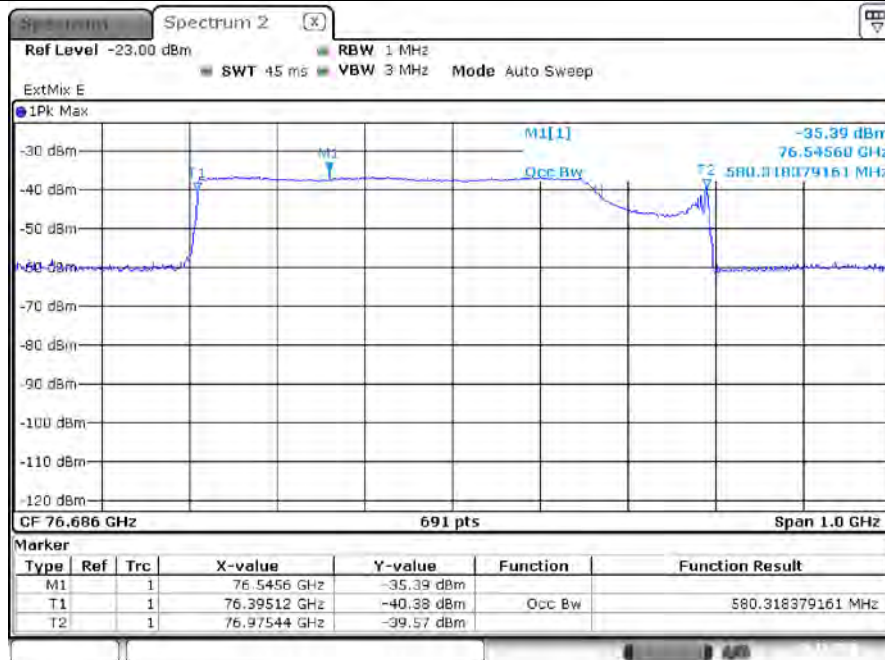
Date: 16.OCT.2020 10:36:14

Test Frequency: 76.579 GHz



Date: 16.OCT.2020 10:41:11

Test Frequency: 76.686 GHz



Date: 16.OCT.2020 10:45:59

3.3 Radiated E.I.R.P Power / E.I.R.P Power Density

3.3.1 Radiated E.I.R.P Power / E.I.R.P Power Density Limit

Radiated E.I.R.P Power / E.I.R.P Power Density Limit	
☒	76-77 GHz Band:
☒	Peak: EIRP 55 dBm [279uW/cm ² at 3m] Average: EIRP 50 dBm [88uW/cm ² at 3m]

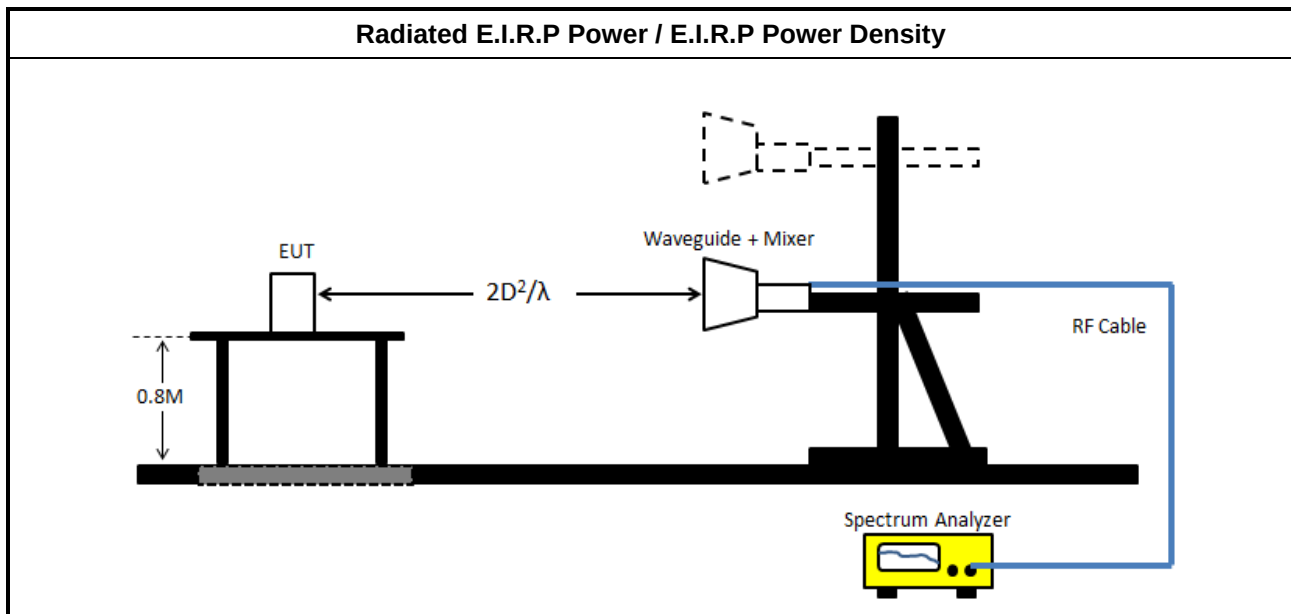
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

Test Method	
☒	For the Occupied bandwidth shall be measured using one of the options below:
☒	Refer as ANSI C63.10, clause 9 for radiated measurement.
☒	Radiated test was conducted at far-field distance. the distance from the radiating element of the EUT to the edge of the far field may be calculated from $[r \geq 2D^2/\lambda]$ r is the distance from the radiating element of the EUT to the edge of the far field, in m D is the largest dimension of both the radiating element and the test antenna (horn), in m λ is the wavelength of the emission under investigation $[300/f \text{ (MHz)}]$, in m
☒	The measured power level is converted to EIRP using the Friis equation: $E \text{ Meas} = 126.8 - 20\log(\lambda) + P - G$ where E is the field strength of the emission at the measurement distance, in dBμV/m P is the power measured at the output of the test antenna, in dBm λ is the wavelength of the emission under investigation $[300/f\text{MHz}]$, in m G is the gain of the test antenna, in dBi $EIRP = E \text{ Meas} + 20 \log(d \text{ Meas}) - 104.7$ where $EIRP$: is the equivalent isotropically radiated power, in dBm. $E \text{ Meas}$: is the field strength of the emission at the measurement distance, in dBμV/m. $d \text{ Meas}$: is the measurement distance, in m.

3.3.4 Test Setup



3.3.5 Measurement Results Calculation

The measured Level is calculated using:

$EIRP = \text{Read Level} - \text{Rx Gain} + 20 \cdot \text{LOG}(4 \cdot 3.14159 \cdot \text{Distance} / (300 / (\text{Test Freq.} \cdot 1000)))$.

$\text{Power Density} = ((10^{(EIRP/10)} / 1000) / (4 \cdot 3.14159 \cdot (\text{Specification Distance} \cdot 100)^2)) \cdot 1000000000000$.

3.3.6 Test Result of Radiated E.I.R.P Power

Test Bandwidth: 175 MHz

Freq. (GHz)	Rx Gain (dBi)	P-Peak (dBm)	P-Average (dBm)	E-Meas- Peak (dBuV/m)	E-Meas- Average (dBuV/m)	Distance (m)	EIRP- Peak (dBm)	EIRP- Average (dBm)
76.152	23.0	-11.48	-28.37	140.41	123.52	0.85	34.20	17.31
76.531	23.0	-11.51	-28.26	140.42	123.67	0.85	34.21	17.46
76.861	23.0	-11.52	-28.22	140.45	123.75	0.85	34.24	17.54
Limit							55	50

Test Bandwidth: 300 MHz

Freq. (GHz)	Rx Gain (dBi)	P-Peak (dBm)	P-Average (dBm)	E-Meas- Peak (dBuV/m)	E-Meas- Average (dBuV/m)	Distance (m)	EIRP- Peak (dBm)	EIRP- Average (dBm)
76.235	23.0	-11.65	-28.58	140.25	123.32	0.85	34.04	17.11
76.556	23.0	-11.42	-28.31	140.52	123.63	0.85	34.31	17.42
76.780	23.0	-11.36	-28.26	140.60	123.70	0.85	34.39	17.49
Limit							55	50

Test Bandwidth: 425 MHz

Freq. (GHz)	Rx Gain (dBi)	P-Peak (dBm)	P-Average (dBm)	E-Meas- Peak (dBuV/m)	E-Meas- Average (dBuV/m)	Distance (m)	EIRP- Peak (dBm)	EIRP- Average (dBm)
76.322	23.0	-11.65	-28.50	140.26	123.41	0.85	34.05	17.20
76.579	23.0	-11.62	-28.37	140.32	123.57	0.85	34.11	17.36
76.686	23.0	-11.37	-28.23	140.58	123.72	0.85	34.37	17.51
Limit							55	50

3.3.7 Test Result of Radiated E.I.R.P Power Density

Test Bandwidth: 175 MHz

Frequency (GHz)	EIRP Power (dBm)		EIRP Power Density ($\mu\text{W}/\text{cm}^2$)		EIRP Power Density Limit ($\mu\text{W}/\text{cm}^2$)		Distance (m)	EIRP Power (W)		EIRP Power Density (W/m^2)	
	Peak	Average	Peak	Average	Peak	Average		Peak	Average	Peak	Average
76.152	34.20	17.31	28.967	0.593	279	88	0.85	2.6300	0.0538	2.90E-01	5.93E-03
76.531	34.21	17.46	29.055	0.614	279	88	0.85	2.6380	0.0558	2.91E-01	6.14E-03
76.861	34.24	17.54	29.239	0.625	279	88	0.85	2.6547	0.0568	2.92E-01	6.25E-03

Test Bandwidth: 300 MHz

Frequency (GHz)	EIRP Power (dBm)		EIRP Power Density ($\mu\text{W}/\text{cm}^2$)		EIRP Power Density Limit ($\mu\text{W}/\text{cm}^2$)		Distance (m)	EIRP Power (W)		EIRP Power Density (W/m^2)	
	Peak	Average	Peak	Average	Peak	Average		Peak	Average	Peak	Average
76.235	34.04	17.11	27.916	0.566	279	88	0.85	2.5346	0.0514	2.79E-01	5.66E-03
76.556	34.31	17.42	29.683	0.607	279	88	0.85	2.6950	0.0552	2.97E-01	6.07E-03
76.780	34.39	17.49	30.272	0.618	279	88	0.85	2.7485	0.0561	3.03E-01	6.18E-03

Test Bandwidth: 425 MHz

Frequency (GHz)	EIRP Power (dBm)		EIRP Power Density ($\mu\text{W}/\text{cm}^2$)		EIRP Power Density Limit ($\mu\text{W}/\text{cm}^2$)		Distance (m)	EIRP Power (W)		EIRP Power Density (W/m^2)	
	Peak	Average	Peak	Average	Peak	Average		Peak	Average	Peak	Average
76.322	34.05	17.20	27.980	0.578	279	88	0.85	2.5404	0.0525	2.80E-01	5.78E-03
76.579	34.11	17.36	28.364	0.599	279	88	0.85	2.5752	0.0544	2.84E-01	5.99E-03
76.686	34.37	17.51	30.129	0.621	279	88	0.85	2.7354	0.0564	3.01E-01	6.21E-03

3.4 Transmitter Radiated Unwanted Emissions

3.4.1 Transmitter Radiated Unwanted Emissions Limit

Transmitter Radiated Unwanted Emissions Limit (Below 40 GHz)			
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 - 40000	500	54	3

Frequency Range (GHz)	EIRP (dBm)	Power Density (pW/cm ² @ 3m)
40 - 200	-1.7	600
200 - 231	0.5	1000

3.4.2 Measuring Instruments

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

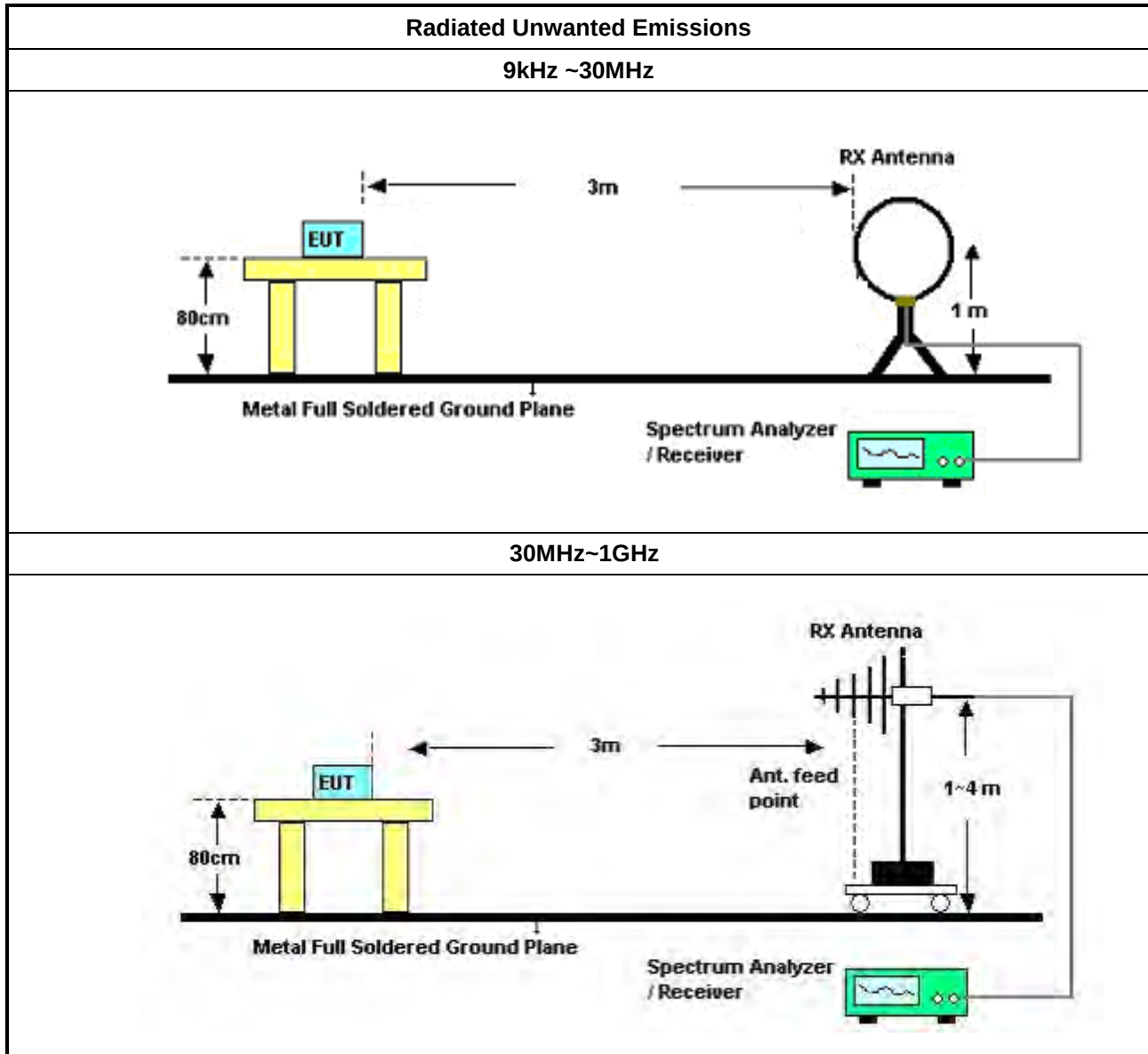
3.4.3 Test Procedures

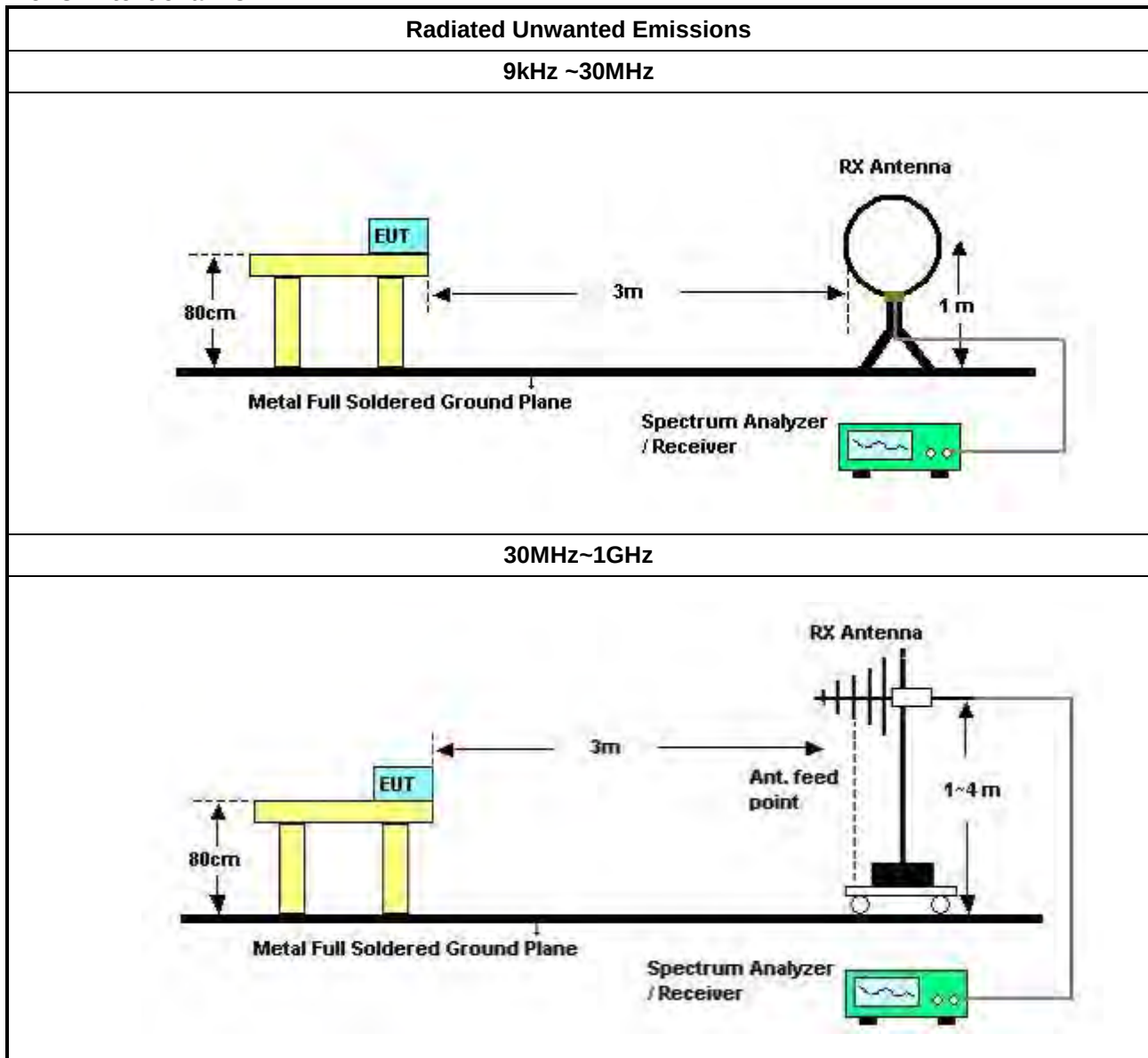
Test Method – General Information	
☒	For the transmitter unwanted emissions shall be measured using following options below:
☒	Refer as ANSI C63.10, clause 6.3 for unwanted emissions into non-restricted bands.
☒	For unwanted emissions below 40GHz bands.
☒	Radiated emissions below 40 GHz shall not exceed the general limits in LP0002 Section 3.6
☒	Refer as ANSI C63.10, clause 4.1.4.2.3 (Video Averaging) average measurements using spectrum reduced video bandwidth (VBW≥10Hz) - [duty cycle ≥ 98 or external power trigger].
☐	Refer as ANSI C63.10, clause 4.1.4.2.4 average value of pulsed emissions.
☐	Refer as ANSI C63.10, clause 4.1.4.2.2 measurement procedure peak limit.

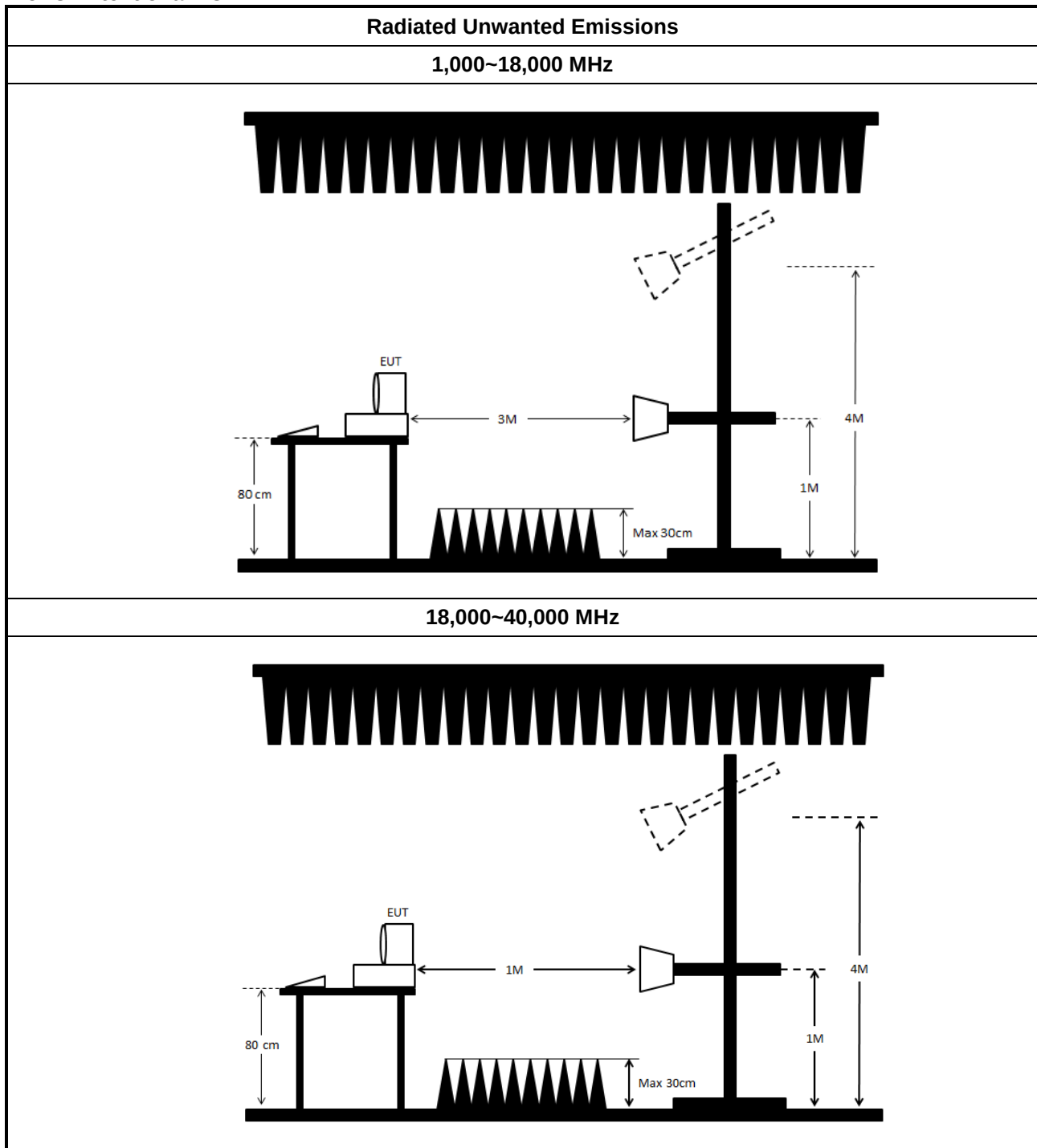
Test Method	
☒	For radiated measurement below 40GHz.
☒	Refer as ANSI C63.10, clause 6.3 through 6.6 for radiated emissions from below 40 GHz.
☒	For radiated measurement above 40GHz. Refer as ANSI C63.10, clause 9.12 for radiated measurement.
☒	Radiated test was conducted at far-field distance. the distance from the radiating element of the EUT to the edge of the far field may be calculated from $[r \geq 2D^2/\lambda]$ r is the distance from the radiating element of the EUT to the edge of the far field, in m D is the largest dimension of both the radiating element and the test antenna (horn), in m λ is the wavelength of the emission under investigation $[300/f \text{ (MHz)}]$, in m
☒	The measured power level is converted to EIRP using the Friis equation: $E \text{ Meas} = 126.8 - 20\log(\lambda) + P - G$ where E is the field strength of the emission at the measurement distance, in dBμV/m P is the power measured at the output of the test antenna, in dBm λ is the wavelength of the emission under investigation $[300/f\text{MHz}]$, in m G is the gain of the test antenna, in dBi $EIRP = E \text{ Meas} + 20 \log(d \text{ Meas}) - 104.7$ where EIRP : is the equivalent isotropically radiated power, in dBm. E Meas : is the field strength of the emission at the measurement distance, in dBμV/m. d Meas : is the measurement distance, in m. Equations to calculate power density $PD = \frac{EIRP_{Linear}}{4\pi d^2}$:r density at the distance specified by the limit from the EIRP in watts using where PD is the power density at the distance specified by the limit, in W/m² EIRPLinear is the equivalent isotropically radiated power, in watts d is the distance at which the power density limit is specified, in m.

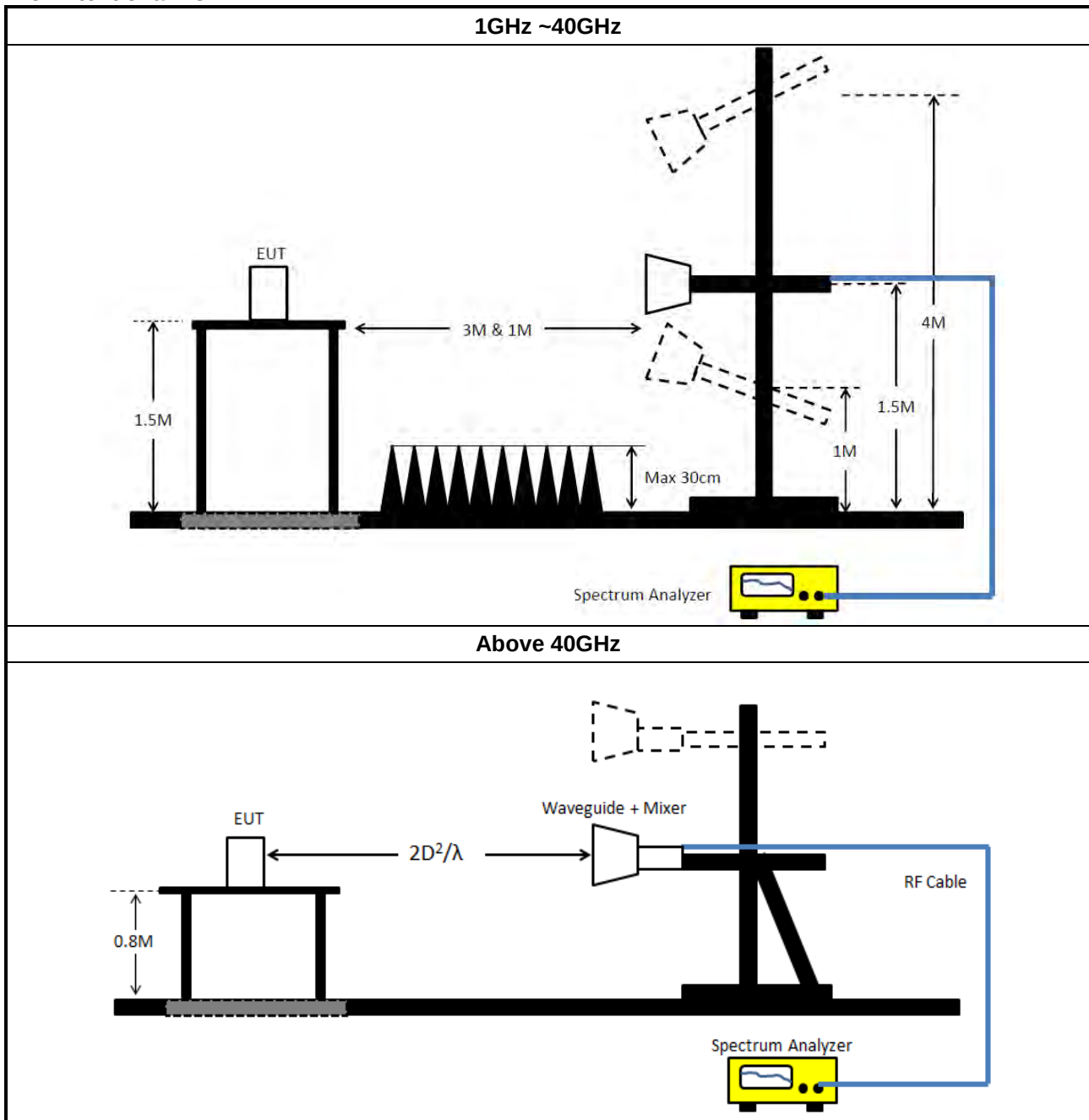
3.4.4 Test Setup

For Intentional - CTX



For Unintentional - CRX


For Unintentional - CRX


For Intentional - CTX

3.4.5 Measurement Results Calculation

The measured Level is calculated using:

For below 40GHz

Corrected Reading: Antenna factor (AF) + Cable loss (CL) + Read level (Raw) - Preamp factor (PA)(if applicable) = Level

For above 40GHz

EIRP = Read Level - Rx Gain + 20*LOG(4*3.14159* Distance / (300/(Test Freq.*1000))).

Power Density = ((10^(EIRP/10)/1000)/(4*3.14159*(Specification Distance *100)^2))*1000000000000.



3.4.6 Test Result of Transmitter Radiated Unwanted Emissions (Below 30MHz)

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to KDB414788 Radiated Test Site, and the result came out very similar.

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.

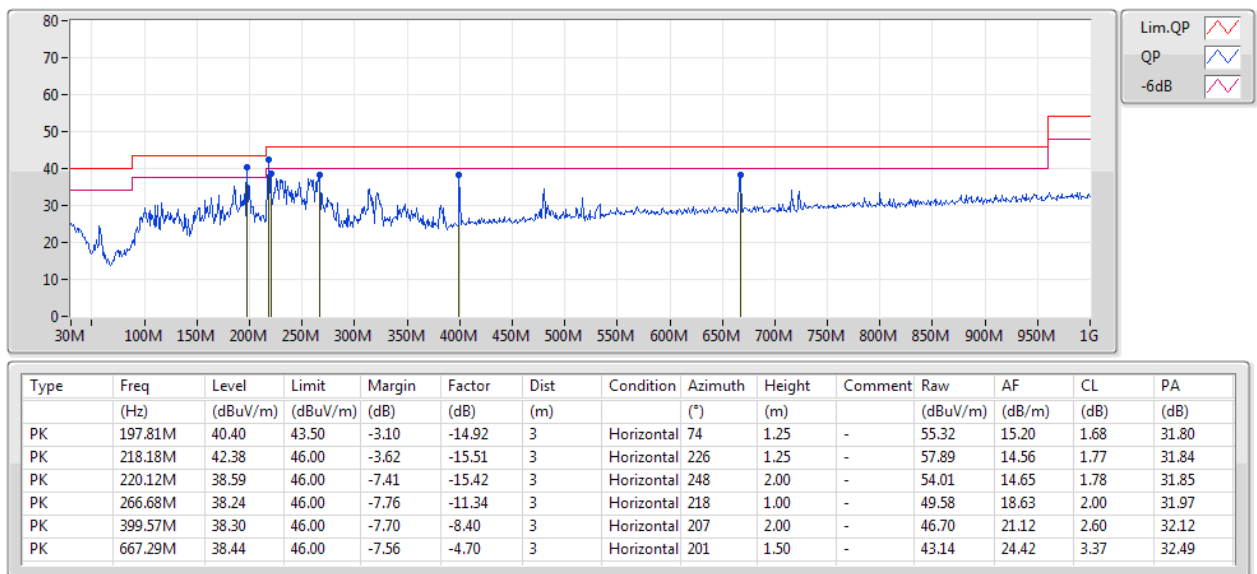
3.4.7 Test Result of Transmitter Radiated Unwanted Emissions (30MHz ~ 1GHz)

For Intentional – CTX

Test Range	30 MHz – 1,000 MHz	Test Mode	Mode 2
Test Bandwidth (MHz)	300	Test Freq. (GHz)	76.861
Test Distance	3 m		

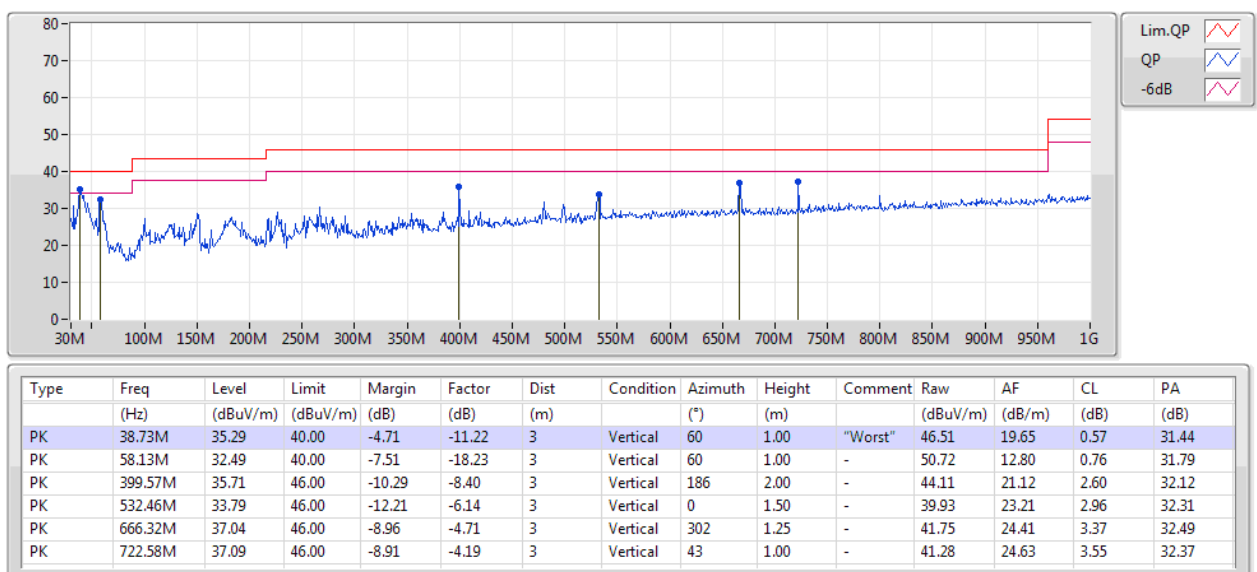
Horizontal

17/10/2020



Vertical

17/10/2020

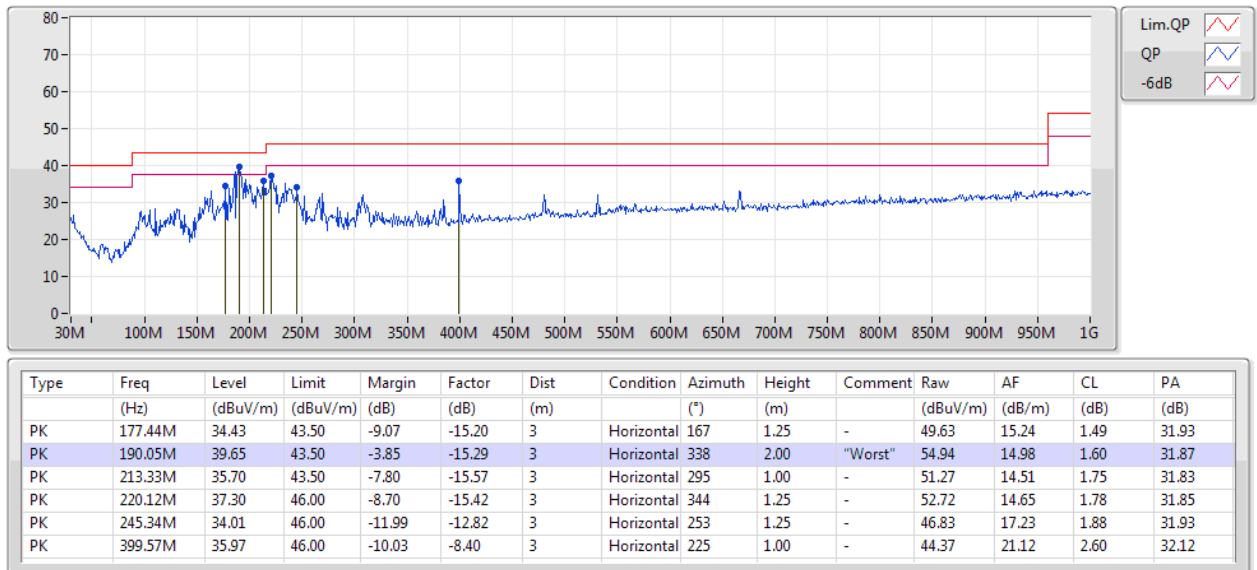


**For Unintentional – CRX**

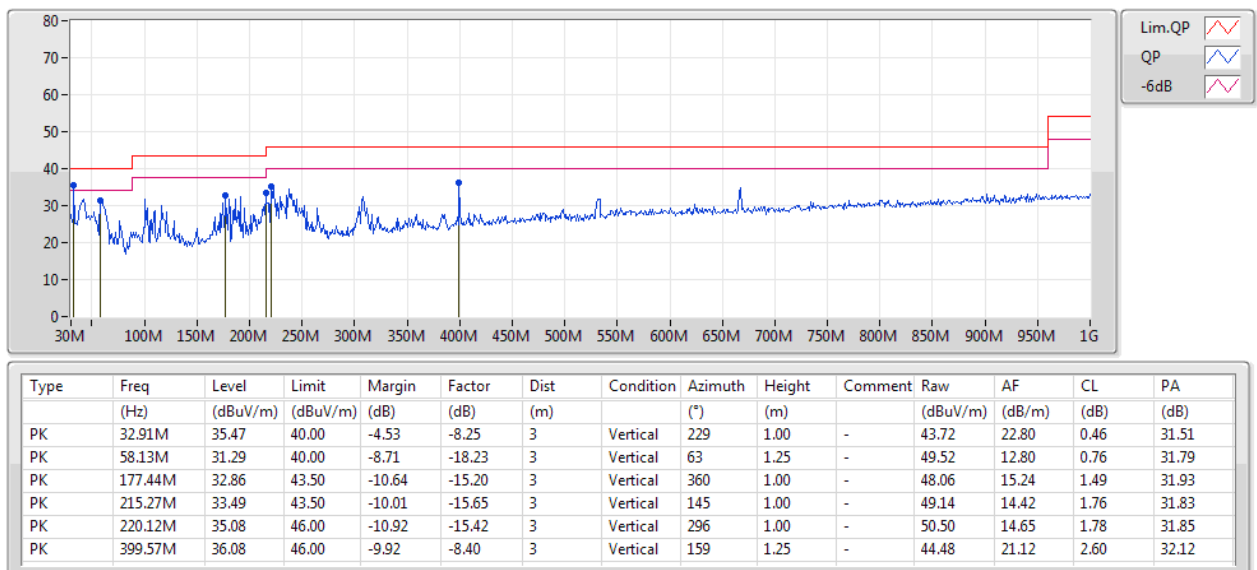
Test Range	30 MHz – 1,000 MHz	Test Mode	Mode 3
Test Bandwidth (MHz)	425	Test Freq. (GHz)	76.686
Test Distance	3 m		

Horizontal

17/10/2020

**Vertical**

17/10/2020



Note 1: ">20dB" means spurious emission levels that exceed the level of 20 dB below the applicable limit.

Note 2: "N/F" means Nothing Found spurious emissions (No spurious emissions were detected.)

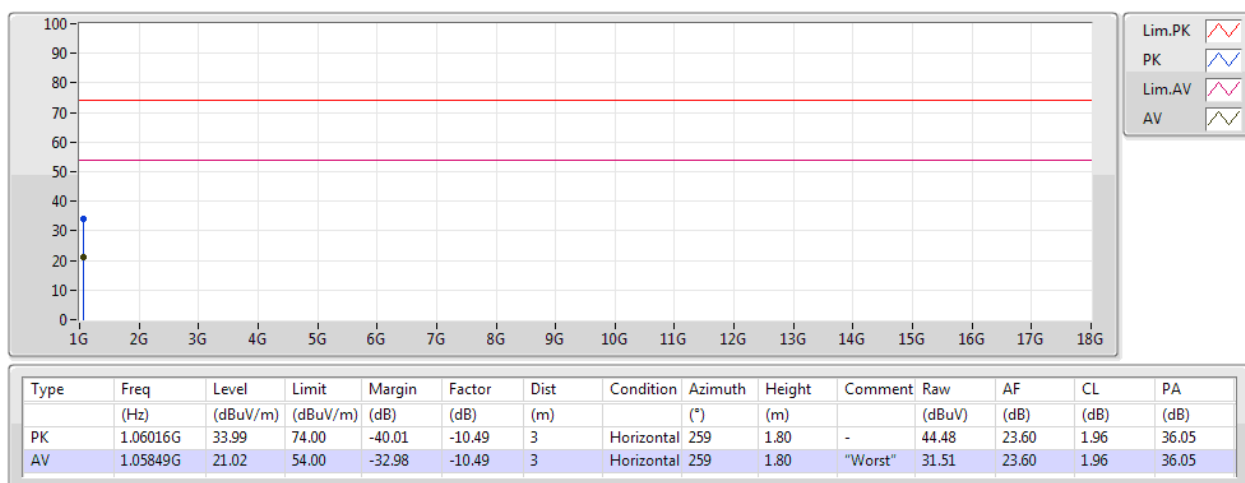
3.4.8 Test Result of Transmitter Radiated Unwanted Emissions (1GHz – 40GHz)

For Intentional - CTX

Test Range	1GHz – 18GHz	Test Mode	Mode 1
Test Bandwidth (MHz)	175	Test Freq. (GHz)	76.152
Test Distance	3 m		

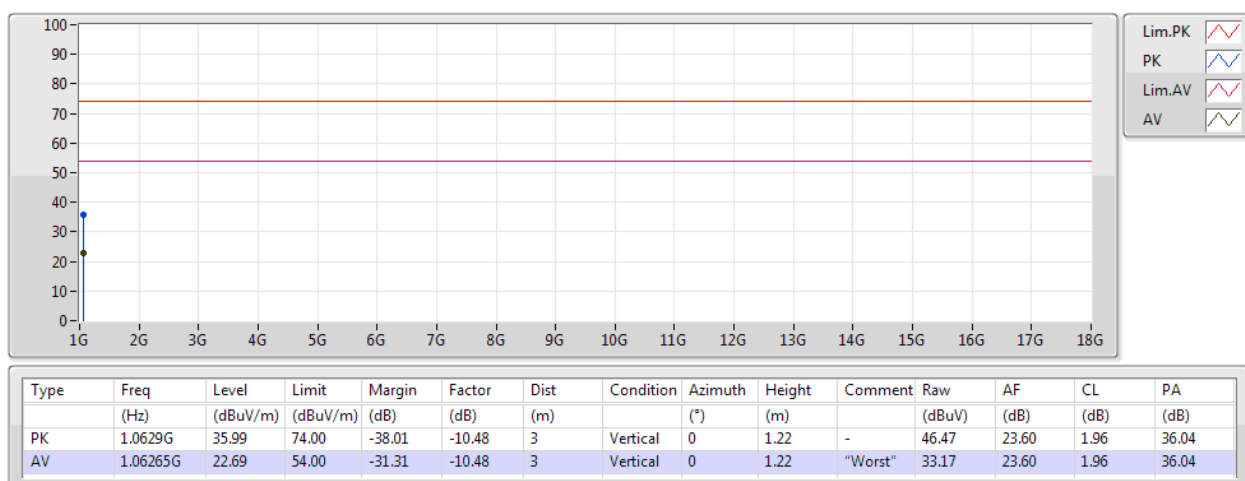
Horizontal

17/10/2020



Vertical

17/10/2020

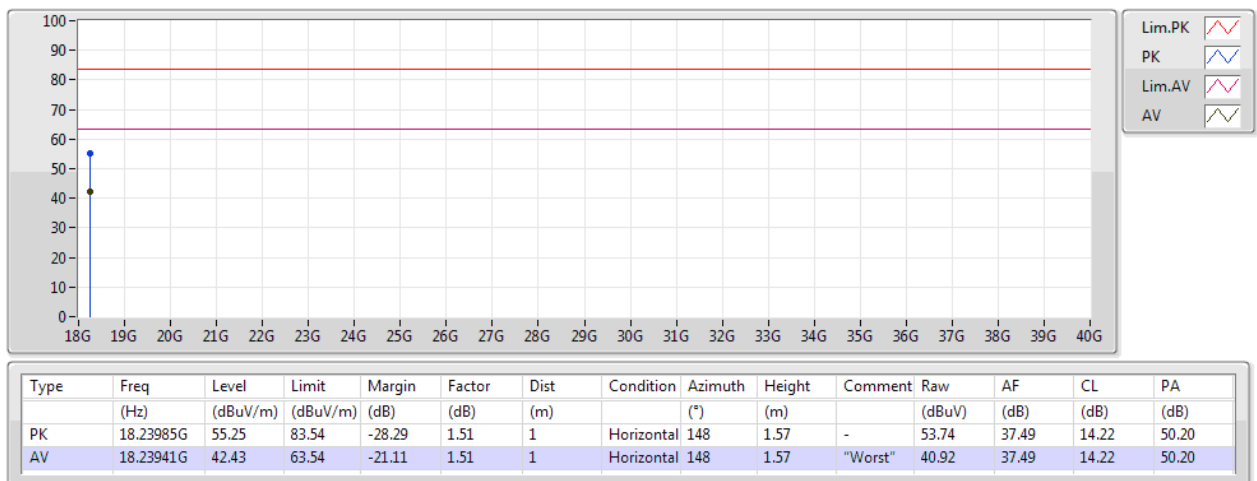




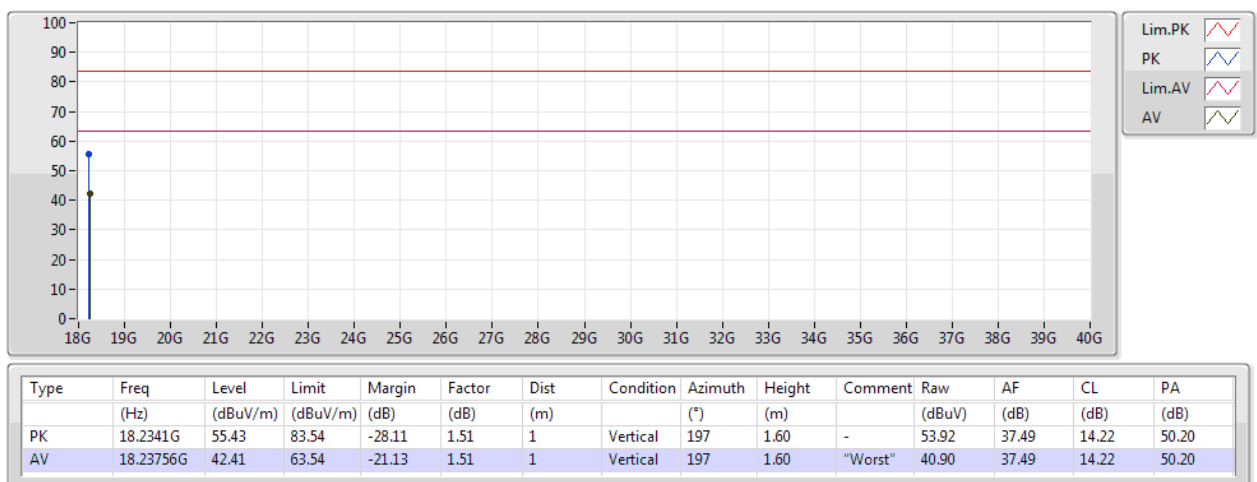
Test Range	18GHz – 40GHz	Test Mode	Mode 1
Test Bandwidth (MHz)	175	Test Freq. (GHz)	76.152
Test Distance	1 m		

Horizontal

17/10/2020

**Vertical**

17/10/2020

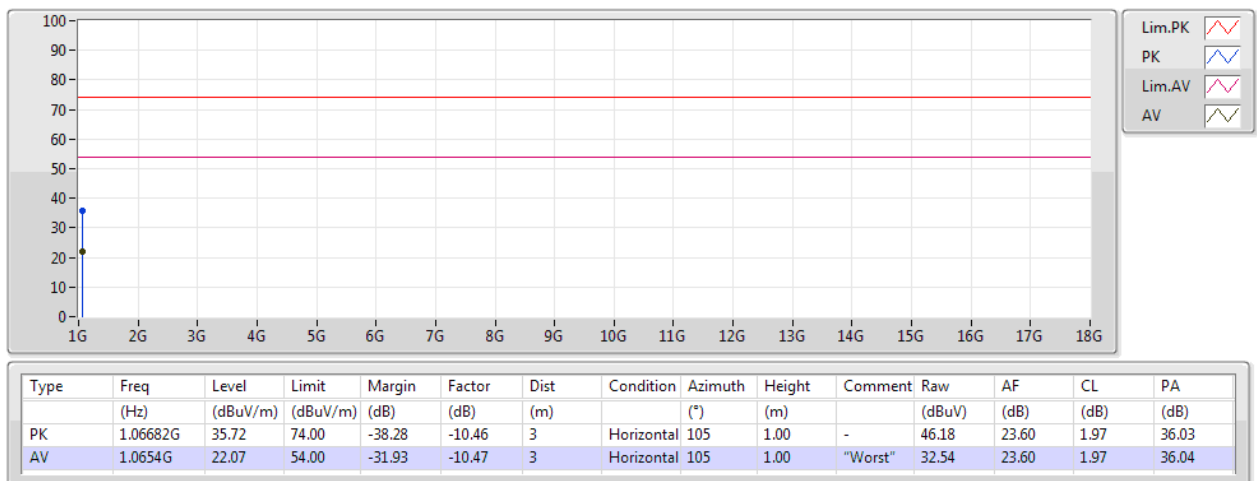




Test Range	1GHz – 18GHz	Test Mode	Mode 2
Test Bandwidth (MHz)	175	Test Freq. (GHz)	76.531
Test Distance	3 m		

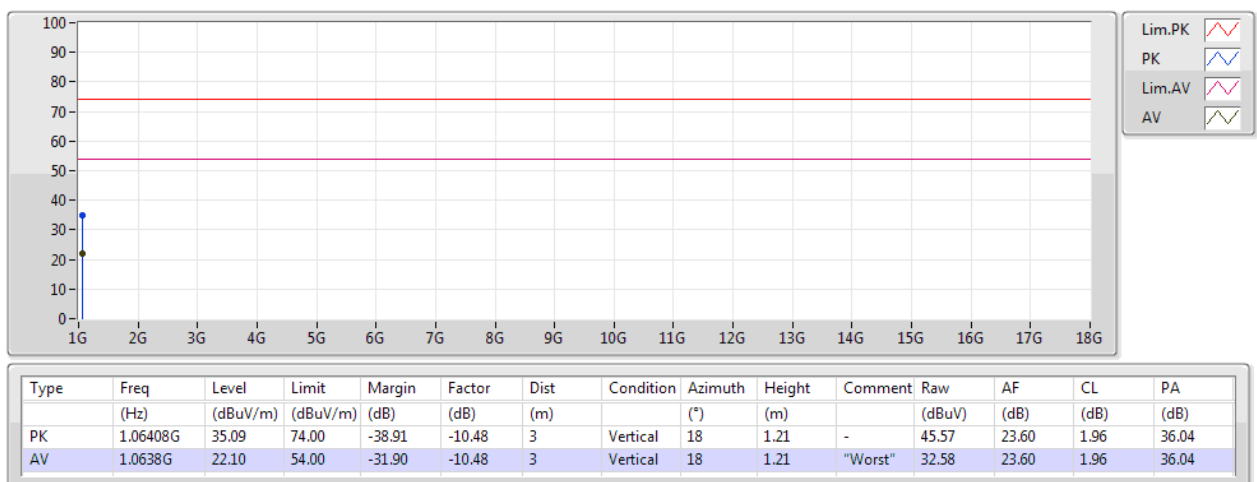
Horizontal

17/10/2020



Vertical

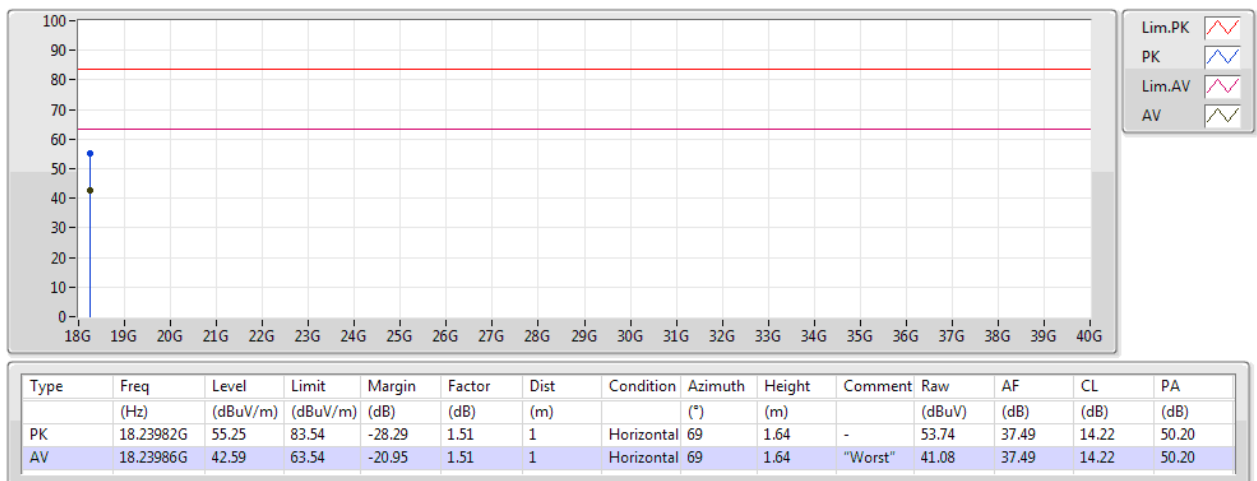
17/10/2020



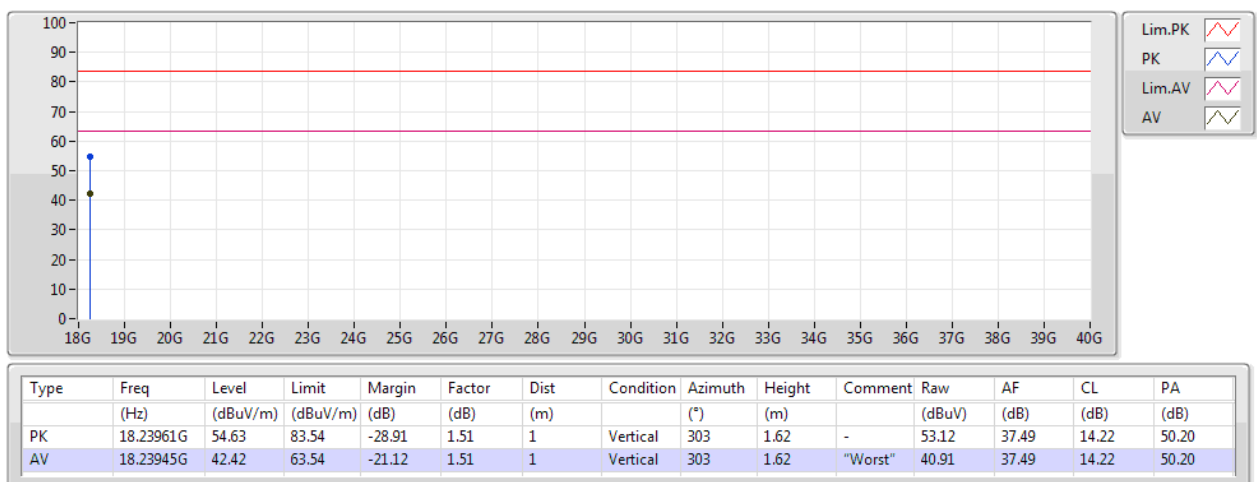
Test Range	18GHz – 40GHz	Test Mode	Mode 2
Test Bandwidth (MHz)	175	Test Freq. (GHz)	76.531
Test Distance	1 m		

Horizontal

17/10/2020


Vertical

17/10/2020

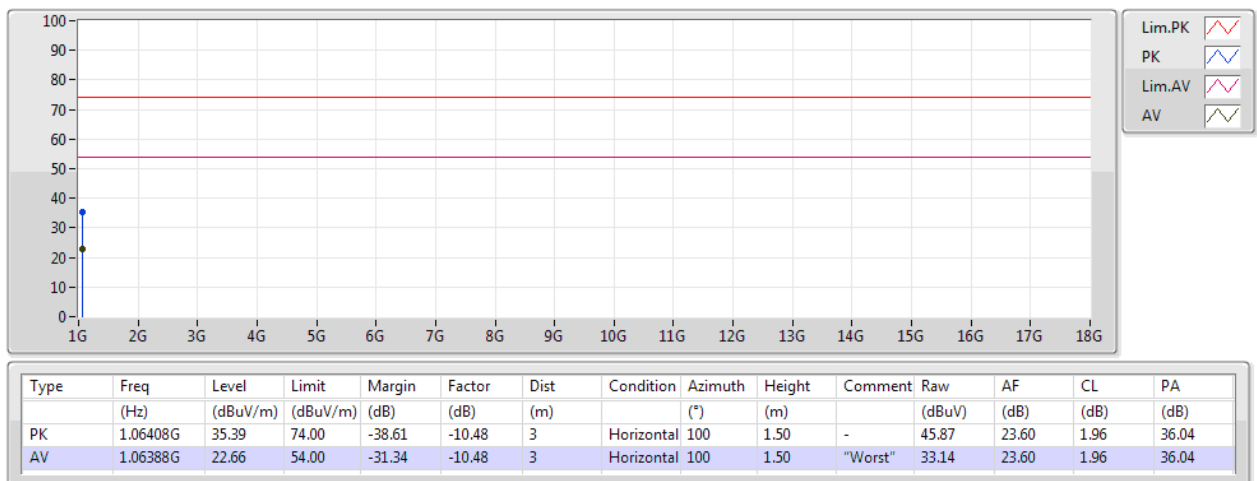




Test Range	1GHz – 18GHz	Test Mode	Mode 3
Test Bandwidth (MHz)	175	Test Freq. (GHz)	76.861
Test Distance	3 m		

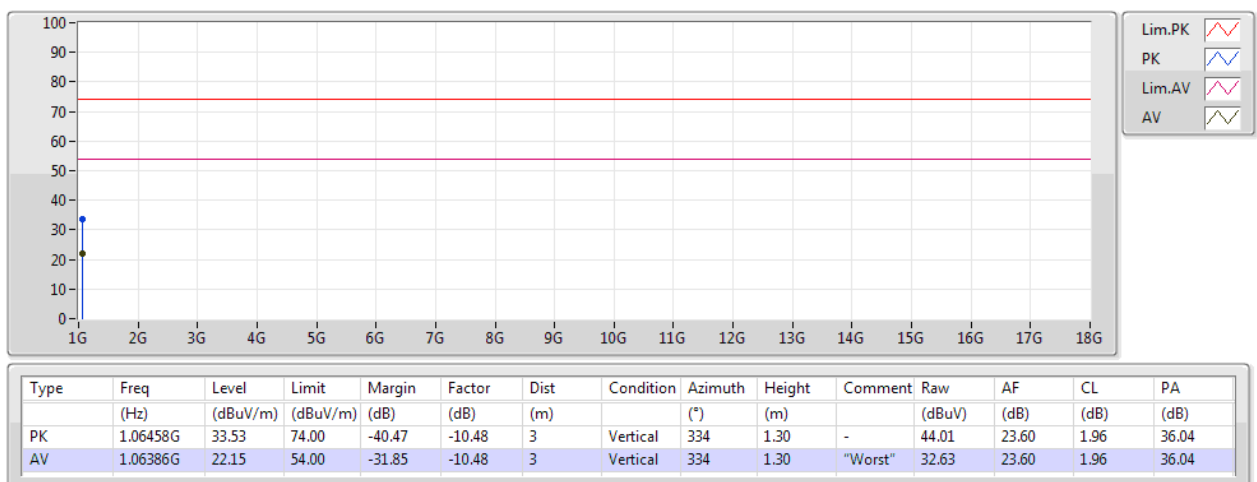
Horizontal

17/10/2020



Vertical

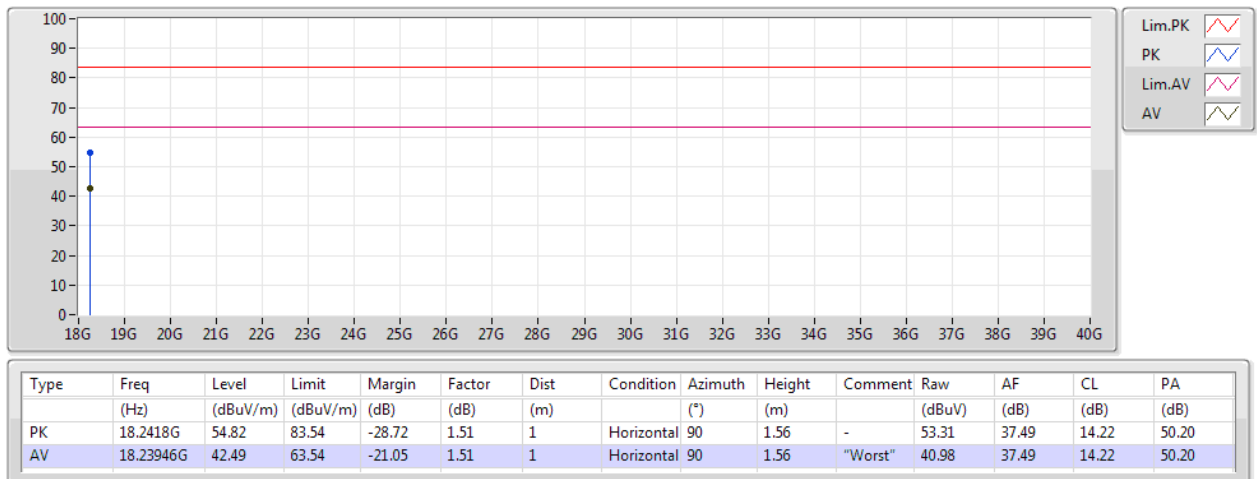
17/10/2020



Test Range	18GHz – 40GHz	Test Mode	Mode 3
Test Bandwidth (MHz)	175	Test Freq. (GHz)	76.861
Test Distance	1 m		

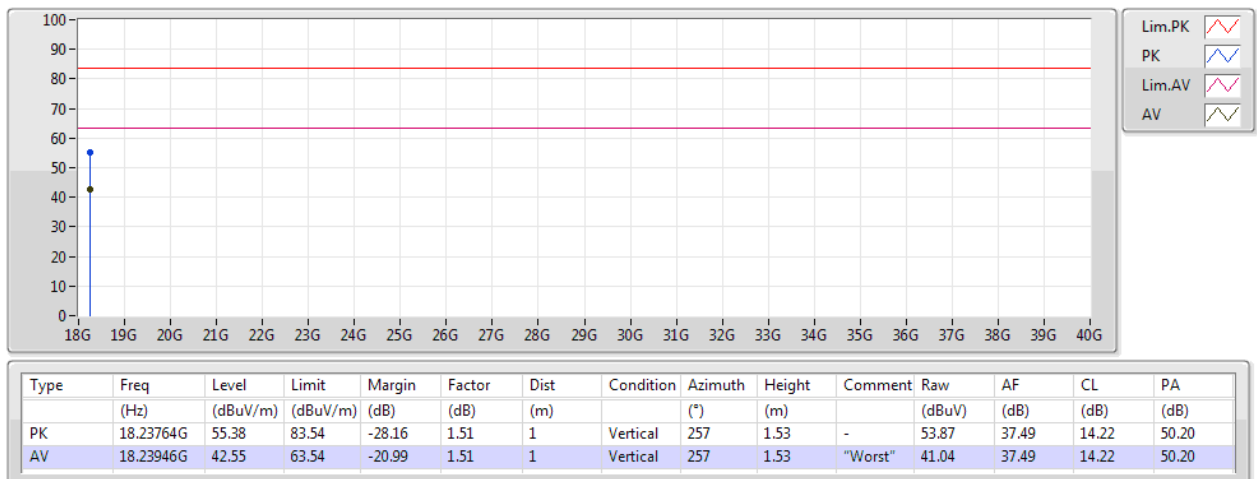
Horizontal

17/10/2020



Vertical

17/10/2020

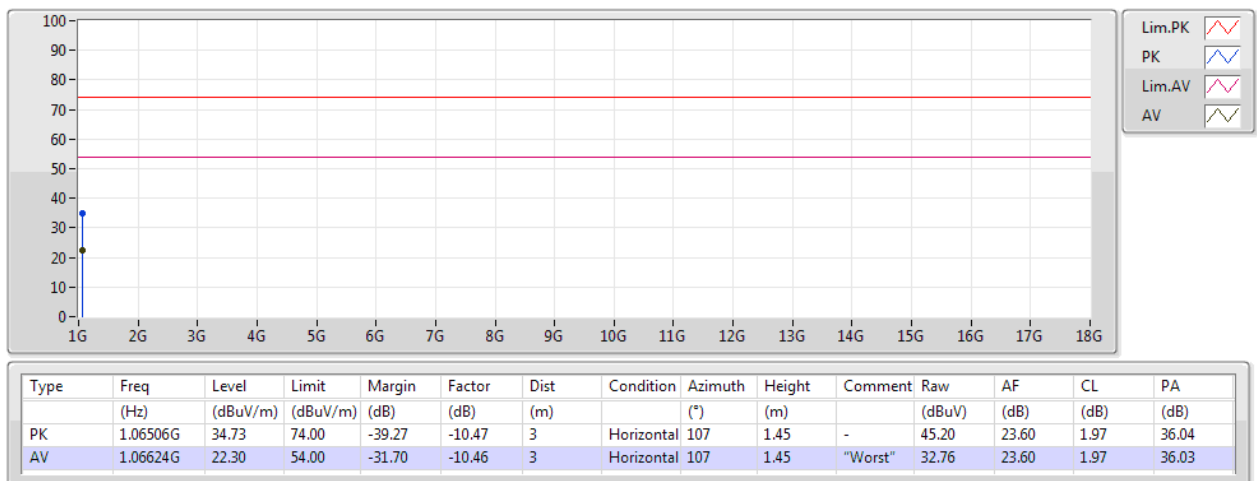




Test Range	1GHz – 18GHz	Test Mode	Mode 4
Test Bandwidth (MHz)	300	Test Freq. (GHz)	76.235
Test Distance	3 m		

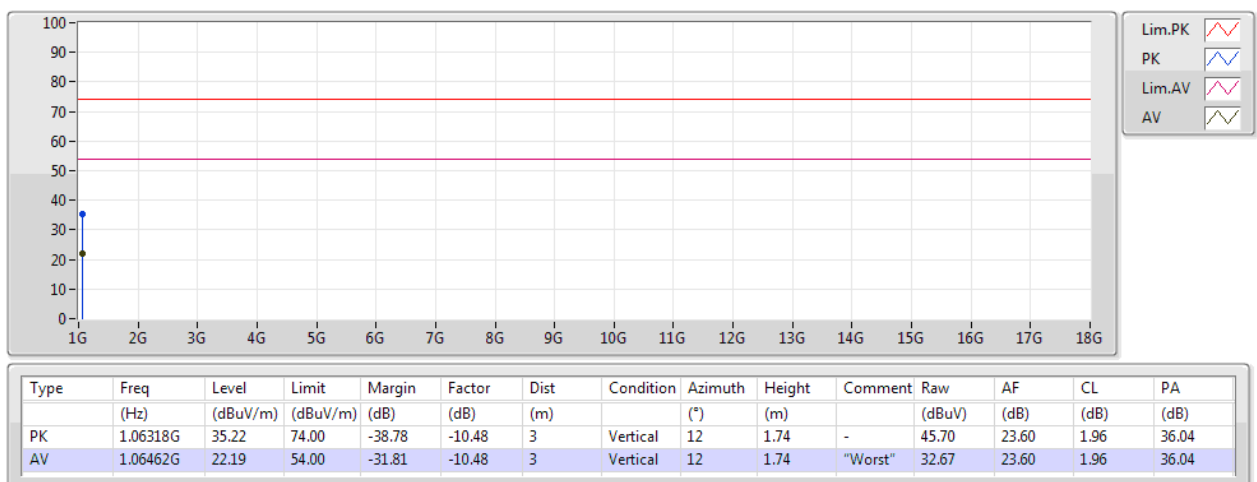
Horizontal

17/10/2020



Vertical

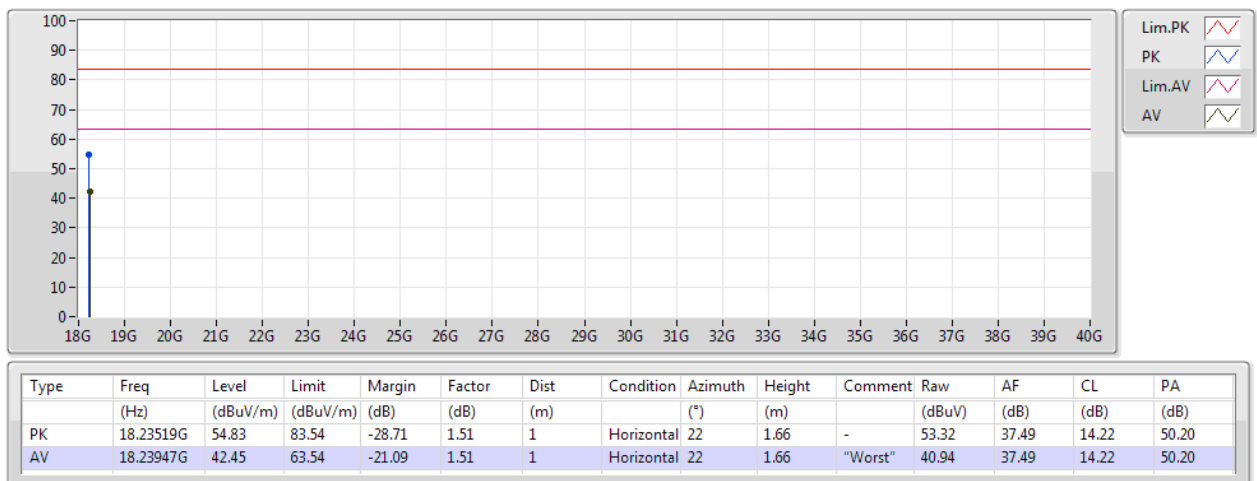
17/10/2020



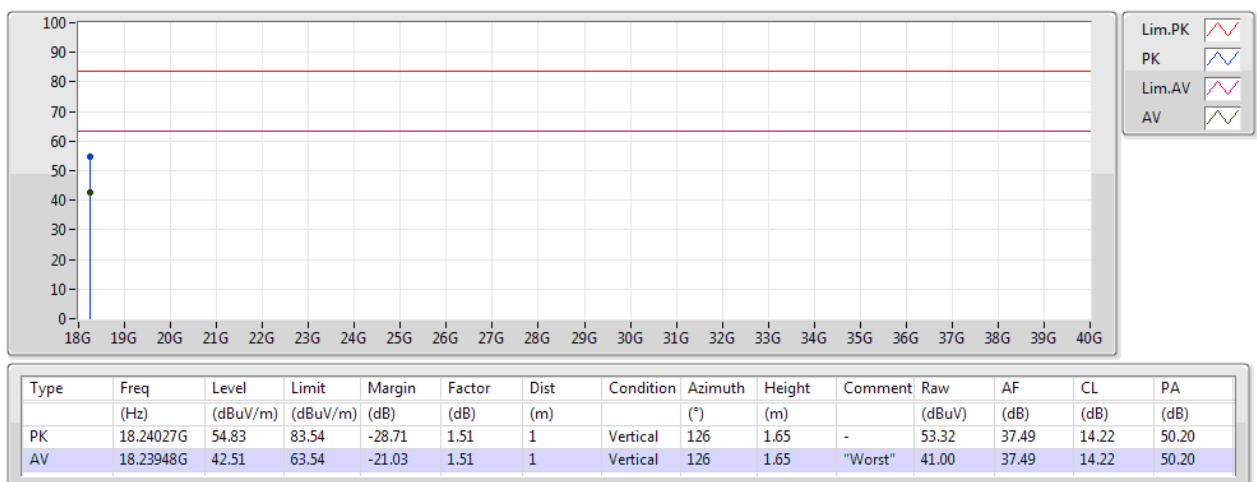
Test Range	18GHz – 40GHz	Test Mode	Mode 4
Test Bandwidth (MHz)	300	Test Freq. (GHz)	76.235
Test Distance	1 m		

Horizontal

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Vertical

17/10/2020

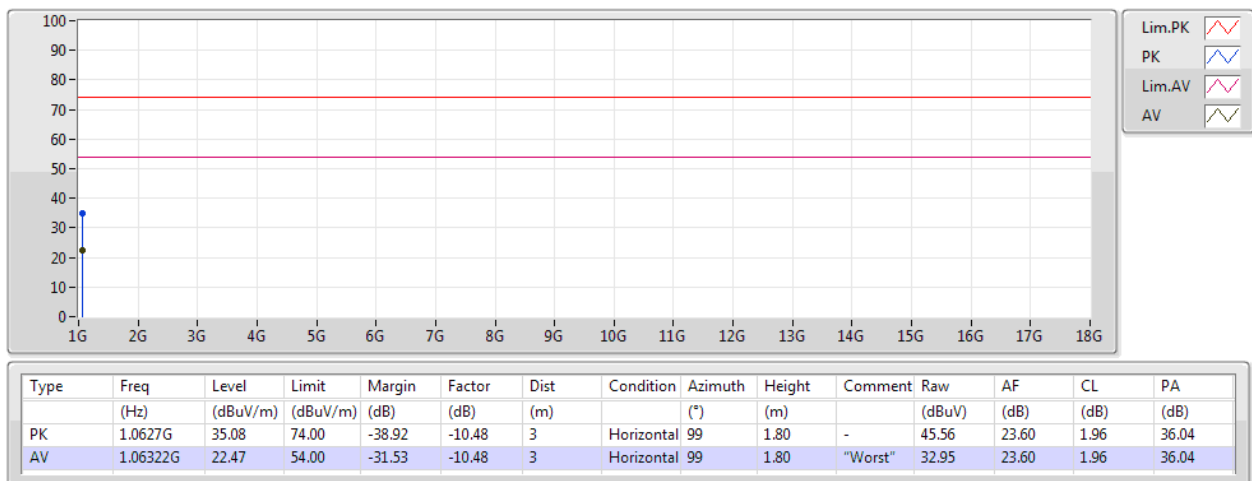




Test Range	1GHz – 18GHz	Test Mode	Mode 5
Test Bandwidth (MHz)	300	Test Freq. (GHz)	76.556
Test Distance	3 m		

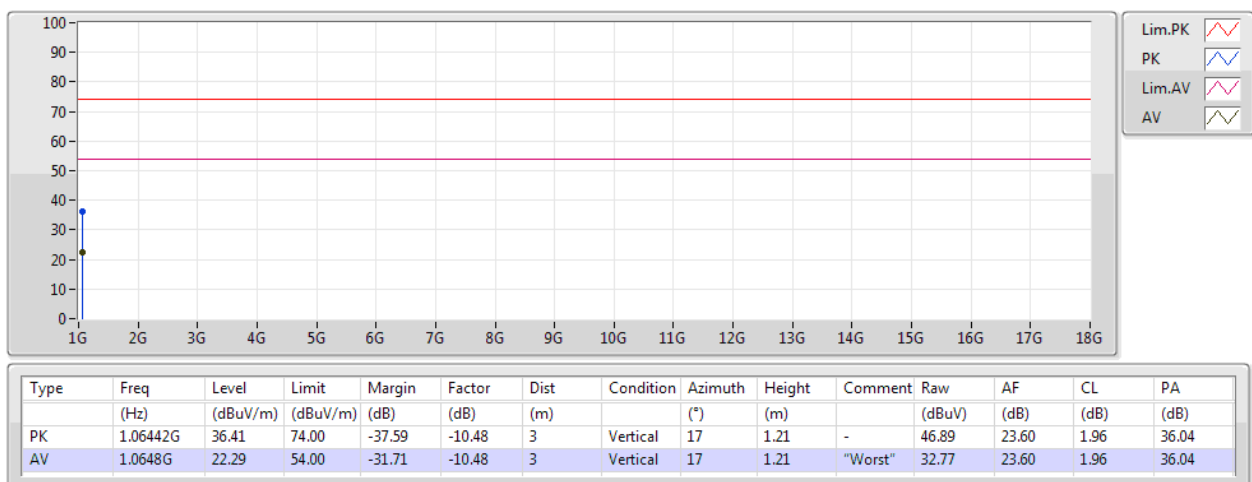
Horizontal

17/10/2020



Vertical

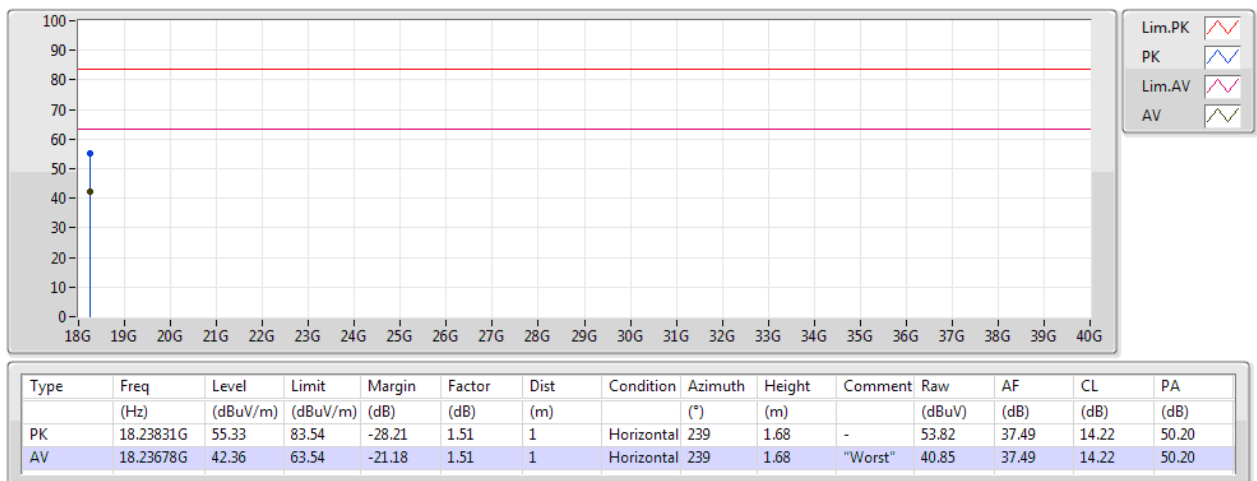
17/10/2020



Test Range	18GHz – 40GHz	Test Mode	Mode 5
Test Bandwidth (MHz)	300	Test Freq. (GHz)	76.556
Test Distance	1 m		

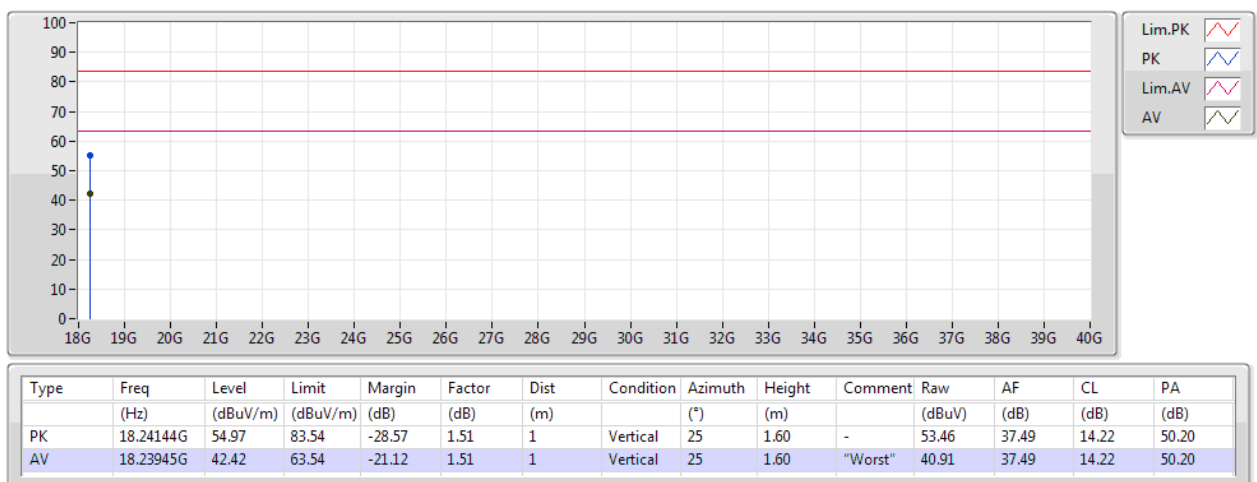
Horizontal

17/10/2020



Vertical

17/10/2020

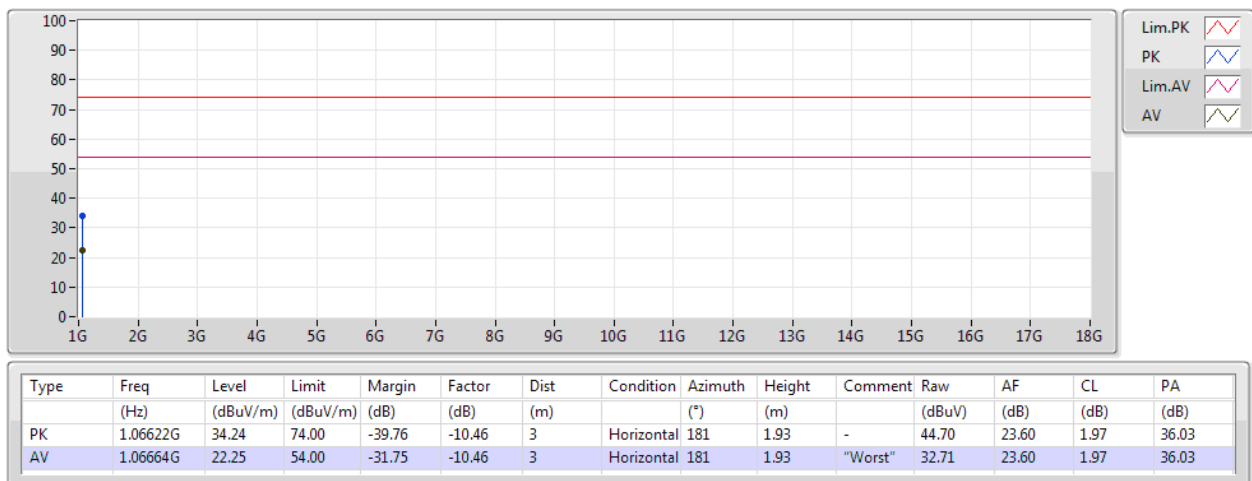




Test Range	1GHz – 18GHz	Test Mode	Mode 6
Test Bandwidth (MHz)	300	Test Freq. (GHz)	76.780
Test Distance	3 m		

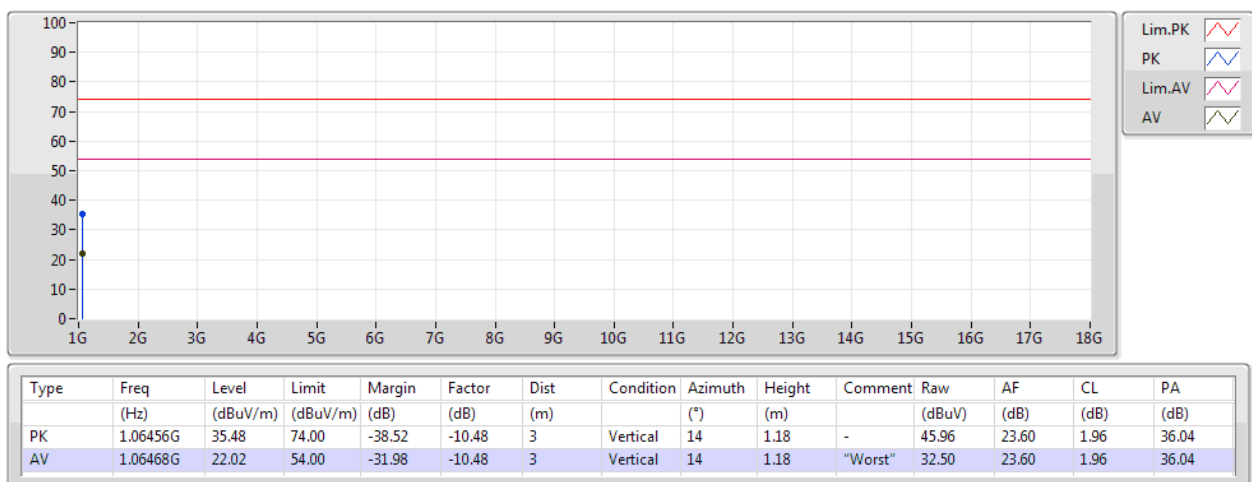
Horizontal

17/10/2020



Vertical

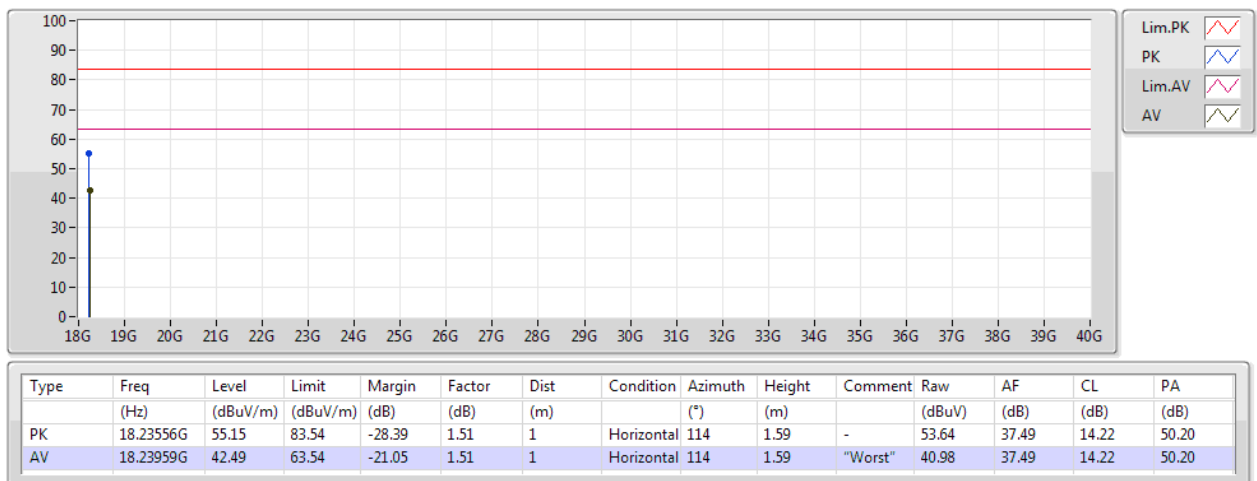
17/10/2020



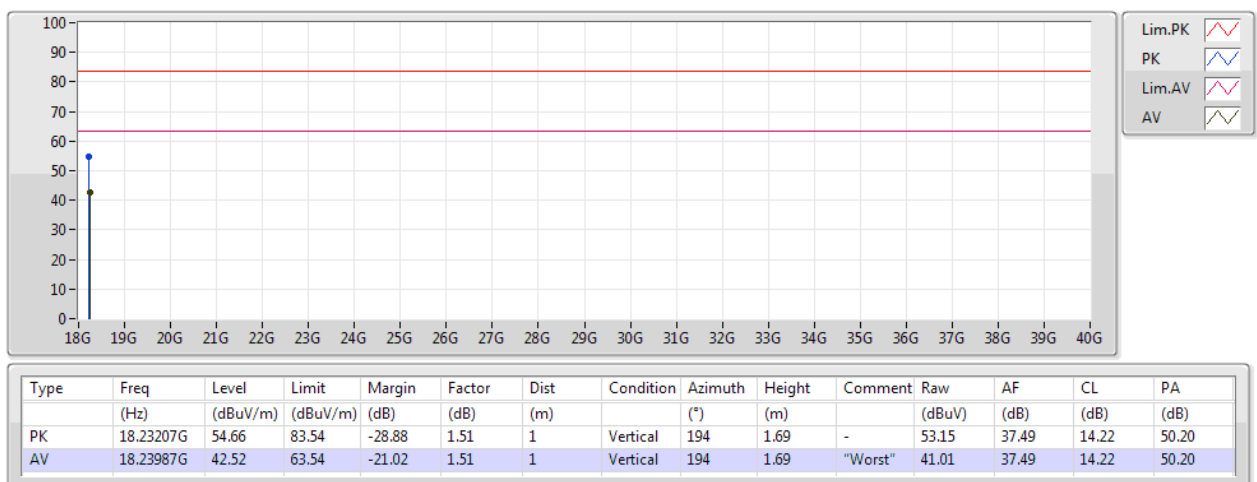
Test Range	18GHz – 40GHz	Test Mode	Mode 6
Test Bandwidth (MHz)	300	Test Freq. (GHz)	76.780
Test Distance	1 m		

Horizontal

17/10/2020


Vertical

17/10/2020

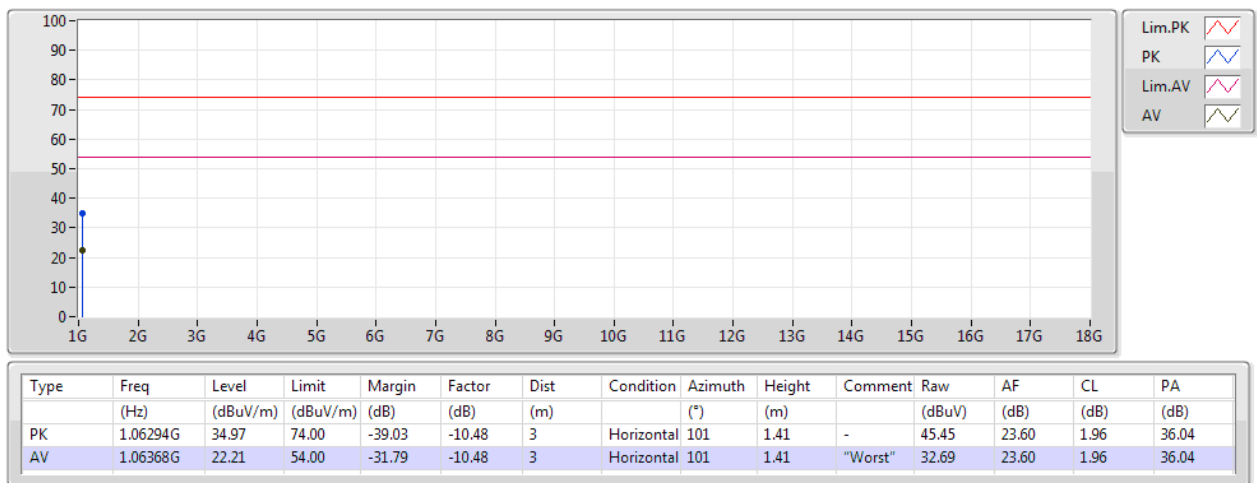




Test Range	1GHz – 18GHz	Test Mode	Mode 7
Test Bandwidth (MHz)	425	Test Freq. (GHz)	76.322
Test Distance	3 m		

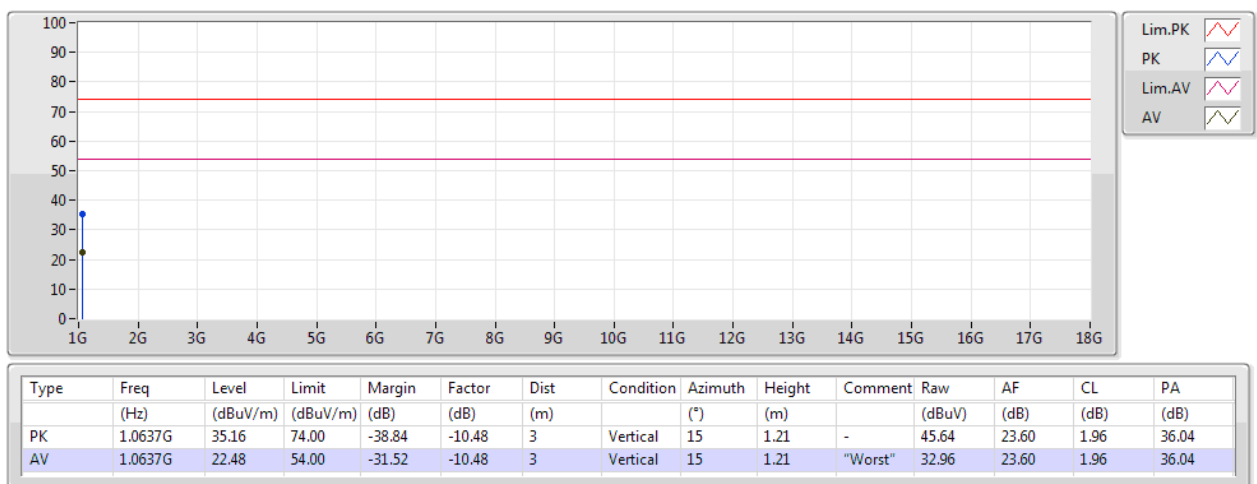
Horizontal

17/10/2020



Vertical

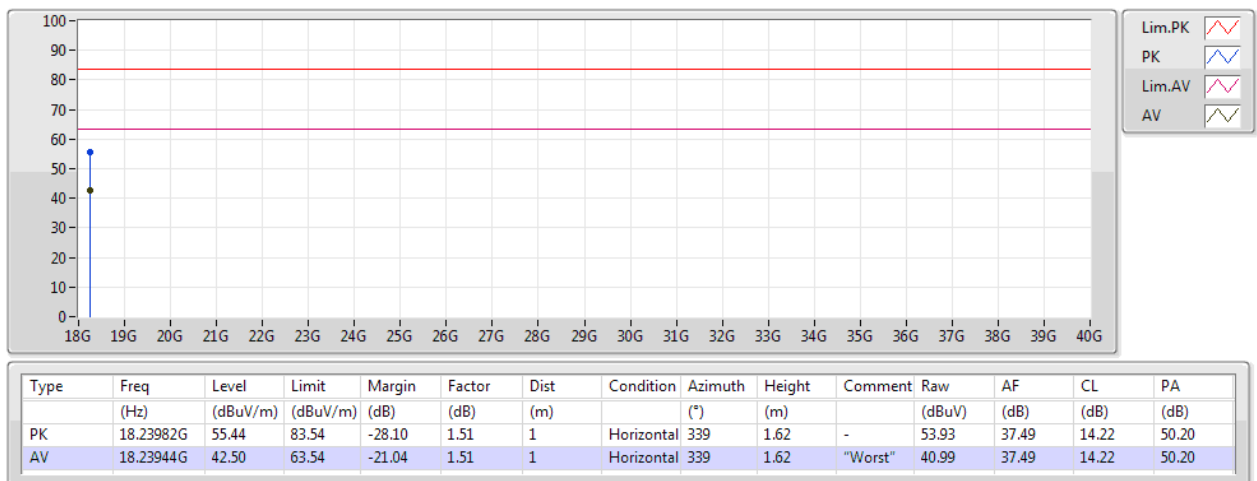
17/10/2020



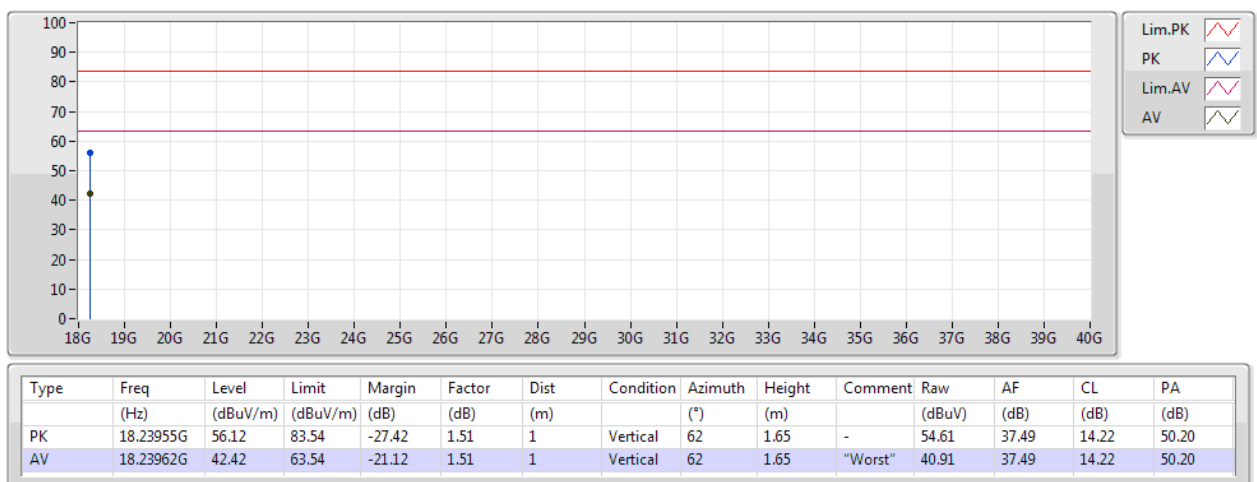
Test Range	18GHz – 40GHz	Test Mode	Mode 7
Test Bandwidth (MHz)	425	Test Freq. (GHz)	76.322
Test Distance	1 m		

Horizontal

17/10/2020


Vertical

17/10/2020

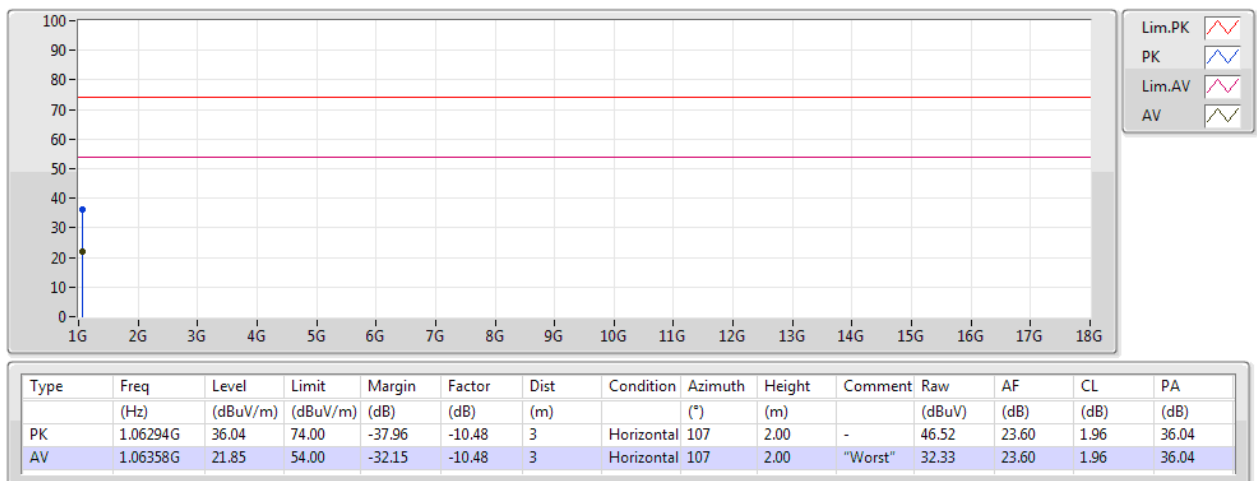




Test Range	1GHz – 18GHz	Test Mode	Mode 8
Test Bandwidth (MHz)	425	Test Freq. (GHz)	76.579
Test Distance	3 m		

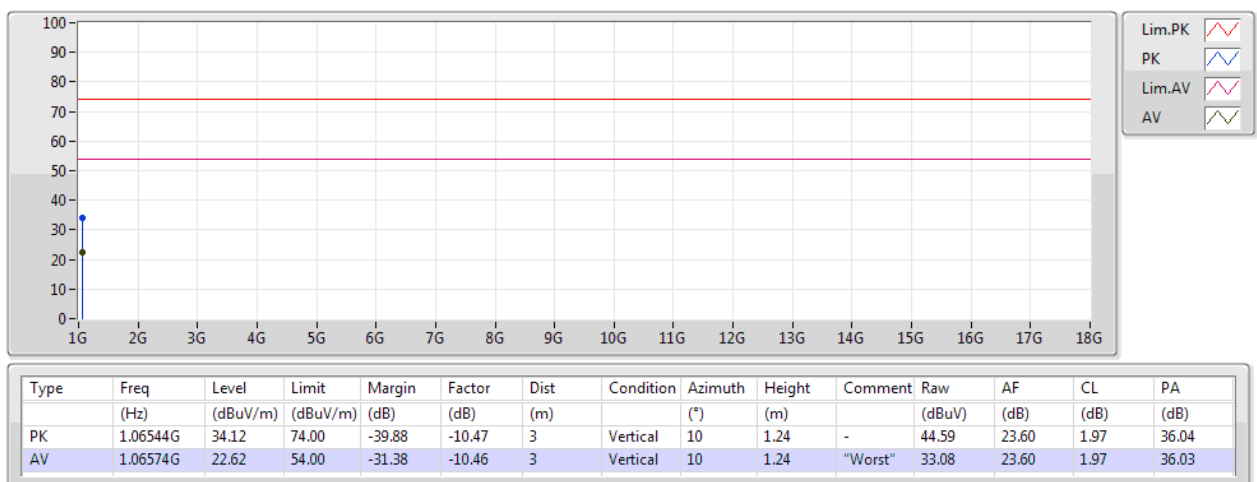
Horizontal

17/10/2020



Vertical

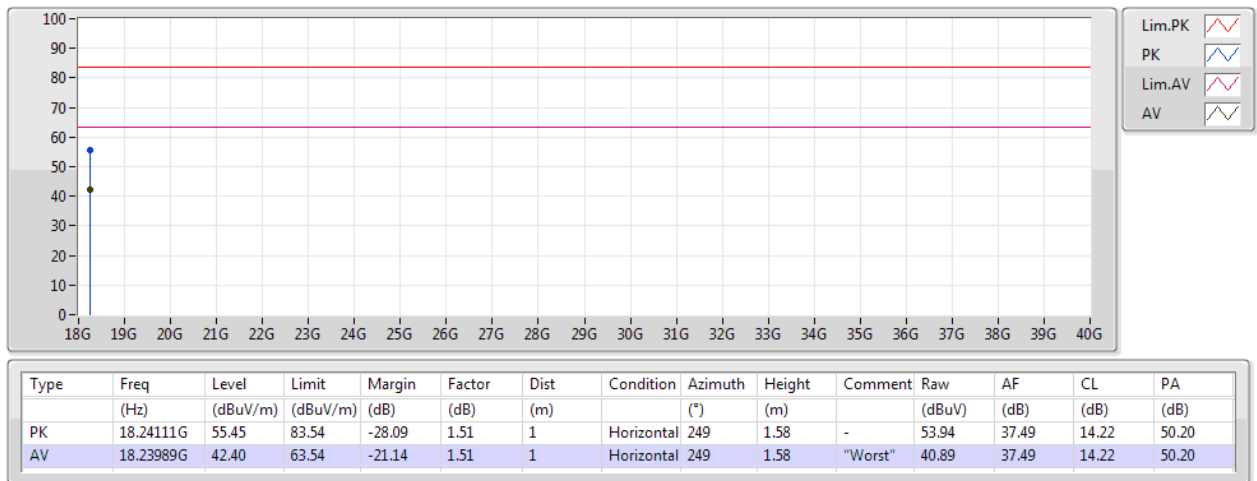
17/10/2020



Test Range	18GHz – 40GHz	Test Mode	Mode 8
Test Bandwidth (MHz)	425	Test Freq. (GHz)	76.579
Test Distance	1 m		

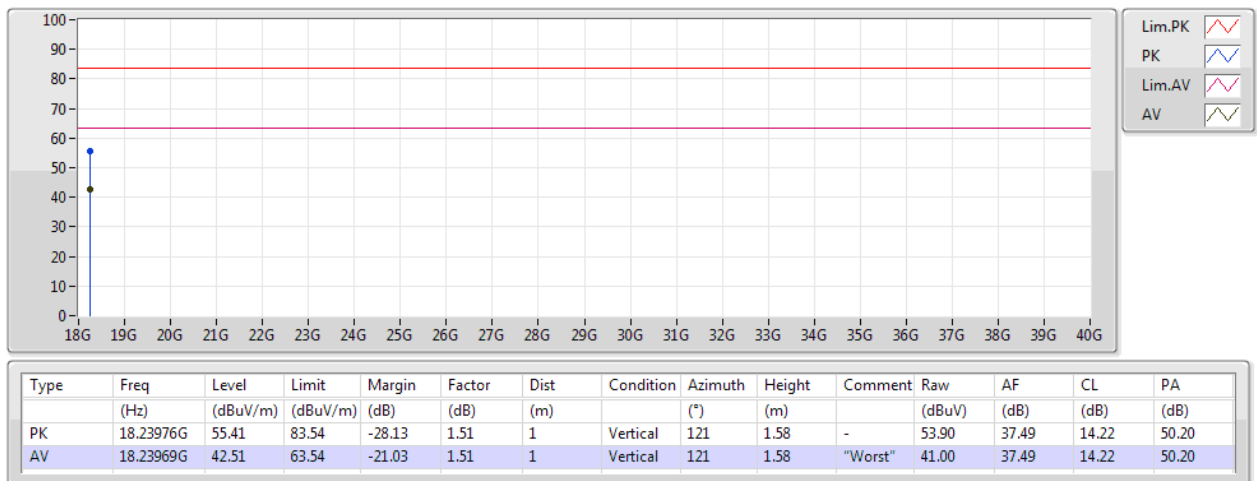
Horizontal

17/10/2020



Vertical

17/10/2020

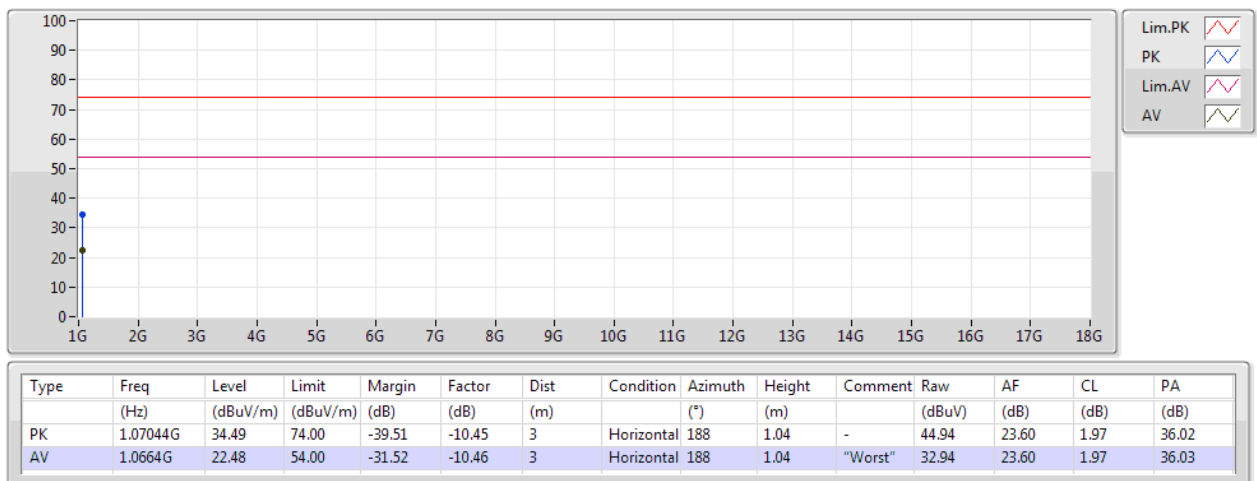




Test Range	1GHz – 18GHz	Test Mode	Mode 9
Test Bandwidth (MHz)	425	Test Freq. (GHz)	76.686
Test Distance	3 m		

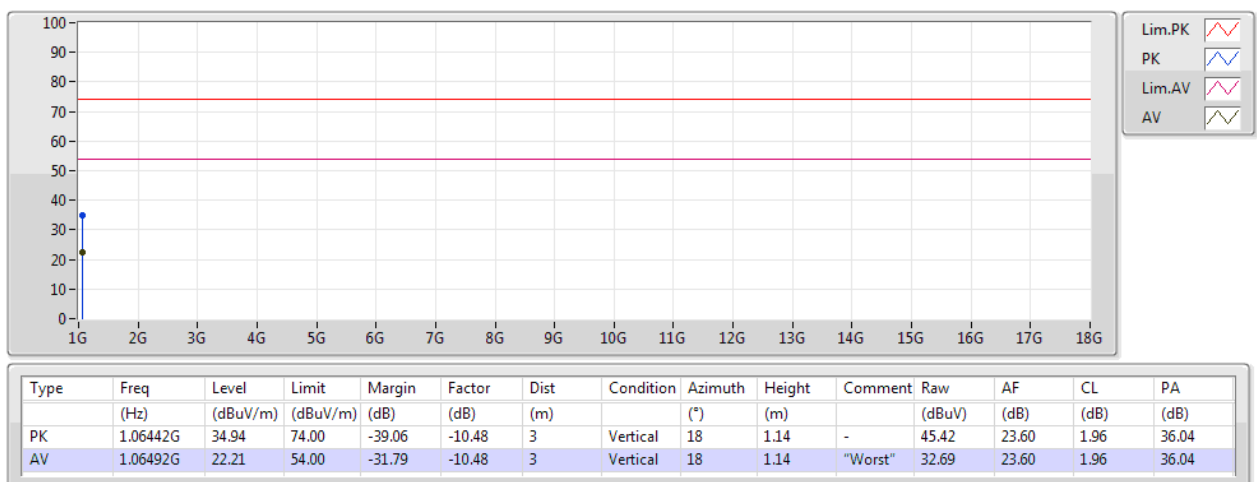
Horizontal

17/10/2020



Vertical

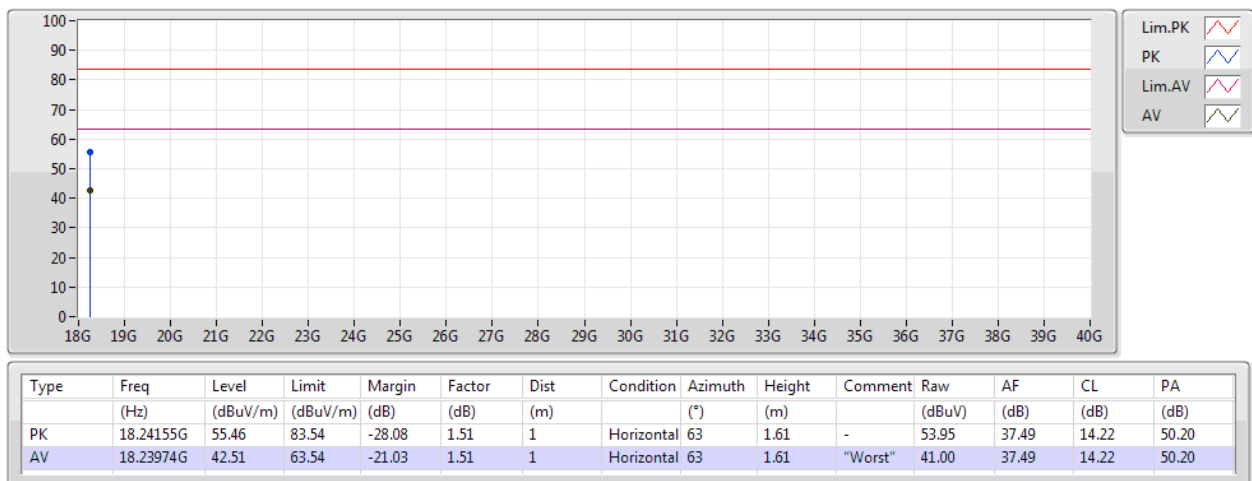
17/10/2020



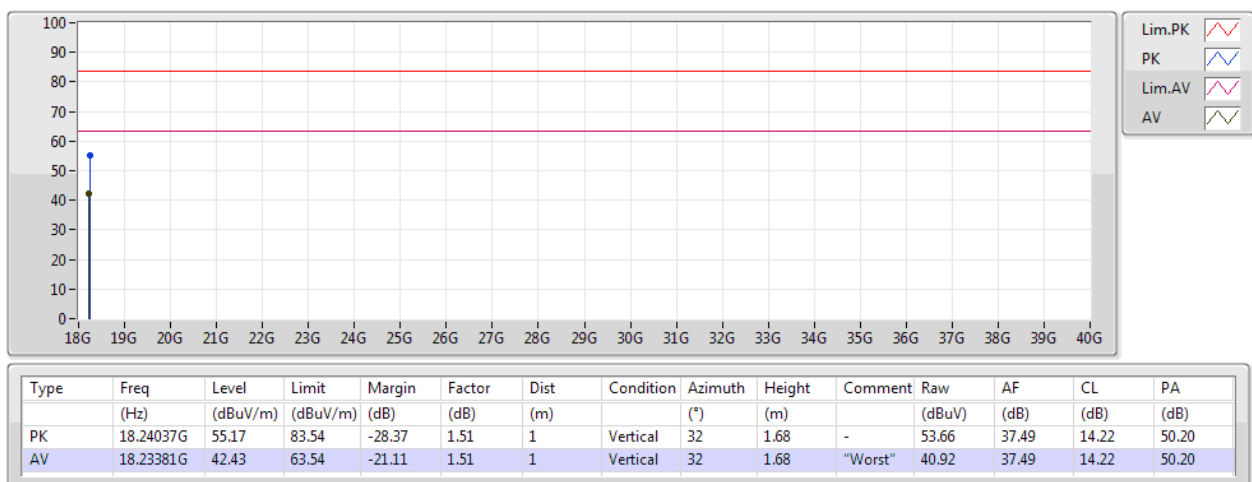
Test Range	18GHz – 40GHz	Test Mode	Mode 9
Test Bandwidth (MHz)	425	Test Freq. (GHz)	76.686
Test Distance	1 m		

Horizontal

17/10/2020


Vertical

17/10/2020

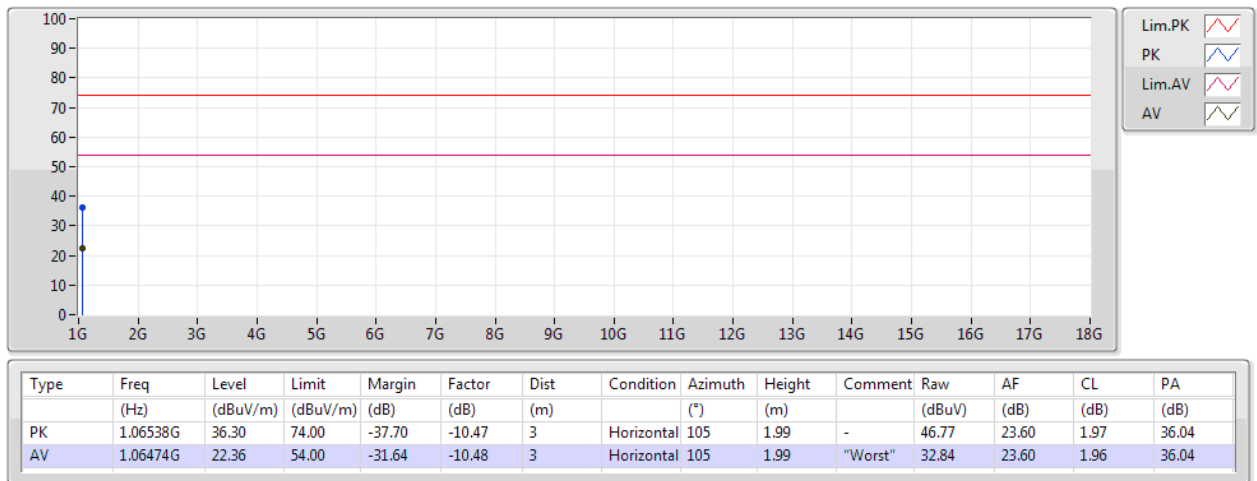


**For Unintentional - CRX**

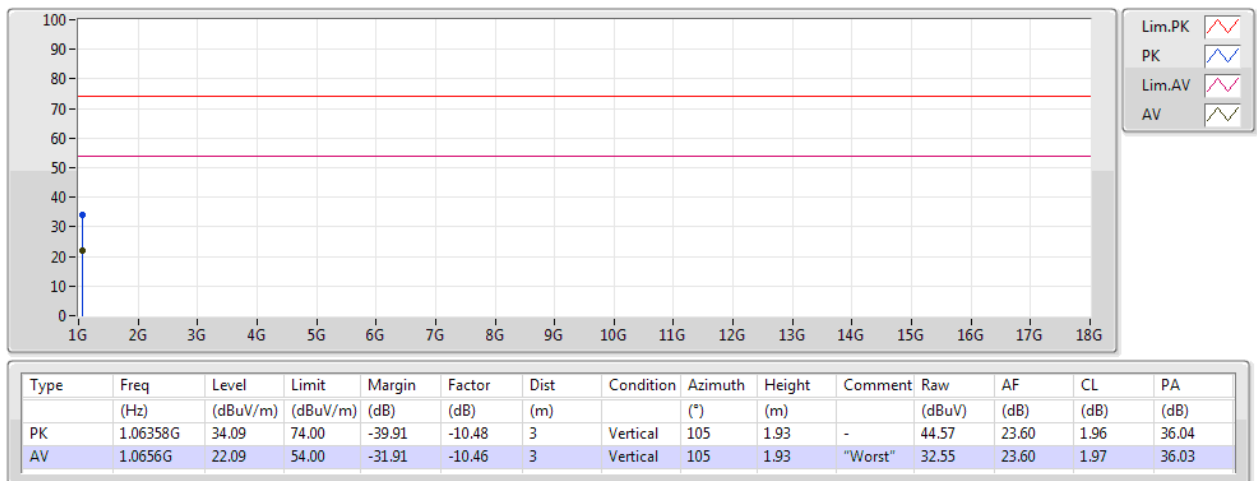
Test Range	1GHz – 18GHz	Test Mode	Mode 1
Test Bandwidth (MHz)	175	Test Freq. (GHz)	76.152
Test Distance	3 m		

Horizontal

17/10/2020

**Vertical**

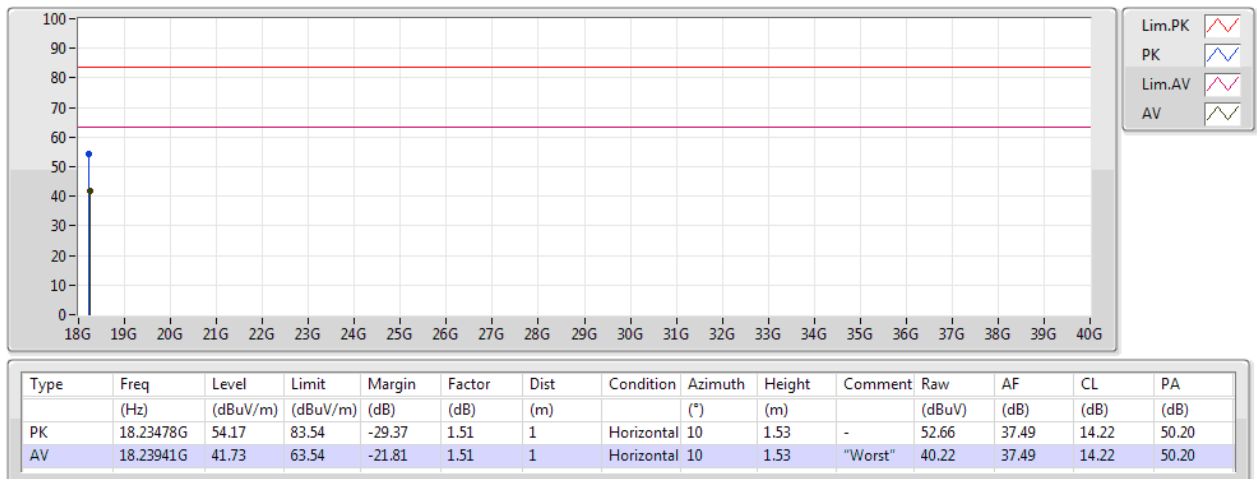
17/10/2020



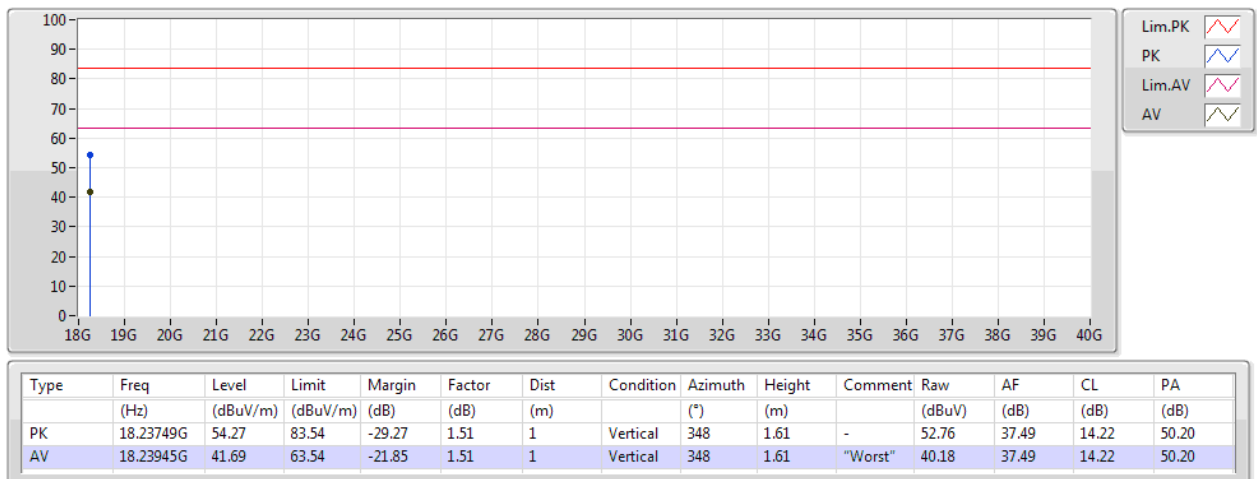
Test Range	18GHz – 40GHz	Test Mode	Mode 1
Test Bandwidth (MHz)	175	Test Freq. (GHz)	76.152
Test Distance	1 m		

Horizontal

17/10/2020


Vertical

17/10/2020

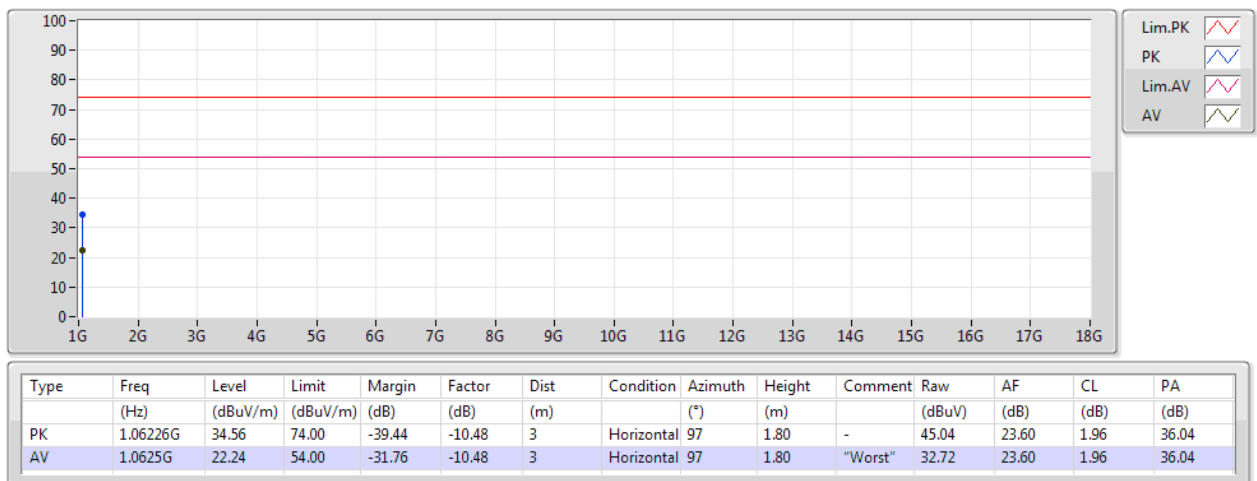




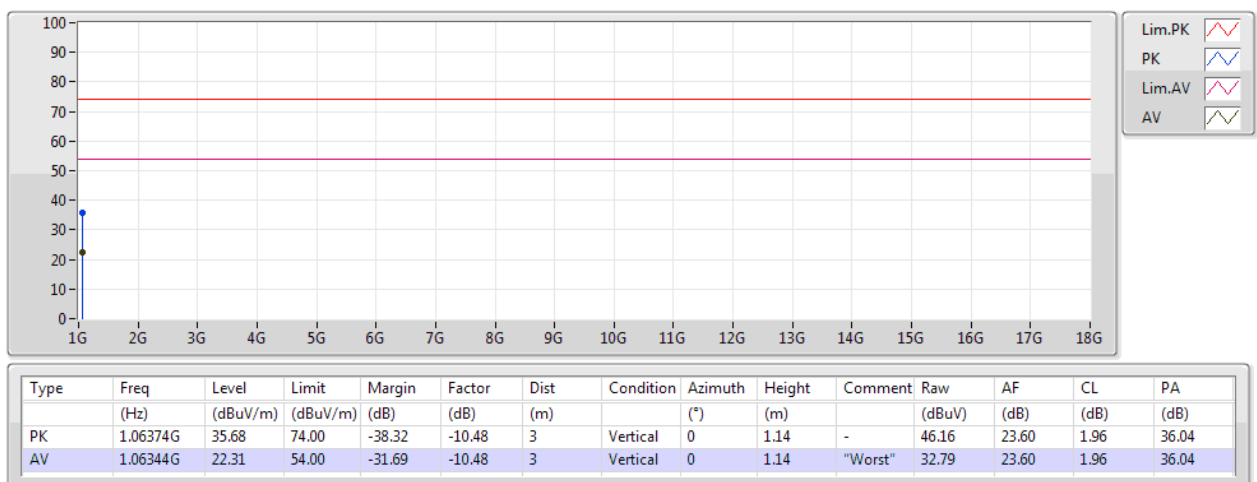
Test Range	1GHz – 18GHz	Test Mode	Mode 2
Test Bandwidth (MHz)	175	Test Freq. (GHz)	76.531
Test Distance	3 m		

Horizontal

17/10/2020

**Vertical**

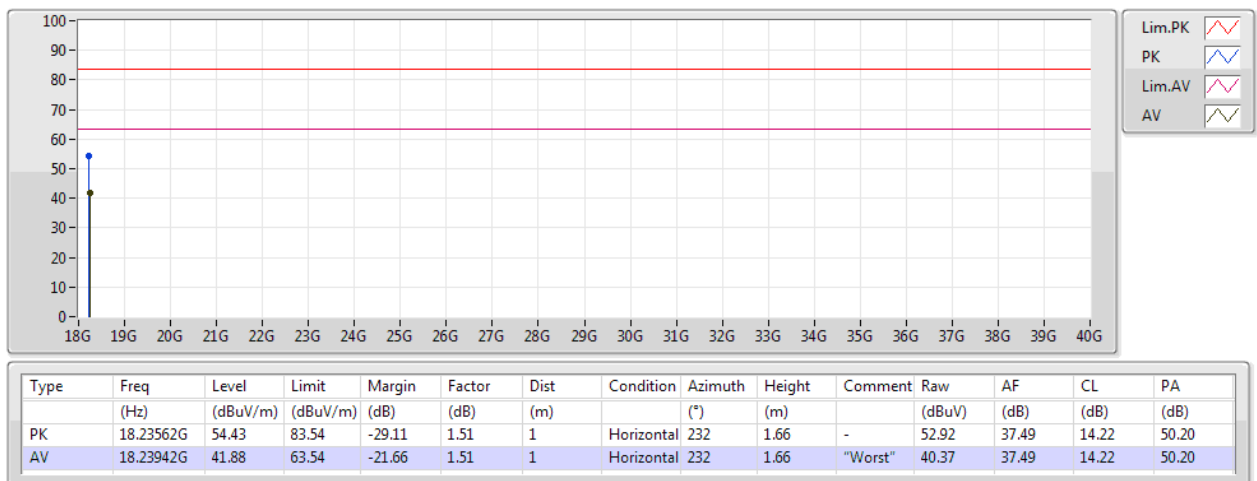
17/10/2020



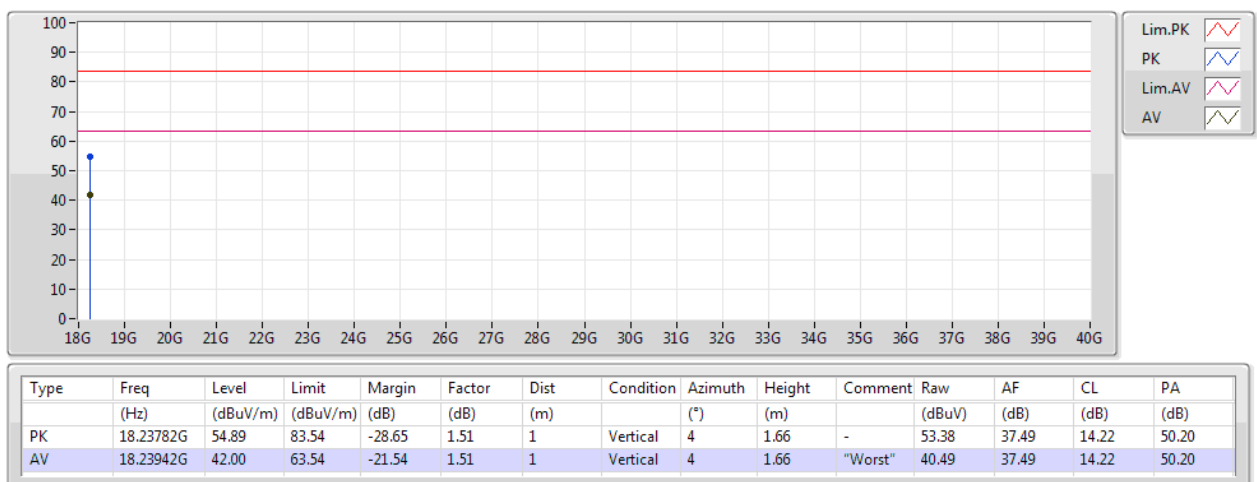
Test Range	18GHz – 40GHz	Test Mode	Mode 2
Test Bandwidth (MHz)	175	Test Freq. (GHz)	76.531
Test Distance	1 m		

Horizontal

17/10/2020


Vertical

17/10/2020

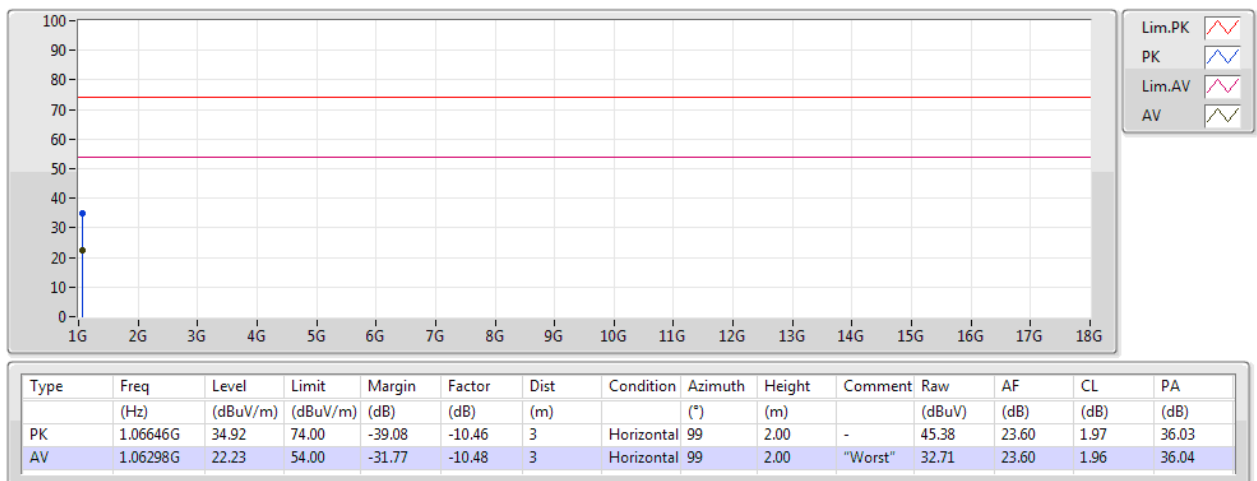




Test Range	1GHz – 18GHz	Test Mode	Mode 3
Test Bandwidth (MHz)	175	Test Freq. (GHz)	76.861
Test Distance	3 m		

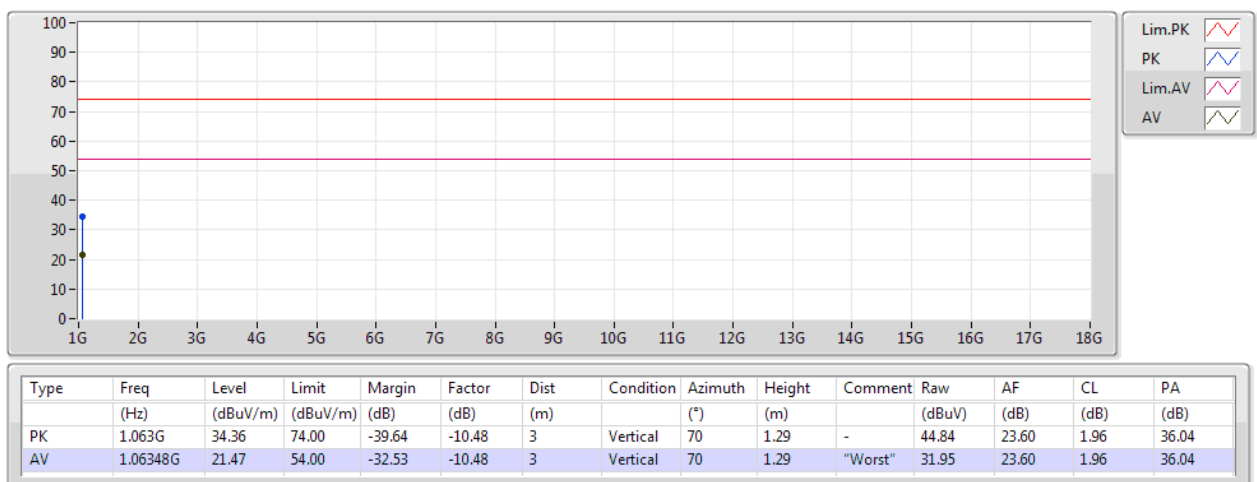
Horizontal

17/10/2020



Vertical

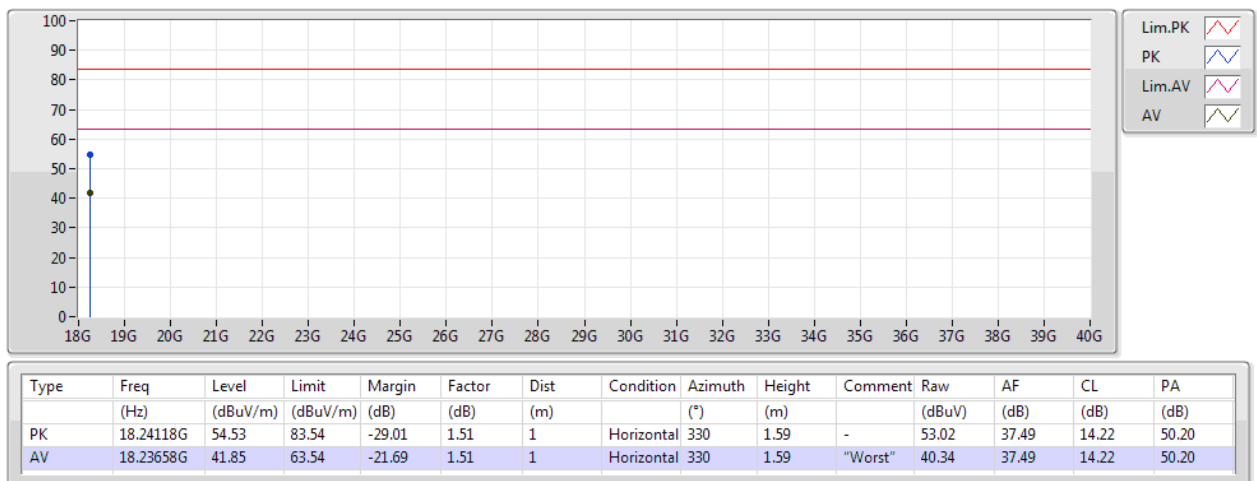
17/10/2020



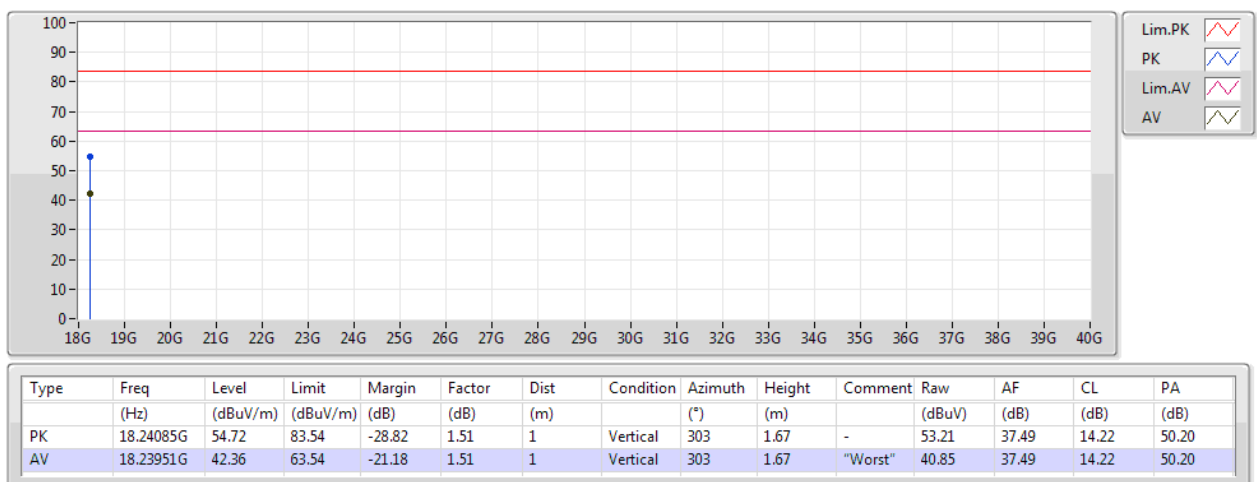
Test Range	18GHz – 40GHz	Test Mode	Mode 3
Test Bandwidth (MHz)	175	Test Freq. (GHz)	76.861
Test Distance	1 m		

Horizontal

17/10/2020


Vertical

17/10/2020

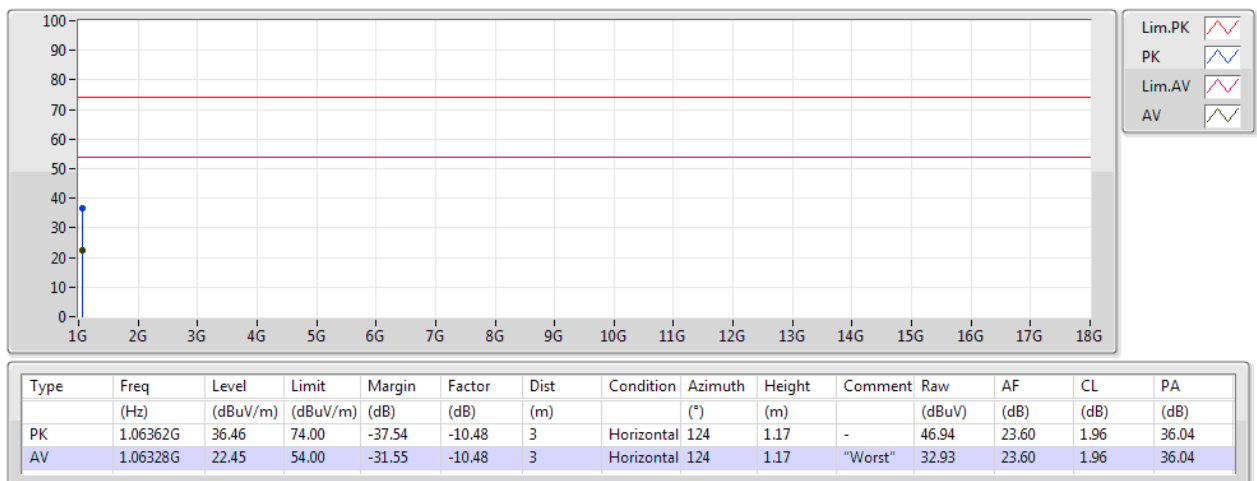




Test Range	1GHz – 18GHz	Test Mode	Mode 4
Test Bandwidth (MHz)	300	Test Freq. (GHz)	76.235
Test Distance	3 m		

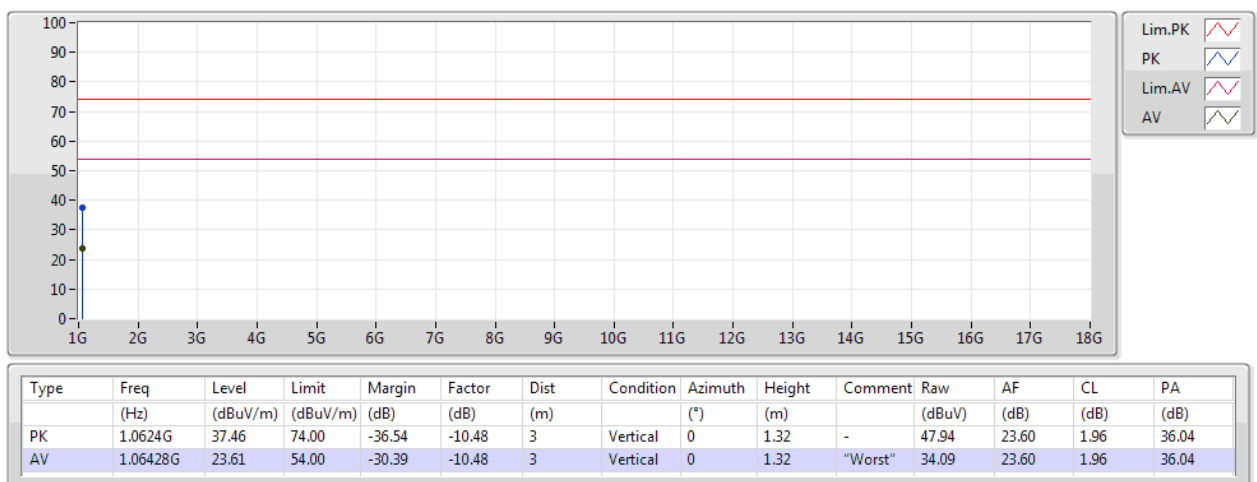
Horizontal

17/10/2020



Vertical

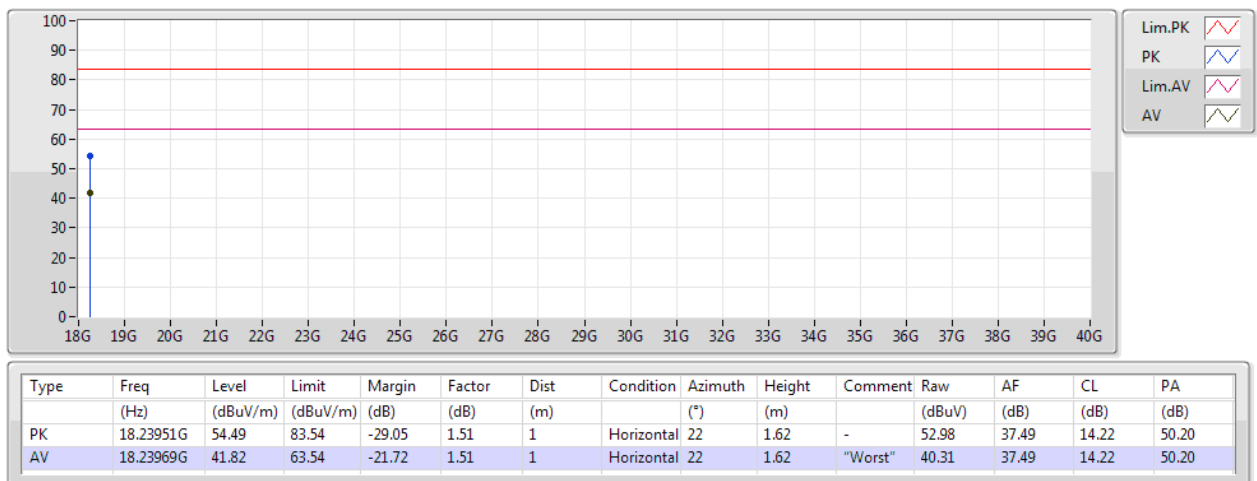
17/10/2020



Test Range	18GHz – 40GHz	Test Mode	Mode 4
Test Bandwidth (MHz)	300	Test Freq. (GHz)	76.235
Test Distance	1 m		

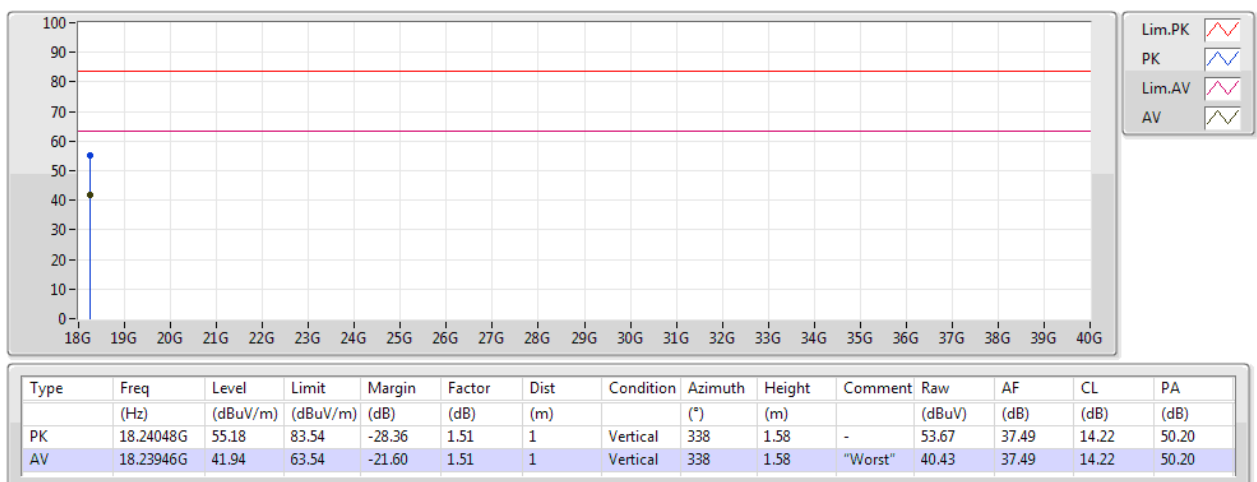
Horizontal

17/10/2020



Vertical

17/10/2020

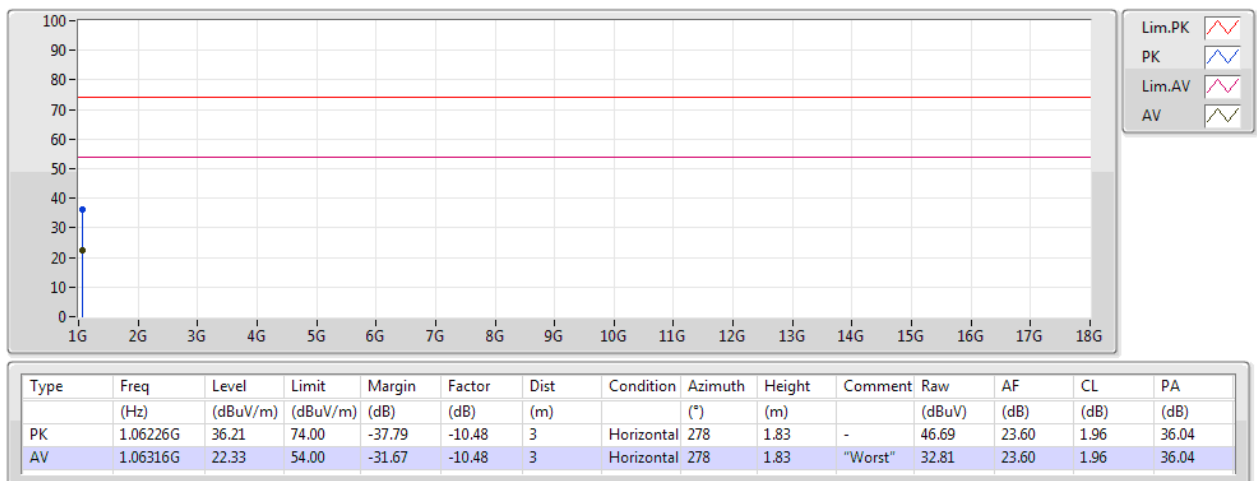




Test Range	1GHz – 18GHz	Test Mode	Mode 5
Test Bandwidth (MHz)	300	Test Freq. (GHz)	76.556
Test Distance	3 m		

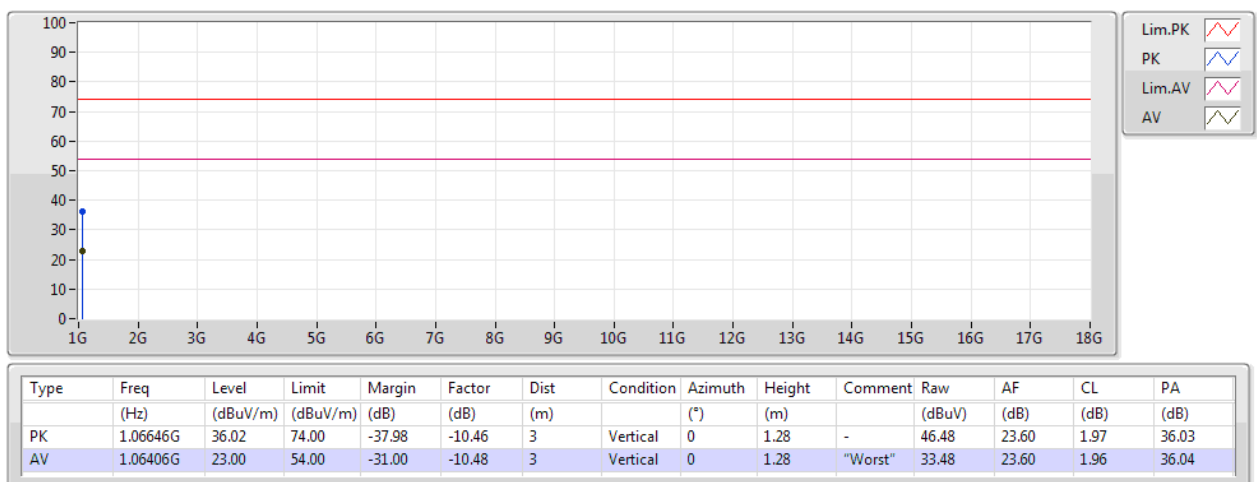
Horizontal

17/10/2020



Vertical

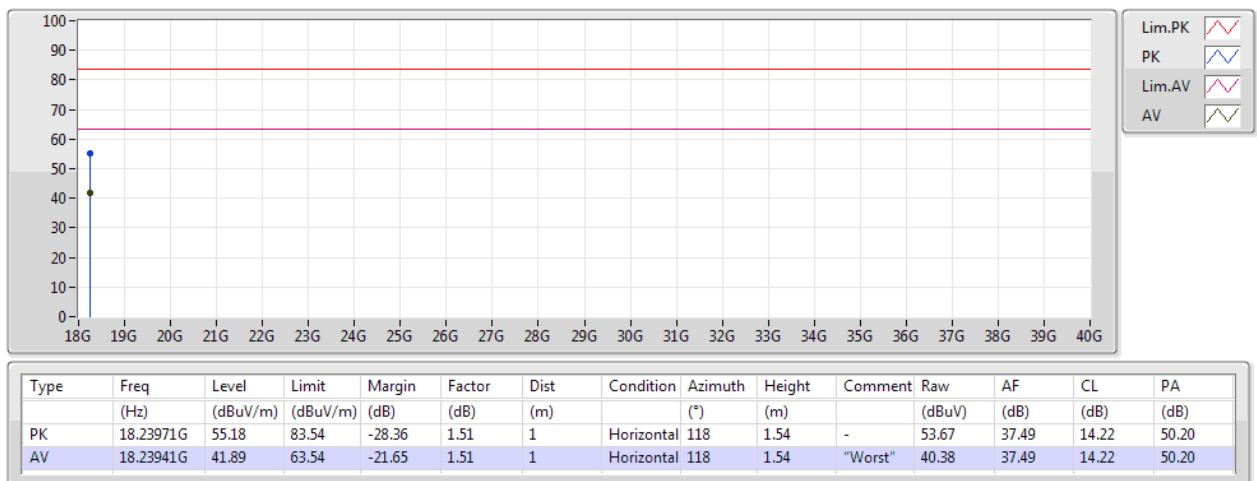
17/10/2020



Test Range	18GHz – 40GHz	Test Mode	Mode 5
Test Bandwidth (MHz)	300	Test Freq. (GHz)	76.556
Test Distance	1 m		

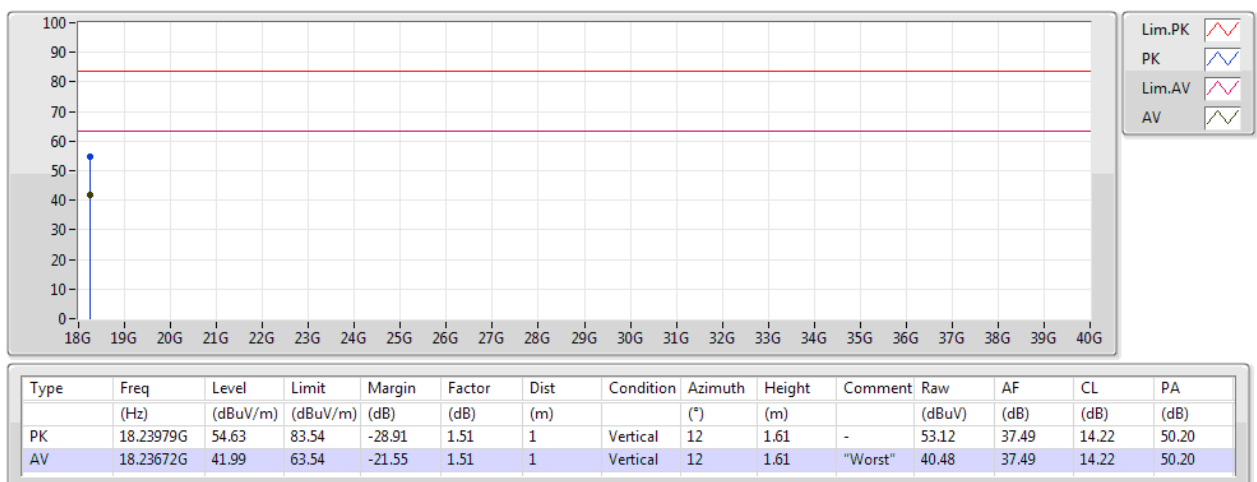
Horizontal

17/10/2020



Vertical

17/10/2020

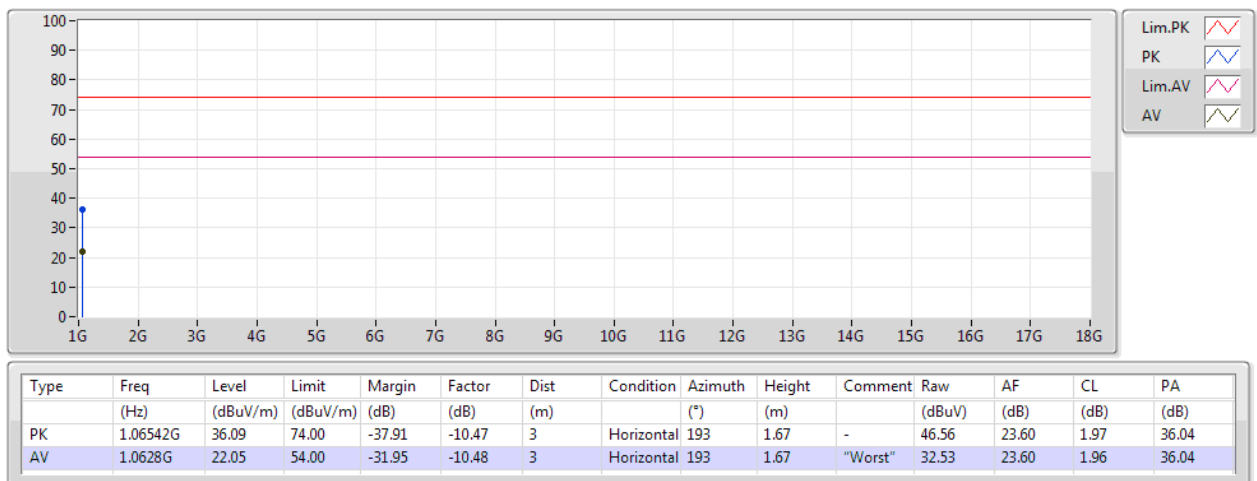




Test Range	1GHz – 18GHz	Test Mode	Mode 6
Test Bandwidth (MHz)	300	Test Freq. (GHz)	76.780
Test Distance	3 m		

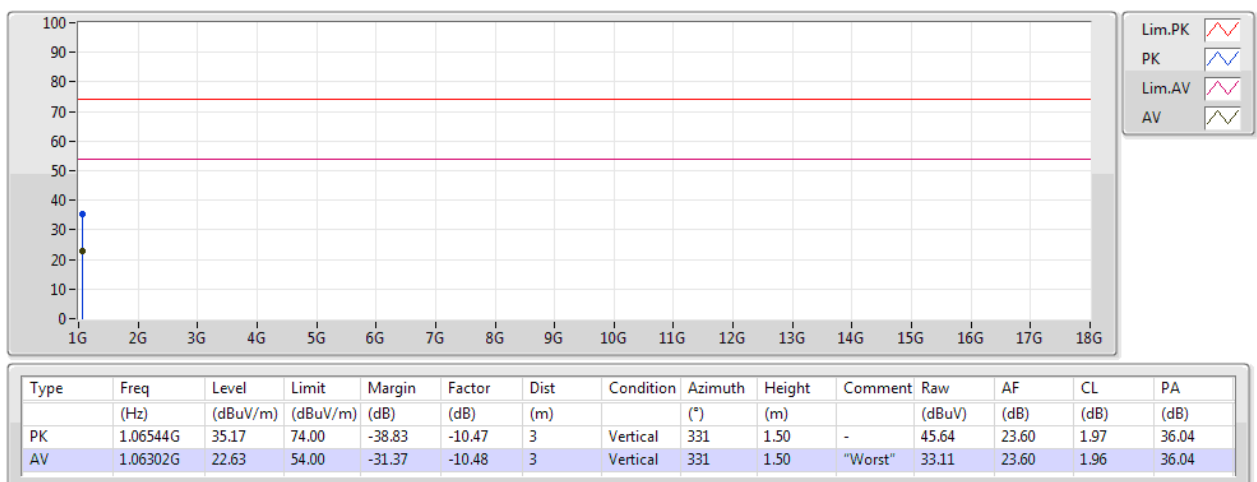
Horizontal

17/10/2020



Vertical

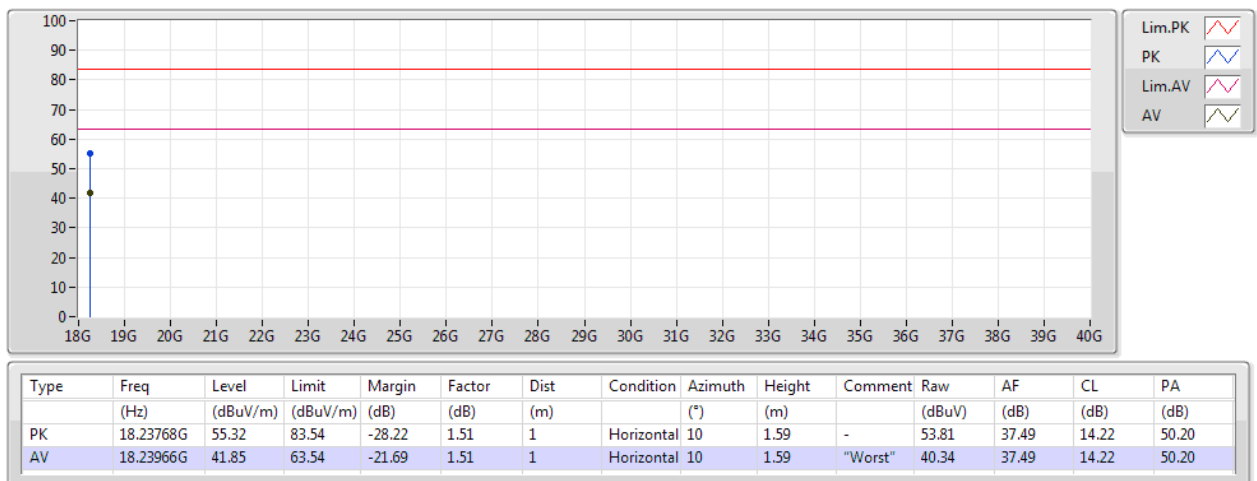
17/10/2020



Test Range	18GHz – 40GHz	Test Mode	Mode 6
Test Bandwidth (MHz)	300	Test Freq. (GHz)	76.780
Test Distance	1 m		

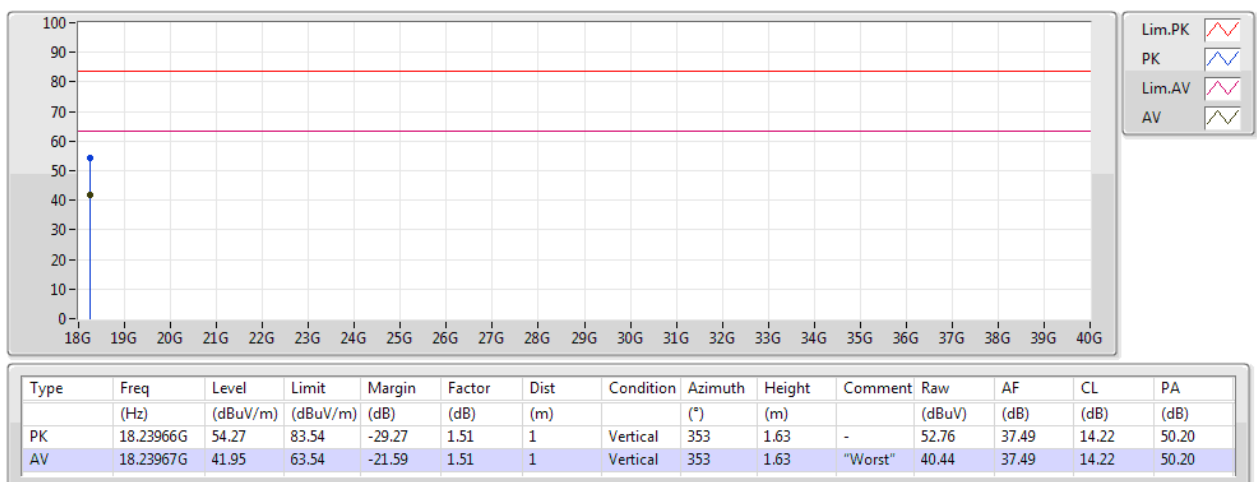
Horizontal

17/10/2020



Vertical

17/10/2020

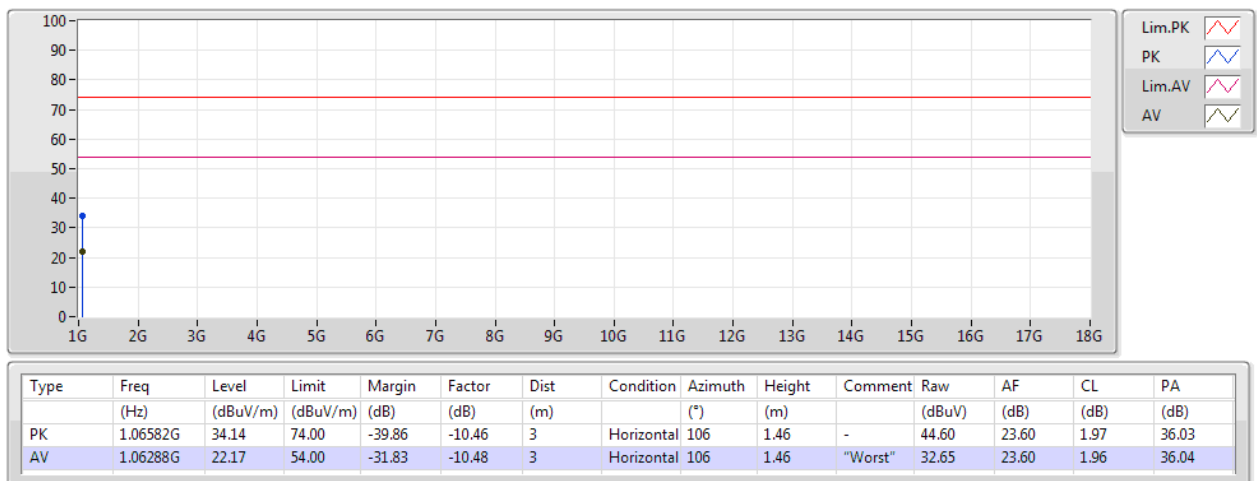




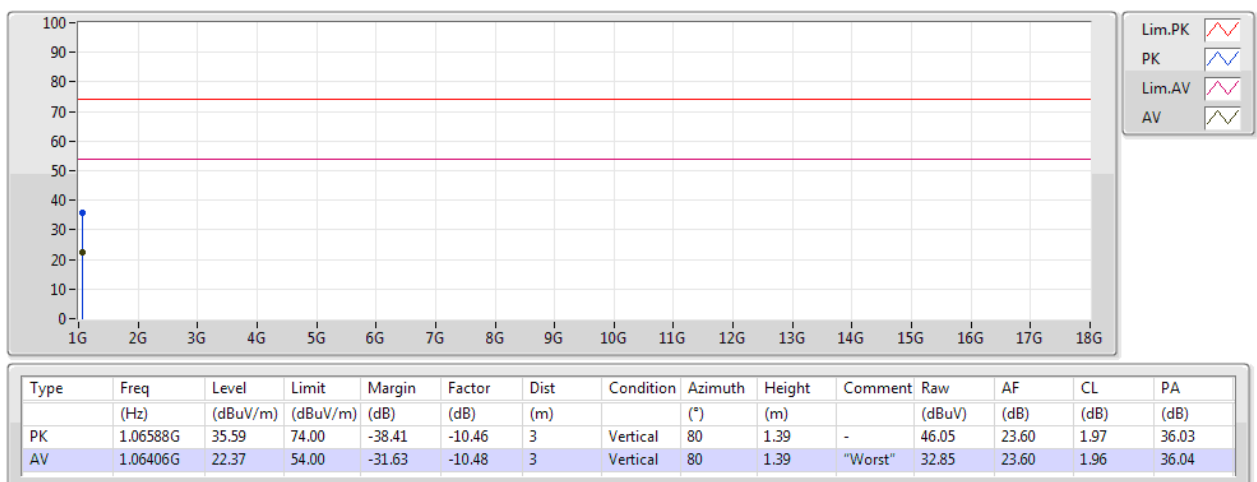
Test Range	1GHz – 18GHz	Test Mode	Mode 7
Test Bandwidth (MHz)	425	Test Freq. (GHz)	76.322
Test Distance	3 m		

Horizontal

17/10/2020

**Vertical**

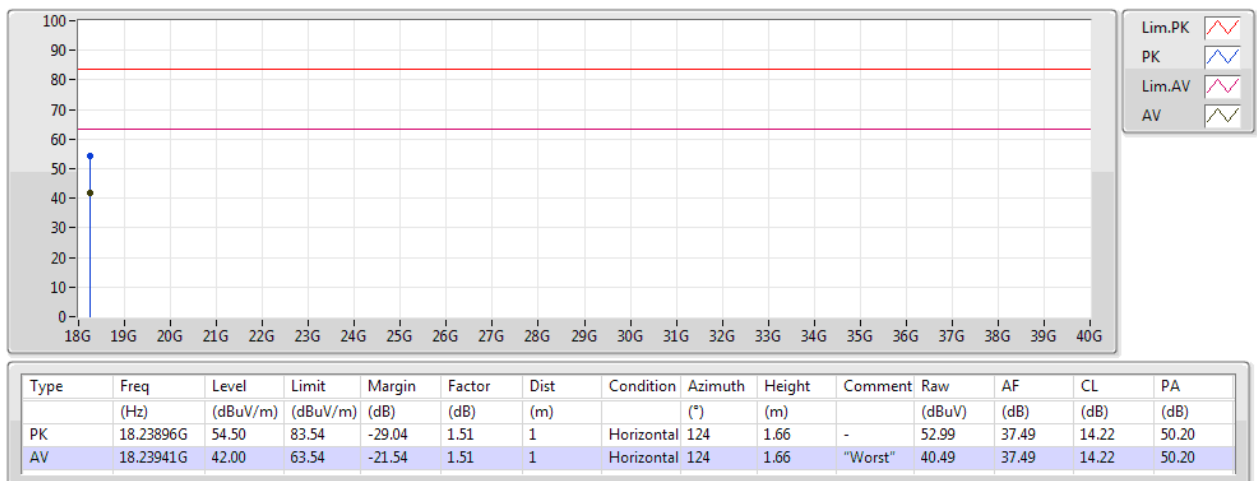
17/10/2020



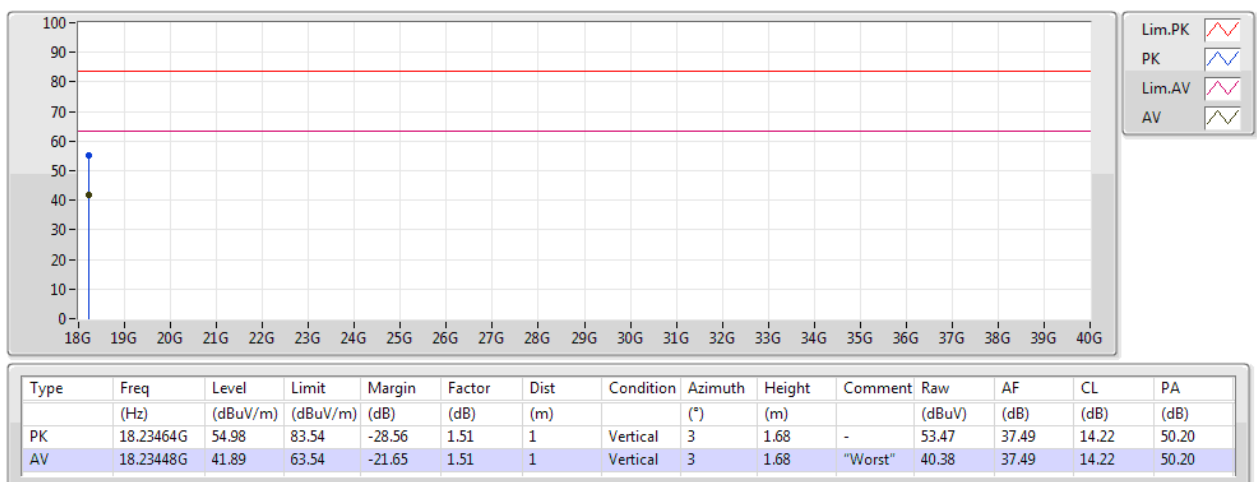
Test Range	18GHz – 40GHz	Test Mode	Mode 7
Test Bandwidth (MHz)	425	Test Freq. (GHz)	76.322
Test Distance	1 m		

Horizontal

17/10/2020


Vertical

17/10/2020

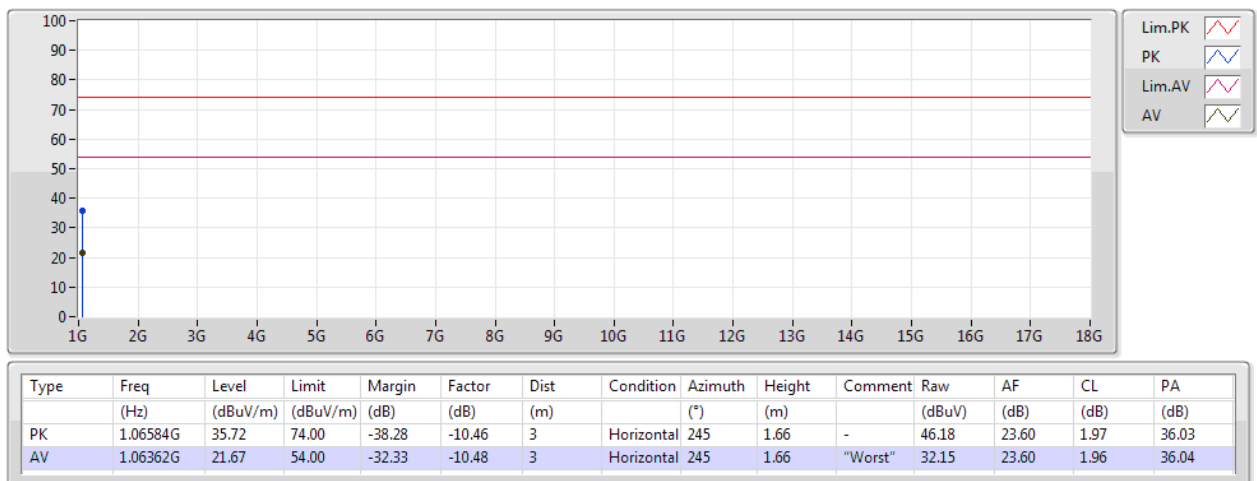




Test Range	1GHz – 18GHz	Test Mode	Mode 8
Test Bandwidth (MHz)	425	Test Freq. (GHz)	76.579
Test Distance	3 m		

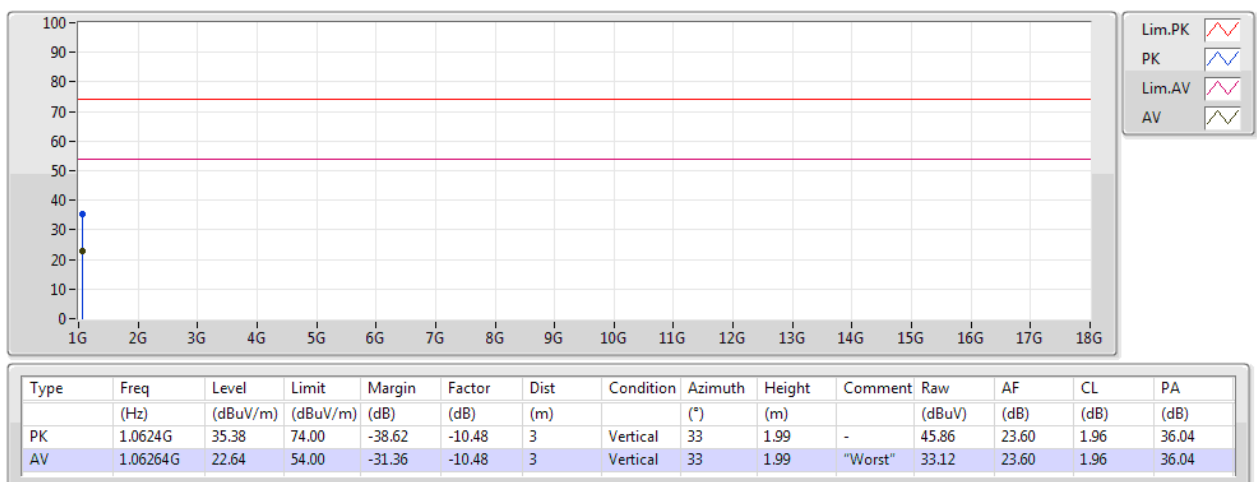
Horizontal

17/10/2020



Vertical

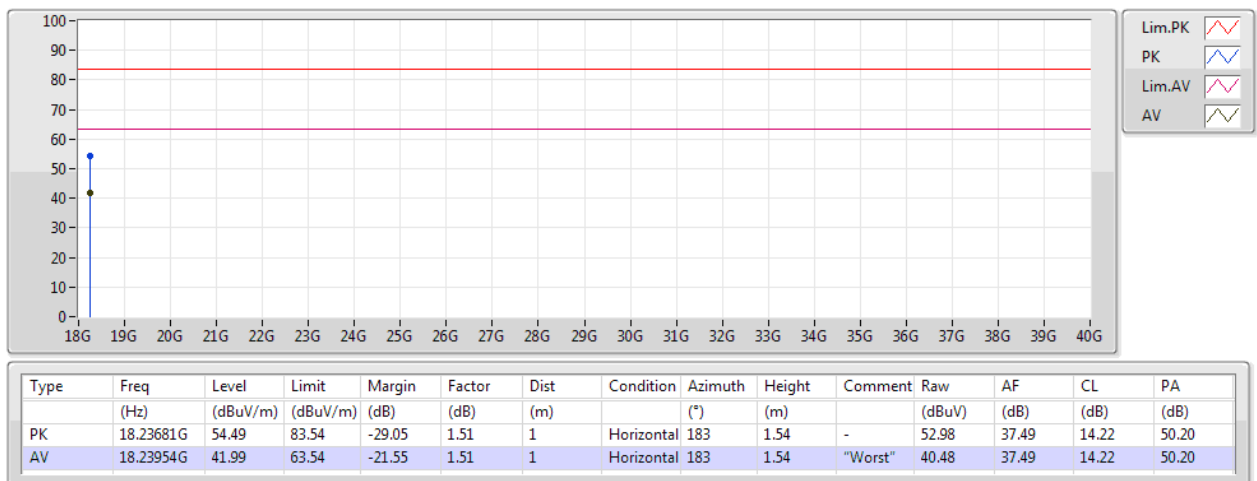
17/10/2020



Test Range	18GHz – 40GHz	Test Mode	Mode 8
Test Bandwidth (MHz)	425	Test Freq. (GHz)	76.579
Test Distance	1 m		

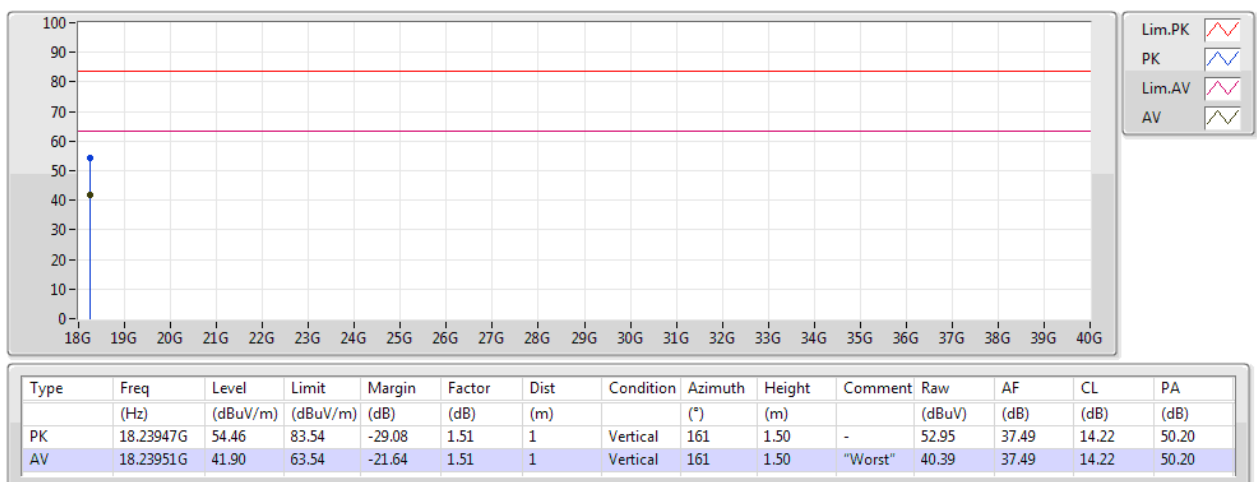
Horizontal

17/10/2020



Vertical

17/10/2020

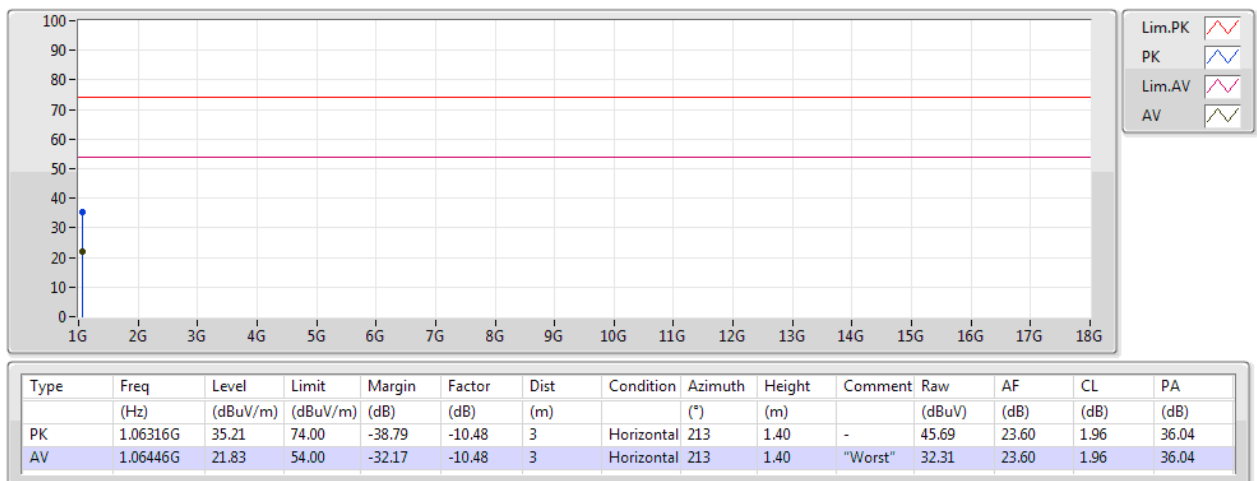




Test Range	1GHz – 18GHz	Test Mode	Mode 9
Test Bandwidth (MHz)	425	Test Freq. (GHz)	76.686
Test Distance	3 m		

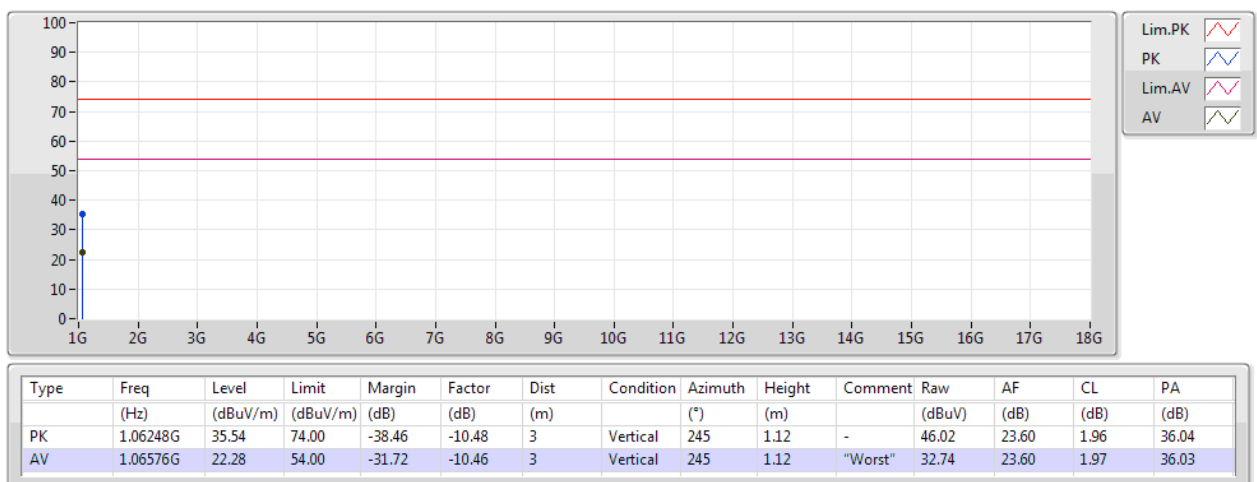
Horizontal

17/10/2020



Vertical

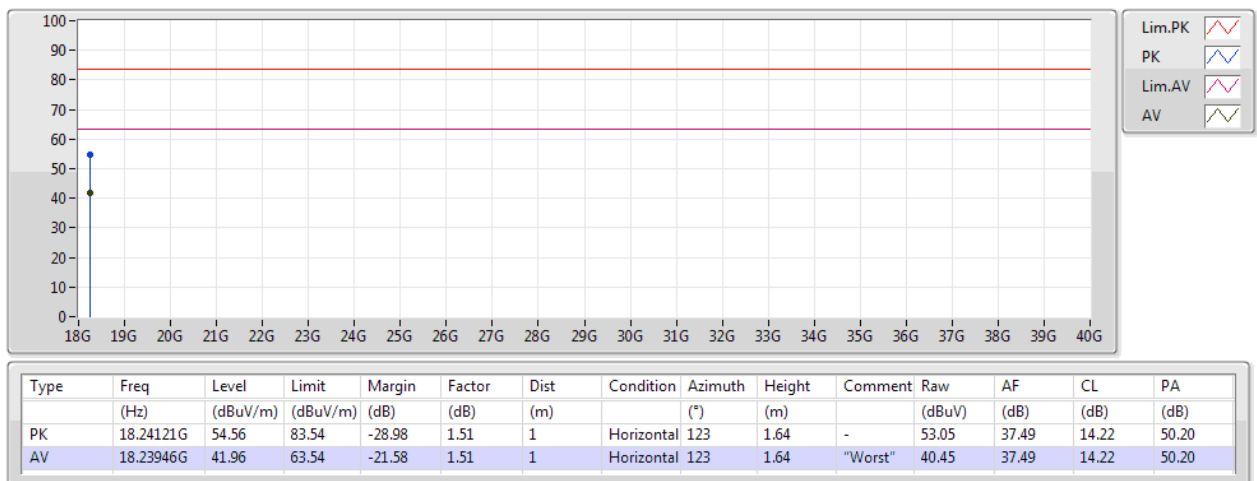
17/10/2020



Test Range	18GHz – 40GHz	Test Mode	Mode 9
Test Bandwidth (MHz)	425	Test Freq. (GHz)	76.686
Test Distance	1 m		

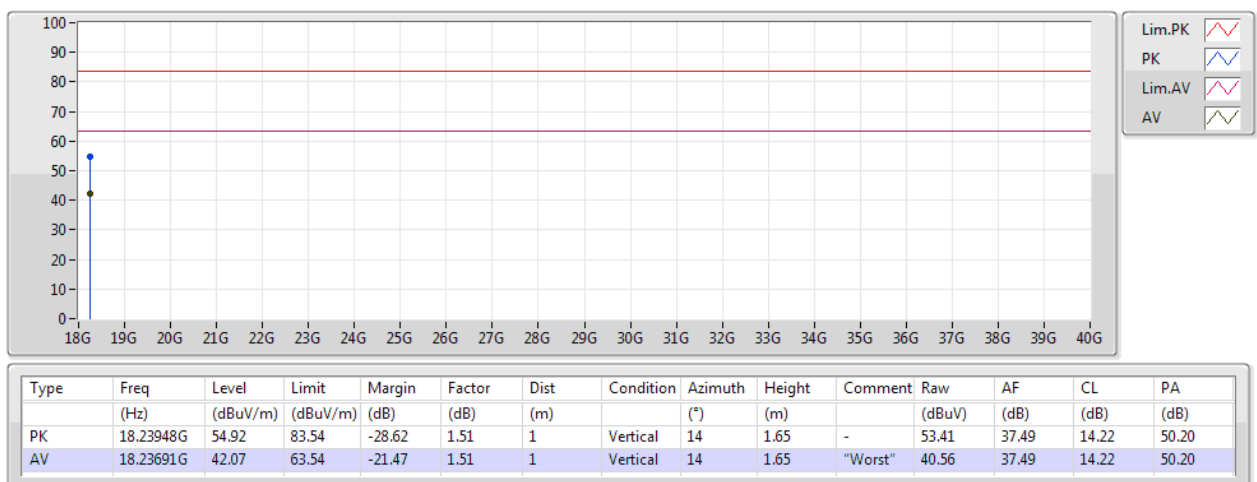
Horizontal

17/10/2020



Vertical

17/10/2020



Note 1: ">20dB" means spurious emission levels that exceed the level of 20 dB below the applicable limit.

Note 2: "N/F" means Nothing Found spurious emissions (No spurious emissions were detected.)

3.4.9 Test Result of Transmitter Radiated Unwanted Emissions (40GHz – 200GHz)

Test Bandwidth: 175 MHz

Test Freq. (GHz)	Rx Gain (dBi)	Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)	EIRP (dBm)	Specification Distance (m)	Power Density (pW/cm ²)	Test Result
76.152	23.0	0.85	41.381	-83.222	-42.86	3	0.0458	PASS
76.531	23.0	0.85	43.257	-82.682	-41.93	3	0.0567	PASS
76.861	23.0	0.85	42.624	-82.493	-41.87	3	0.0575	PASS
Limit							600	-

Test Bandwidth: 300 MHz

Test Freq. (GHz)	Rx Gain (dBi)	Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)	EIRP (dBm)	Specification Distance (m)	Power Density (pW/cm ²)	Test Result
76.235	76.235	23.0	0.85	43.771	-82.331	3	0.0629	PASS
76.556	76.556	23.0	0.85	42.558	-83.121	3	0.0496	PASS
76.780	76.780	23.0	0.85	42.981	-82.865	3	0.0537	PASS
Limit							600	-

Test Bandwidth: 425 MHz

Test Freq. (GHz)	Rx Gain (dBi)	Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)	EIRP (dBm)	Specification Distance (m)	Power Density (pW/cm ²)	Test Result
76.322	23.0	0.85	42.330	-82.330	-41.77	3	0.0589	PASS
76.579	23.0	0.85	41.782	-83.770	-43.32	3	0.0412	PASS
76.686	23.0	0.85	42.158	-83.142	-42.61	3	0.0484	PASS
Limit							600	-

3.4.10 Test Result of Transmitter Radiated Unwanted Emissions (200GHz – 231GHz)

Test Bandwidth: 175 MHz

Test Freq. (GHz)	Rx Gain (dBi)	Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)	EIRP (dBm)	Specification Distance (m)	Power Density (pW/cm ²)	Test Result
76.152	23.0	0.85	203.125	-89.317	-35.13	3	0.2713	PASS
76.531	23.0	0.85	202.647	-88.314	-34.15	3	0.3401	PASS
76.861	23.0	0.85	203.138	-88.648	-34.46	3	0.3165	PASS
Limit							1000	-

Test Bandwidth: 300 MHz

Test Freq. (GHz)	Rx Gain (dBi)	Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)	EIRP (dBm)	Specification Distance (m)	Power Density (pW/cm ²)	Test Result
76.235	23.0	0.85	202.436	-89.237	-35.08	3	0.2744	PASS
76.556	23.0	0.85	202.992	-88.931	-34.75	3	0.2961	PASS
76.780	23.0	0.85	203.526	-89.318	-35.12	3	0.2723	PASS
Limit							1000	-

Test Bandwidth: 425 MHz

Test Freq. (GHz)	Rx Gain (dBi)	Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)	EIRP (dBm)	Specification Distance (m)	Power Density (pW/cm ²)	Test Result
76.322	23.0	0.85	204.734	-88.731	-34.48	3	0.3154	PASS
76.579	23.0	0.85	205.158	-88.128	-33.86	3	0.3639	PASS
76.686	23.0	0.85	203.146	-89.314	-35.13	3	0.2715	PASS
Limit							1000	-

3.5 Frequency Stability

3.5.1 Frequency Stability Limit

Frequency Stability Limit
Fundamental emissions must be contained within the frequency bands specified in this 76-81GHz band during all conditions of operation. Equipment is presumed to operate over the temperature range -20 to +50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage.

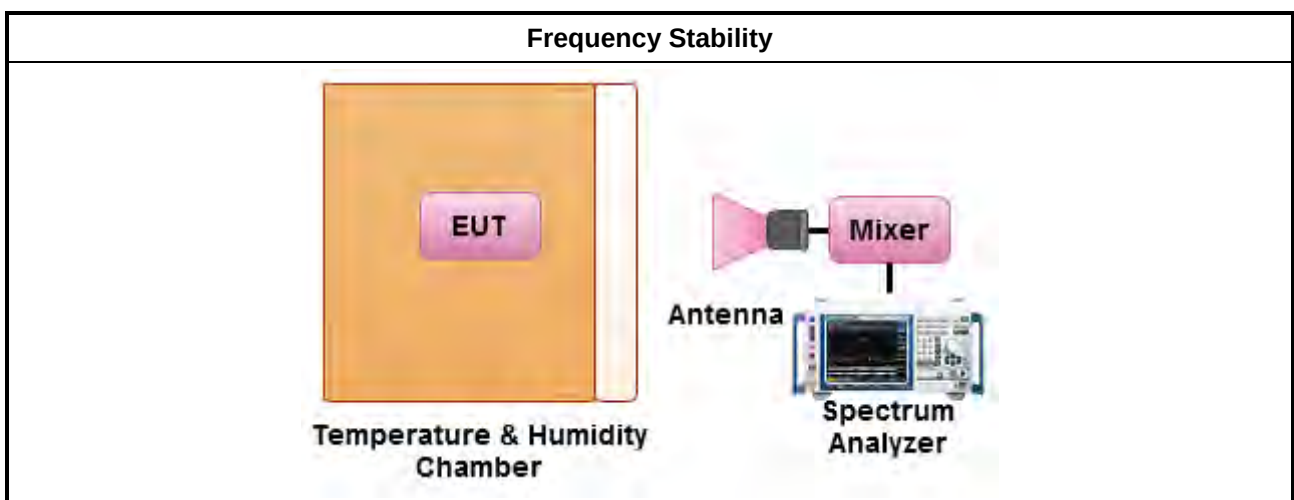
3.5.2 Measuring Instruments

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

3.5.3 Test Procedures

Test Method
☒ For the frequency stability shall be measured using one of the options below:
☒ Refer as ANSI C63.10, clause 9.14 for frequency stability measurement.
☒ Refer as ANSI C63.10, clause 9 for radiated measurement.
☒ Radiated test was conducted at far-field distance. the distance from the radiating element of the EUT to the edge of the far field may be calculated from $[r \geq 2D^2/\lambda]$ r is the distance from the radiating element of the EUT to the edge of the far field, in m D is the largest dimension of both the radiating element and the test antenna (horn), in m λ is the wavelength of the emission under investigation $[300/f \text{ (MHz)}]$, in m
☒ The mixer may be placed outside the chamber in front of the temperature chamber door, and the chamber door opened for each reading.

3.5.4 Test Setup



3.5.5 Test Result of Frequency Stability

Test Bandwidth: 175 MHz

Test Freq. (GHz): 76.152

Test Temperature: (°C)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
-40	76153.09	1665.5	within band
-30	76151.61	190	within band
-20	76152.89	1467	within band
-10	76151.86	444	within band
0	76151.67	247	within band
10	76152.15	730	within band
20	76151.42	Reference	within band
30	76151.54	117	within band
40	76151.48	55	within band
50	76151.46	38	within band
60	76151.61	189	within band
70	76151.46	43	within band
85	76151.64	218	within band
Test Voltage: (Vdc)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
10.2	76152.31	892	within band
12	76151.42	Reference	within band
13.8	76152.79	1366	within band

**Test Freq. (GHz): 76.531**

Test Temperature: (°C)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
-40	76533.17	1592	within band
-30	76532.91	1329	within band
-20	76533.15	1575	within band
-10	76532.70	1125	within band
0	76531.95	369	within band
10	76532.33	749	within band
20	76531.58	Reference	within band
30	76532.93	1355	within band
40	76531.89	312	within band
50	76531.82	241	within band
60	76532.11	530	within band
70	76532.20	616	within band
85	76531.54	-36	within band
Test Voltage: (Vdc)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
10.2	76531.56	-24	within band
12	76531.58	Reference	within band
13.8	76531.60	20	within band

**Test Freq. (GHz): 76.861**

Test Temperature: (°C)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
-40	76863.17	2171	within band
-30	76862.92	1916	within band
-20	76861.71	708	within band
-10	76862.39	1390	within band
0	76861.37	367	within band
10	76861.20	203	within band
20	76861.00	Reference	within band
30	76861.17	173	within band
40	76861.12	120	within band
50	76861.02	15	within band
60	76861.01	14	within band
70	76861.12	118	within band
85	76861.18	181	within band
Test Voltage: (Vdc)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
10.2	76861.16	155	within band
12	76861.00	Reference	within band
13.8	76861.02	21	within band

**Test Bandwidth: 300 MHz****Test Freq. (GHz): 76.235**

Test Temperature: (°C)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
-40	76237.17	1590	within band
-30	76235.89	310	within band
-20	76236.37	790	within band
-10	76235.91	330	within band
0	76235.72	140	within band
10	76235.89	310	within band
20	76235.58	Reference	within band
30	76235.23	-350	within band
40	76235.29	-290	within band
50	76235.57	-9.999999995	within band
60	76235.12	-460	within band
70	76235.49	-90	within band
85	76235.00	-580	within band
Test Voltage: (Vdc)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
10.2	76235.43	-150	within band
12	76235.58	Reference	within band
13.8	76235.34	-240	within band

**Test Freq. (GHz): 76.556**

Test Temperature: (°C)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
-40	76557.44	2020	within band
-30	76557.29	1870	within band
-20	76556.90	1480	within band
-10	76557.19	1770	within band
0	76557.14	1720	within band
10	76556.19	770	within band
20	76555.42	Reference	within band
30	76555.28	-140	within band
40	76555.23	-190	within band
50	76555.42	0	within band
60	76555.40	-20	within band
70	76555.37	-50	within band
85	76555.37	-50	within band
Test Voltage: (Vdc)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
10.2	76555.52	100	within band
12	76555.42	Reference	within band
13.8	76555.39	-30	within band

**Test Freq. (GHz): 76.780**

Test Temperature: (°C)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
-40	76782.17	1590	within band
-30	76780.75	170	within band
-20	76781.35	770	within band
-10	76780.85	270	within band
0	76781.99	1410	within band
10	76781.58	1000	within band
20	76780.58	Reference	within band
30	76780.40	-180	within band
40	76780.38	-200	within band
50	76780.31	-270	within band
60	76780.41	-170	within band
70	76780.44	-140	within band
85	76780.31	-270	within band
Test Voltage: (Vdc)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
10.2	76780.33	-250	within band
12	76780.58	Reference	within band
13.8	76780.43	-150	within band

**Test Bandwidth: 425 MHz****Test Freq. (GHz): 76.322**

Test Temperature: (°C)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
-40	76323.15	1870	within band
-30	76322.79	1510	within band
-20	76322.74	1460	within band
-10	76321.93	650	within band
0	76321.76	480	within band
10	76321.84	560	within band
20	76321.28	Reference	within band
30	76322.67	1390	within band
40	76322.50	1220	within band
50	76321.58	300	within band
60	76322.11	830	within band
70	76322.47	1190	within band
85	76321.13	-148	within band
Test Voltage: (Vdc)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
10.2	76321.77	490	within band
12	76321.28	Reference	within band
13.8	76321.51	230	within band

**Test Freq. (GHz): 76.579**

Test Temperature: (°C)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
-40	76580.73	2450	within band
-30	76580.35	2070	within band
-20	76579.56	1280	within band
-10	76579.83	1550	within band
0	76580.11	1830	within band
10	76580.23	1950	within band
20	76578.28	Reference	within band
30	76578.57	290	within band
40	76578.70	420	within band
50	76578.52	240	within band
60	76578.92	640	within band
70	76578.36	80	within band
85	76578.57	286	within band
Test Voltage: (Vdc)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
10.2	76578.43	150	within band
12	76578.28	Reference	within band
13.8	76578.91	630	within band

**Test Freq. (GHz): 76.686**

Test Temperature: (°C)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
-40	76687.15	1870	within band
-30	76685.78	500	within band
-20	76685.45	170	within band
-10	76685.86	580	within band
0	76686.44	1160	within band
10	76686.99	1710	within band
20	76685.28	Reference	within band
30	76686.22	940	within band
40	76685.64	360	within band
50	76685.52	240	within band
60	76686.16	880	within band
70	76686.40	1120	within band
85	76686.00	720	within band
Test Voltage: (Vdc)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
10.2	76685.73	450	within band
12	76685.28	Reference	within band
13.8	76685.11	-170	within band



4 Test Equipment and Calibration Data

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.4GHz	Feb. 26, 2020	Feb. 25, 2021	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Dec. 25, 2019	Dec. 24, 2020	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Feb. 25, 2020	Feb. 24, 2021	Conduction (CO01-CB)
Pulse Limiter	Rohde&Schwarz	ESH3-Z2	100430	9kHz ~ 30MHz	Jan. 31, 2020	Jan. 30, 2021	Conduction (CO01-CB)
COND Cable	Woken	Cable	Low cable-CO01	9kHz ~ 30MHz	May 20, 2020	May 19, 2021	Conduction (CO01-CB)
Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Conduction (CO01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Apr. 13, 2020	Apr. 12, 2021	Radiation (03CH05-CB)
3m Semi Anechoic Chamber NSA	TDK	SAC-3M	03CH05-CB	30 MHz ~ 1 GHz	Aug. 10, 2020	Aug. 09, 2021	Radiation (03CH05-CB)
Bilog Antenna with 6dB Attenuator	TESEQ & EMCI	CBL 6112D & N-6-06	35236 & AT-N0610	30MHz ~ 2GHz	Mar. 27, 2020	Mar. 26, 2021	Radiation (03CH05-CB)
Pre-Amplifier	EMCI	EMC330N	980331	20MHz ~ 3GHz	Apr. 28, 2020	Apr. 27, 2021	Radiation (03CH05-CB)
Signal Analyzer	R&S	FSV40	101904	9kHz ~ 40GHz	May 12, 2020	May 11, 2021	Radiation (03CH05-CB)
RF Cable-low	Woken	RG402	Low Cable-04+23	30MHz~1GHz	Oct. 05, 2020	Oct. 04, 2021	Radiation (03CH05-CB)
EMI Test Receiver	R&S	ESCS	826547/017	9kHz ~ 2.75GHz	May 13, 2020	May 12, 2021	Radiation (03CH05-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH05-CB)
Mixer*	OML	M19HWA	U91113-1	40 ~ 60 GHz	Oct. 01, 2019	Sep. 30, 2021	Radiation (03CH05-CB)
Mixer*	OML	M15HWA	V91113-1	50 ~ 75 GHz	Oct. 25, 2019	Oct. 24, 2021	Radiation (03CH05-CB)
Mixer*	OML	M12HWA	E91113-1	60 ~ 90 GHz	Oct. 25, 2019	Oct. 24, 2021	Radiation (03CH05-CB)
Mixer*	OML	M08HWA	F91113-1	90 ~ 140 GHz	Oct. 25, 2019	Oct. 24, 2021	Radiation (03CH05-CB)
Mixer*	OML	M05HW/A	G91113-1	140 ~ 220 GHz	Oct. 25, 2019	Oct. 24, 2021	Radiation (03CH05-CB)
Mixer*	OML	M03HWD	120320-1	220 ~ 325 GHz	Oct. 25, 2019	Oct. 24, 2021	Radiation (03CH05-CB)
Standard Horn Antenna	Custom Microwave	M19RH	U91113-A	40 ~ 60 GHz	N.C.R.	N.C.R.	Radiation (03CH05-CB)
Standard Horn Antenna	Custom Microwave	M15RH	V91113-A	50 ~ 75 GHz	N.C.R.	N.C.R.	Radiation (03CH05-CB)



Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Standard Horn Antenna	Custom Microwave	M12RH	E91113-A	60 ~ 90 GHz	N.C.R	N.C.R	Radiation (03CH05-CB)
Standard Horn Antenna	Custom Microwave	M08RH	F91113-A	90 ~ 140 GHz	N.C.R	N.C.R	Radiation (03CH05-CB)
Standard Horn Antenna	Custom Microwave	M05RH	G91113-A	140 ~ 220 GHz	N.C.R	N.C.R	Radiation (03CH05-CB)
Standard Horn Antenna	Custom Microwave	M03RH	120320-A	220 ~ 325 GHz	N.C.R	N.C.R	Radiation (03CH05-CB)
Detector	Millitech	DET-15-RPFW0	#A18185(074)	50 ~ 75 GHz	Apr. 02, 2020	Apr. 01, 2021	Radiation (03CH05-CB)
PC Oscilloscope	PICO TECH	6402C	CX372/002	N/A	Jul. 10, 2020	Jul. 09, 2021	Radiation (03CH05-CB)
3m Semi Anechoic Chamber VSWR	TDK	SAC-3M	03CH01-CB	1GHz ~18GHz 3m	May 29, 2020	May 28, 2021	Radiation (03CH01-CB)
Horn Antenna	ETS-LINDGREN	3115	00075790	750MHz ~ 18GHz	Nov. 04, 2019	Nov. 03, 2020	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 21, 2020	Jul. 20, 2021	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 08, 2020	Jan. 07, 2021	Radiation (03CH01-CB)
Pre-Amplifier	MITEQ	TTA1840-35-HG	1864479	18GHz ~ 40GHz	Jul. 08, 2020	Jul. 07, 2021	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Apr. 16, 2020	Apr. 15, 2021	Radiation (03CH01-CB)
RF Cable-high	Woken	RG402	High Cable-16	1 GHz ~ 18 GHz	Oct. 05, 2020	Oct. 04, 2021	Radiation (03CH01-CB)
RF Cable-high	Woken	RG402	High Cable-16+17	1 GHz ~ 18 GHz	Oct. 05, 2020	Oct. 04, 2021	Radiation (03CH01-CB)
RF Cable-high	Woken	RG402	High Cable-40G#1	18GHz ~ 40 GHz	Jul. 16, 2020	Jul. 15, 2021	Radiation (03CH01-CB)
RF Cable-high	Woken	RG402	High Cable-40G#2	18GHz ~ 40 GHz	Jul. 16, 2020	Jul. 15, 2021	Radiation (03CH01-CB)
Test Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (03CH01-CB)
Temp. and Humidity Chamber	Gaint Force	GTH-408-40-C P-AR	MAA1410-011	-40~100 degree	Sep. 09, 2020	Sep. 08, 2021	Radiation (03CH01-CB)
Spectrum analyzer	R&S	FSV40	101028	9kHz~40GHz	Nov. 01, 2019	Oct. 31, 2020	Conducted (TH03-CB)

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

“**” Calibration Interval of instruments listed above is two years.

N.C.R. means Non-Calibration required.