

Oneweb Test Report

Oneweb UT Terminals OW130L (Indoor & Nearfield Facility)

Model	OW130L	
Test Title	Antenna Subsystem_RFP	
VCRM #	UT-PRD-GEN-045 / UT-ANTSS-RX-001	RFP-01
	UT-PRD-GEN-049 / UT-ANTSS-RX-004	RFP-02
	UT-PRD-M-123 / UT-ANTSS-RX-010.000	RFP-03
	UT-PRD-GEN-075 / UT-ANTSS-RX-032	RFP-04
	UT-PRD-GEN-044 / UT-ANTSS-TX-001	RFP-05
	UT-PRD-GEN-048 / UT-ANTSS-TX-005	RFP-06
	UT-PRD-GEN-081 / UT-ANTSS-TX-029	RFP-07
	UT-PRD-GEN-075 / UT-ANTSS-TX-037	RFP-08
	UT-ANT-RF-TX-008	RFP-09
	UT-PRD-GEN-233 / UT-ANTSS-TX-009.001	RFP-10

08 AUG 2022

Version 1.0

Prepared by

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1. History of document

Version	Date	Summary of Change	Editor	Comment
V1.0	08/08/2022	1. Antenna Measurement report	Woochang Choi	
		1.		
		1.		
		1.		

2. Introduction

This document is the result of performance verification of OW130L, a development project using Onweb. This antenna supports the Ku band and confirms the performance requirements of the VCRM antenna_subsystem.

3. Requirements of antenna performance

UT Antenna Subsystem(AntSS) & PRD Requirements			
RFP-01	UT-PRD-GEN-045	UT – Forward link, Frequency range	The UT shall operate in 10.7 GHz to 12.7 GHz band in forward link. VSWR 1.5 : 1
	UT-ANTSS-RX-001	Receive RF Frequency Range	The Antenna Subsystem shall support a receive RF input frequency range of 10.7 GHz to 12.7 GHz from OneWeb satellites.
RFP-02	UT-PRD-GEN-049	UT – RHCP Polarization support	The UT shall use RHCP polarization in receive direction.
	UT-ANTSS-RX-004	Polarization	The Antenna Subsystem shall be capable of receiving right-hand circularly polarized (RHCP) signal.
RFP-03	UT-PRD-M-123	Dual Parabolic 18.2 dB/K G/T	The Dual Parabolic 18.2 dB/K UT shall support a 18.2 dB/K G/T at 11.8 GHz over a +/- 84 degree from zenith elevation scan
	UT-ANTSS-RX -010.000	AMSA G/T	An Antenna Subsystem using AMSA(s) shall have a G/T, when the antenna is pointed at any point within its field of view, that is larger than or equal to the larger of 18.2 dB/K [TBC] and the G/T declared by the manufacturer. The G/T is to be measured with radome loss under the following conditions: 1. over field over view, 2. with antenna temperature of 35 degrees K, 3. with the Tx-chain operating at maximum EIRP level (for full-duplex Antenna Subsystem), 4. with maximum OMT insertion loss, 5. with maximum IF cable insertion loss, 6. with maximum SSM noise figure at 24 dB, 7. across the Antenna Subsystem operational temperature range, and 8. at 11.8GHz
RFP-04	UT-PRD-GEN-075	XCVR antenna aperture Xpol	The XCVR shall have an antenna radiation cross-polarization isolation of at least 20 dB in transmit and receive mode at main beam within the scan volume. Rx band

	UT-ANTSS-RX-032	Cross polarization	The Antenna Subsystem shall have a minimum receive cross polarization isolation on its main beam of 15 dB over the antenna's field of view.
RFP-05	UT-PRD-GEN-044	UT – Return link, Frequency range	The UT shall operate in 14.0 GHz to 14.5 GHz band in return link. VSWR 1.5 : 1
	UT-ANTSS-TX-001	Transmit RF Frequency Range	The Antenna Subsystem shall support a transmit RF frequency range of 14 GHz to 14.5 GHz.
RFP-06	UT-PRD-GEN-048	UT - LHCP Polarization support	The UT shall use LHCP polarization in transmit direction.
	UT-ANTSS-TX-005	Polarization	The Antenna Subsystem shall be capable of transmitting a left-hand circularly polarized (LHCP) signal.
RFP-07	UT-PRD-GEN-081	XCVR EIRP sd mask	-> The UTs shall comply the EIRP spectrum density mask 1503-3-v3 specified by OneWeb in the document OW-UT-TN-00184
	UT-ANTSS-TX-029	EIRP Density Mask 1503-3v3	The Antenna Subsystem's EIRP density patterns shall comply with the masks in OW-UT-TN-00184 while transmitting a 39.9dBW carrier in a 2.16 MHz carrier bandwidth.
RFP-08	UT-PRD-GEN-075	XCVR antenna aperture Xpol	The XCVR shall have an antenna radiation cross-polarization isolation of at least 20 dB in transmit and receive mode at main beam within the scan volume. Tx band
	UT-ANTSS-TX-037	Cross polarization	The Antenna Subsystem shall have a minimum transmit cross polarization isolation on its main beam of 15 dB over the antenna's field of view.
RFP-09	UT-ANT-RF-TX-008	BeamSquint Angle Relative to Rx beam over Rx and Tx frequencies	The Antenna Subsystem shall have a maximum transmit Beam Squint Angle of 0.2 degrees relative to Rx beam over Rx and Tx frequencies (for full duplex operation)
RFP-10	UT-PRD-GEN-233	UT EIRP	The UT shall meet the transmit EIRP level 39.9 dBW per 20MHz component carrier even when operating in a dual carrier mode in 40 MHz over the 14.0 - 14.5 GHz Ku band.
	UT-ANTSS-TX -009.001/002	Single carrier UTs	The Antenna Subsystem shall support a maximum EIRP level of 39.9 dBW, including radome loss, when transmitting one reverse link carrier, over the the antenna's field of view, the transmit frequency range, and temperature range. Actual output EIRP has variations of ± 2 dB, including the RF calibration reporting accuracy tolerance from the SSM and the AntSS.

		Dual carrier UTs	The Antenna Subsystem shall support a maximum EIRP level of 42.9 dBW, including radome loss, when transmitting two reverse link carriers, over the antenna's field of view, the Tx frequency range, and temperature range. Actual output EIRP has variations of ± 2.0 dB, including the RF calibration reporting accuracy tolerance from the SSM and the AntSS.
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4. Antenna Performance Data Summary

4.1. RFP-01(Receive RF Frequency Range)

UT-PRD-GEN-045 UT-ANTSS-RX-001	Requirement	Measure Result	
VSWR	<1.5: 1	<1.4:1	Comply

4.2. RFP-02(Polarization_Rx)

UT-PRD-GEN-049 UT-ANTSS-RX-004	Requirement	Measure Result	
Polarization (Axial ratio)	RHCP <1.75dB(CPI 20dB)	RHCP < 0.8dB(CPI 26.7dB)	Comply

4.3. RFP-03(AMSA G/T)

UT-PRD-M-123 UT-ANTSS-RX-010	Requirement	Measure Result	
G/T		17.49dB/K	Comply
	11.8GHz	18.2dB/K	Comply
		18.92dB/K	Comply

4.4. RFP-04(Cross polarization _Rx)

UT-PRD-GEN-075 UT-ANTSS-RX-032	Requirement	Measure Result	
Cross Polarization	Scan volume ≥ 20dB (Field of view ≥ 15dB)	36 dB(28 dB)	Comply
		34 dB(31 dB)	Comply
		28 dB(28 dB)	Comply

4.5. RFP-05(Transmit RF Frequency Range)

UT-PRD-GEN-044 UT-ANTSS-TX-001	Requirement	Measure Result	
VSWR	<1.5: 1	<1.3 : 1	Comply

4.6. RFP-06(Polarization Tx)

UT-PRD-GEN-048 UT-ANTSS-TX-005	Requirement	Measure Result	
Polarization (Axial ratio)	LHCP <1.75dB(CPI 20dB)	LHCP < 1.1dB(CPI 24dB)	Comply

4.7. RFP-07(EIRP Density Mask 1503-3v3)

UT-PRD-GEN-081 UT-ANTSS-TX-029	Requirement	Measure Result	
EIRP SD	EIRP Density mask 1503-3v3	pattern reference	Comply
		pattern reference	Comply
		pattern reference	Comply

4.8. RFP-08(Cross polarization_Tx)

UT-PRD-GEN-075 UT-ANTSS-TX-037	Requirement	Measure Result	
Cross Polarization	Scan volume ≥20dB (Field of view ≥15dB)	25 dB(25 dB)	Comply
		24 dB(22 dB)	Comply
		26 dB(25 dB)	Comply

4.9. RFP-09(Beam Squint Angle relative to Rx beam over Rx and Tx frequencies)

UT-ANT-RF- TX-008	Requirement	Measure Result					
			Rx		Tx		
			Freq[GHz]	Pk[deg]	Freq[GHz]		Pk[deg]
BeamSquint Angle	0.2degrees	Horizontal Cut (Normalized)	10.7	0.00	14	-0.03	Comply
			11.0	0.00	14.1	-0.01	
			11.25	0.00	14.25	0.00	
			11.5	0.00	14.4	0.00	
			11.8	0.00	14.5	0.00	
			12.0	0.00			
			12.25	-0.01			
			12.5	0.00			
		12.7	0.00				
		Vertical Cut (Normalized)	10.7	0.00	14	-0.03	Comply
			11.0	0.00	14.1	-0.04	
			11.25	0.00	14.25	-0.05	
			11.5	0.00	14.4	-0.04	
			11.8	0.00	14.5	-0.03	
12.0	0.00						
12.25	0.00						
12.5	0.00						
12.7	-0.01						

4.10. RFP-10(UT EIRP)

UT-PRD-GEN-233 UT-ANTSS-TX-009.001	Requirement	Measure Result		
UT EIRP	39.9dBW(Single)	14.0GHz	40.02dBW	Comply
		14.25GHz	40.2dBW	Comply
		14.5GHz	40.58dBW	Comply
	42.9dBW(Dual)	14.0GHz	43.02dBW	Comply
		14.25GHz	43.2dBW	Comply
		14.5GHz	43.58dBW	Comply

*EIRP Considering ESD pattern

5. RFP-01(Receive RF Frequency Range)

5.1. Test Equipment and Facilities

- Network analyzer
- Calibration KIT
- RF cable
- ANTENNA(Reflector + Feedhorn+Polarizer+OMT)
- W/G to SMA adapter(WR62)
- W/G to SMA adapter(WR75)

5.2. Test Method

5.2.1. Test Setup

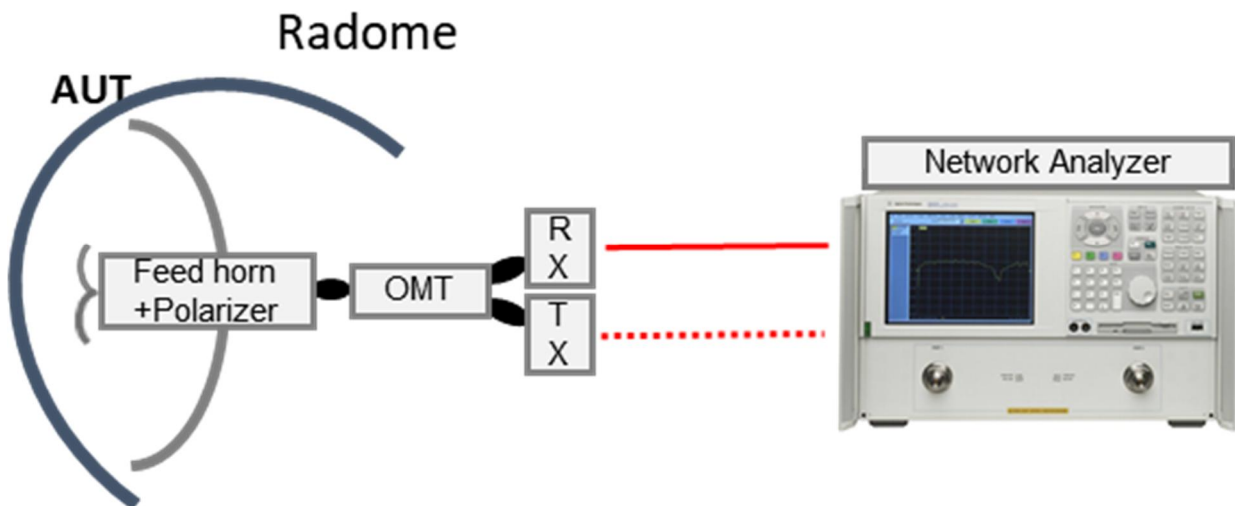


Figure 1 Test Configuration

5.2.2. Test Steps

	Test Procedure
A	Set the test equipment as shown in Figure 1.
B	Set the measurement frequency (10.7GHz ~ 12.7GHz) by operating the Network Analyzer's Frequency menu.
C	Perform the calibration by operating the Calibration menu of Network Analyzer.
D	Connect the cable to the Rx port of the antenna and measure the VSWR.
E	Check the maximum value of the standing wave ratio in the Rx band to confirm that the requirement is satisfied.
F	satisfied, it is judged that the Receive RF Frequency Range requirements are satisfied.
	The VCRM Requirement ID UT-PRD-GEN-045 / UT-ANTSS-RX-001

5.3. Test Result



Figure 2 Measurement Configuration

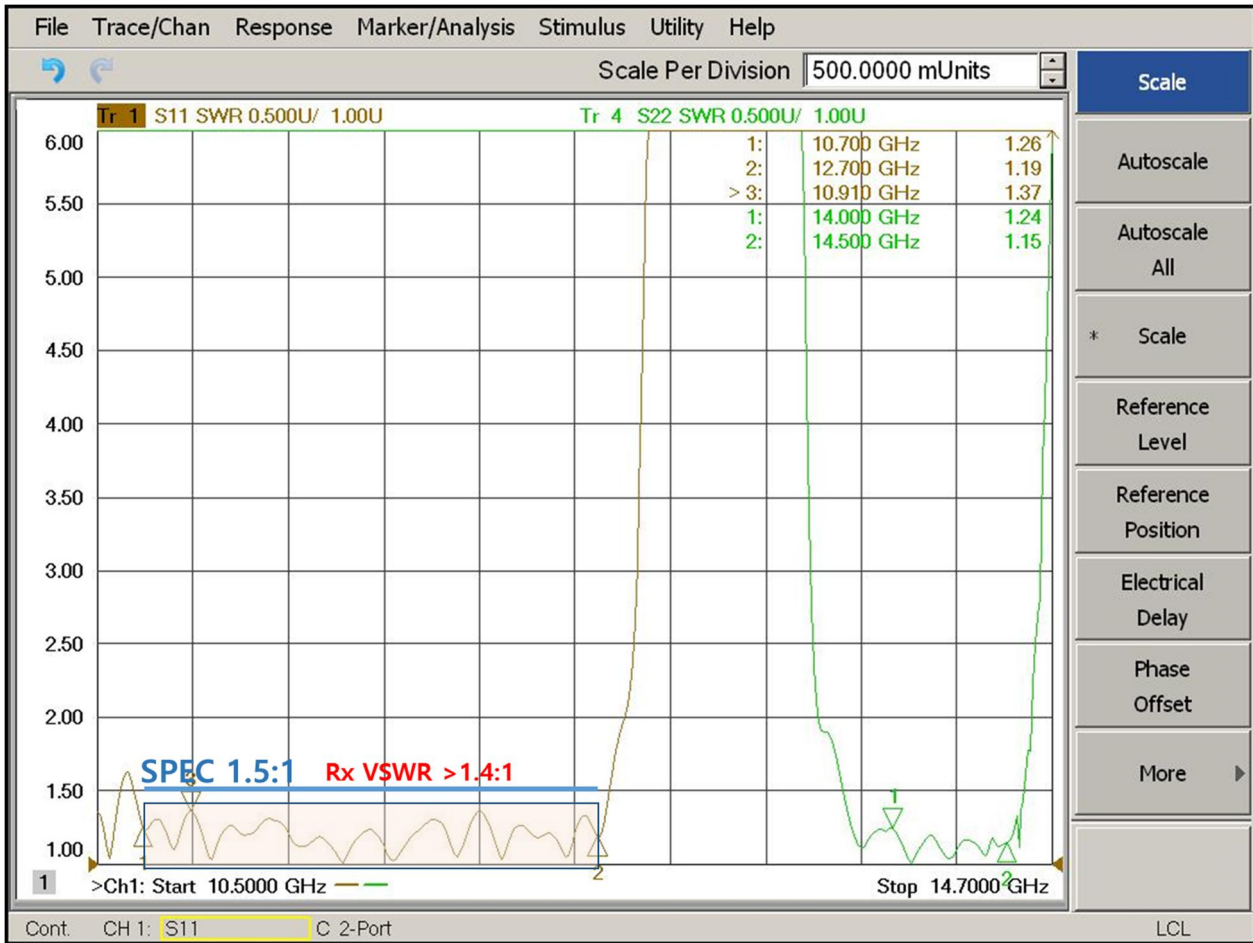


Figure 3 Result(VSWR)

	Requirement	Measure Result(Rx)
VSWR	<1.5 : 1	< 1.4 : 1

6. RFP-02(Polarization)

6.1. Test Equipment and Facilities

- Range test facility
 - Chamber
 - Positioner Controller
 - Control PC
 - Network analyzer
 - Probe antenna
- RF cable
- ANTENNA(Radome + Reflector + Feedhorn+Polarizer+OMT)
- W/G to SMA adapter(WR62)
- W/G to SMA adapter(WR75)

6.2. Test Method

6.2.1. Test Setup

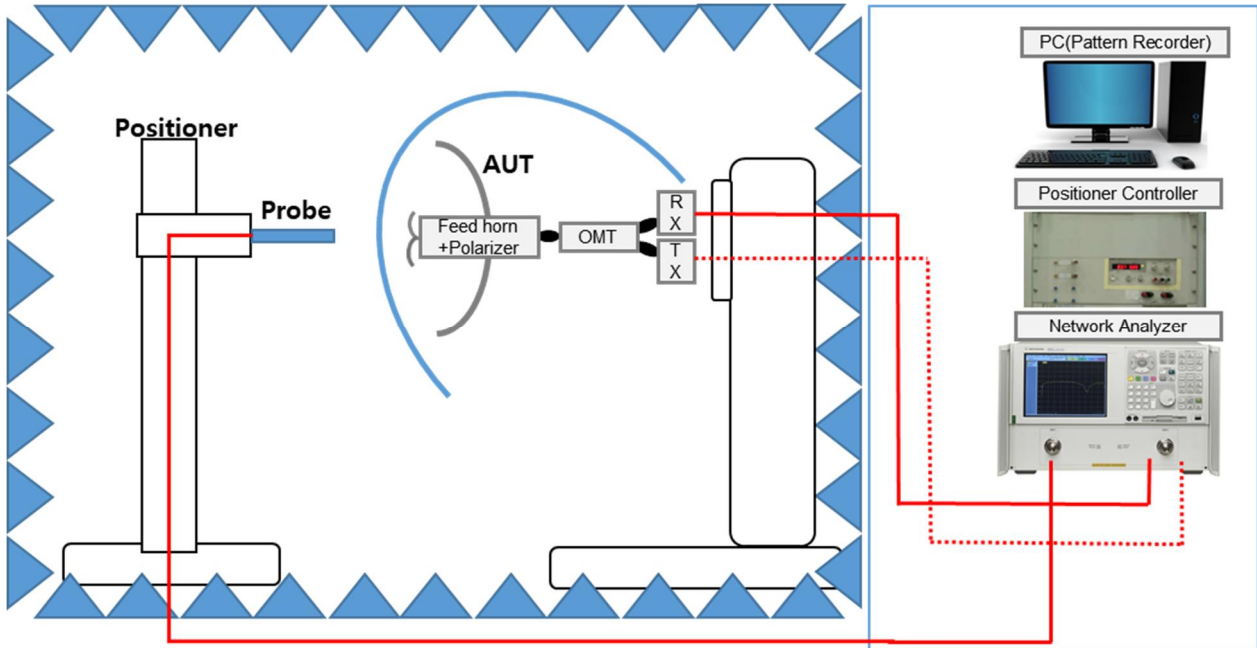


Figure 4 Range measurement Configuration

6.2.2. Test Steps

Test Procedure	
A	Set the test equipment as shown in Figure 4.
B	Connect the cable to Rx band port of AUT.
C	Set the measurement frequency of Pattern Recorder to Ku band 10.7GHz~12.7GHz.
D	The antenna is vertically and horizontally aligned so that the reception level of the antenna is maximized, and the horizontal pattern is measured.
E	Rotate the source horn 90 degrees and measure the horizontal pattern.
F	The antenna pattern measured in the above (A to E) is synthesized to confirm the polarization, from the measuring equipment.
G	Verify that the polarization of the antenna from the measurement meets the polarization requirements.

The VCRM Requirement ID UT-PRD-GEN-049 / UT-ANTSS-RX-004

6.3. Test Result



Figure 5 Measurement Configuration

Freq-sweep at peaked positions

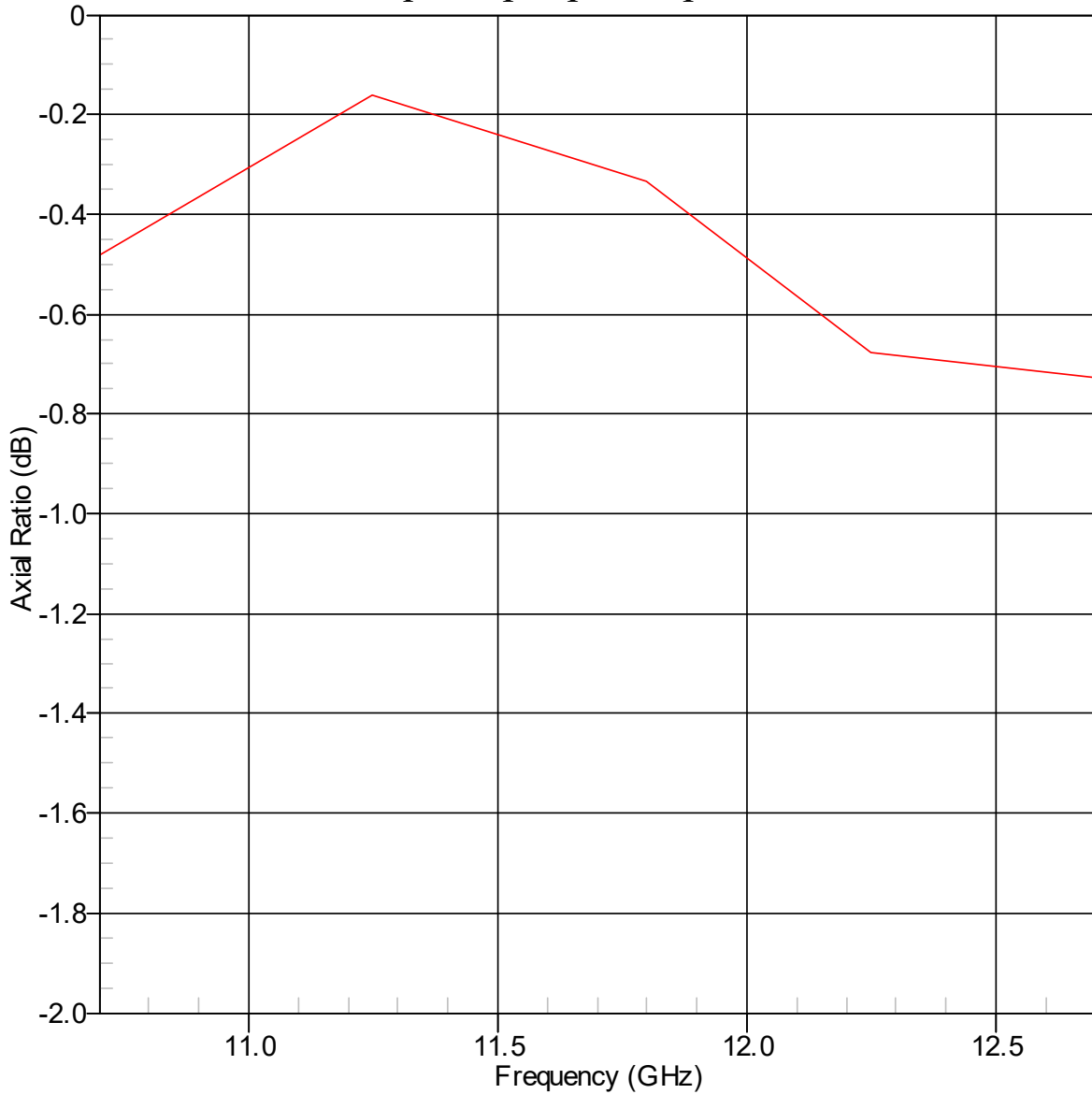


Figure 6 Result (Polarization)

	Requirement	Measure Result(Rx)
Axial ratio	<1.75dB(CPI 20dB)	< 0.8dB(CPI 26.7dB)

7. RFP-03(AMSA G/T)

7.1. Test Equipment and Facilities

- Range test facility

- Chamber
- Positioner Controller
- Control PC
- Network analyzer
- Source horn antenna
- Standard horn antenna
- RF cable
- ANTENNA(Radome + Reflector + Feedhorn+Polarizer+OMT)
- W/G to SMA adapter(WR62)
- W/G to SMA adapter(WR75)

7.2. Test Method

7.2.1. Test Setup

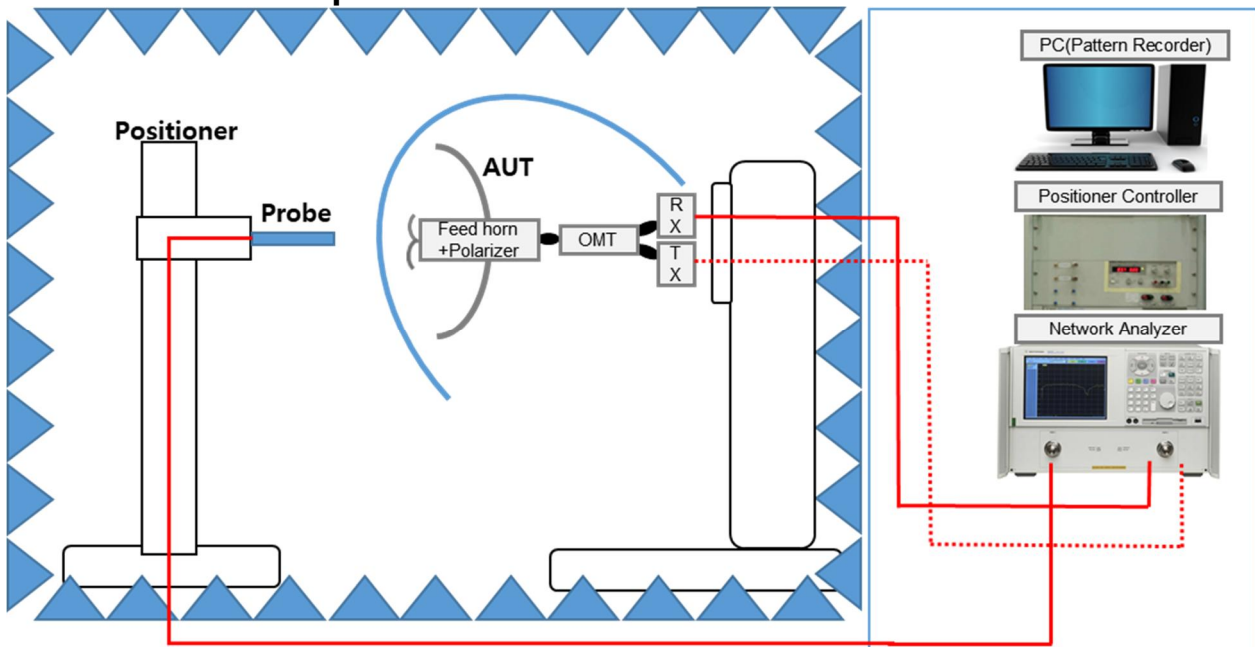


Figure 7 Range measurement Configuration

7.2.2. Test Steps

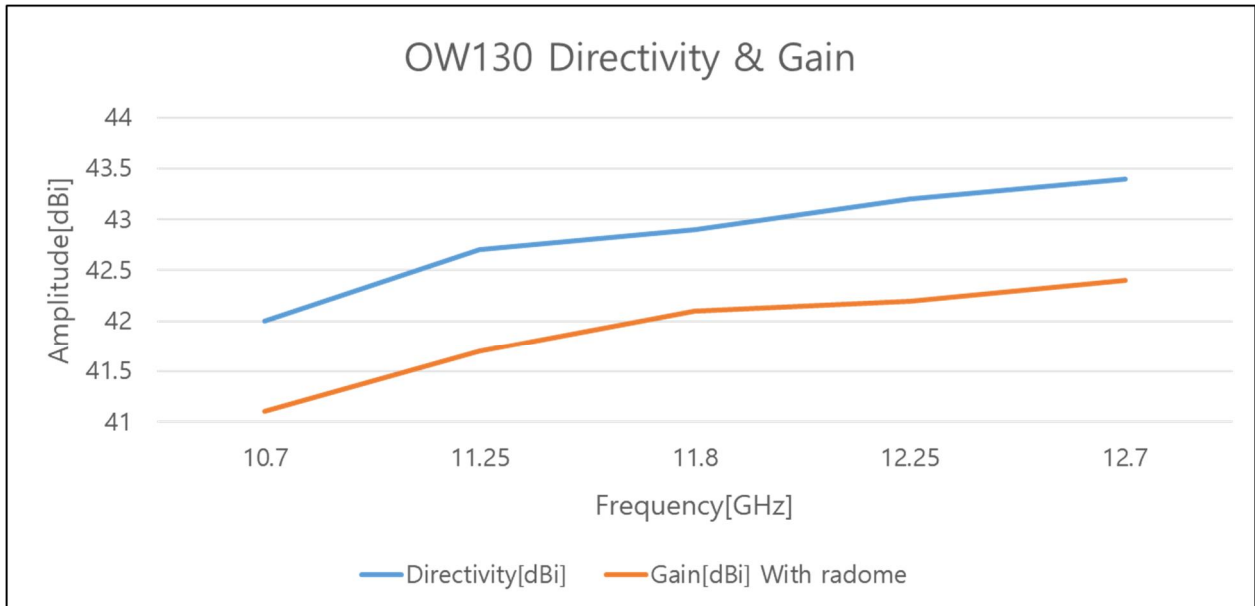
Test Procedure	
A	Set the test equipment as shown in Figure 7.
B	Connect the cable to Rx band port of AUT.
C	Set the measurement frequency of Pattern Recorder to Ku band 10.7GHz, 11.8GHz, and 12.7GHz.
D	The antenna is vertically and horizontally aligned so that the reception level of the antenna is maximized, and the horizontal pattern is measured.

E	Rotate the source horn 90 degrees and measure the horizontal pattern.
F	The antenna pattern measured in the above (A to E) is synthesized to confirm the Gain from the measuring equipment.
G	Analyze the G / T using the measured antenna gain and the noise figure of the measured RCM and loss factor.
	The VCRM Requirement ID UT-PRD-M-123 / UT-ANTSS-RX-010.000

7.3. Test Result



Figure 8 Measurement Configuration



Target Gain	Frequency	Directivity[dBi]	Gain		Total Loss
			Without	With	
41.4 @11.8GHz	10.7	42.0	41.5	41.1	0.9
	11.25	42.7	42.0	41.7	1.0
	11.8	42.9	42.4	42.1	0.8
	12.25	43.2	42.6	42.2	1.0
	12.7	43.4	42.7	42.4	1.0

Figure 9 Result (Directivity & Gain)

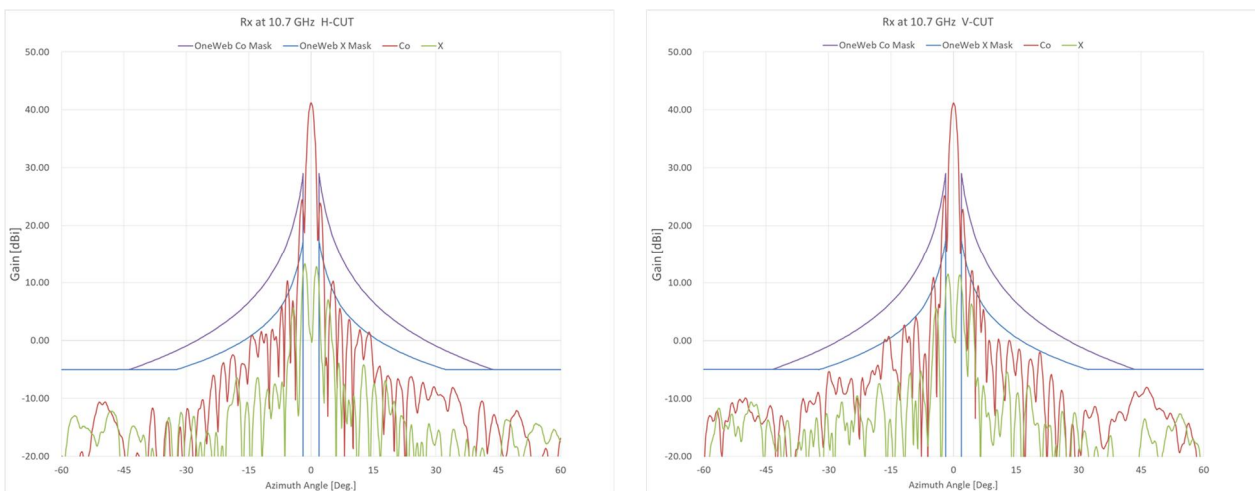


Figure 10 Result (Freq 10.7GHz)



Factory Acceptance Test

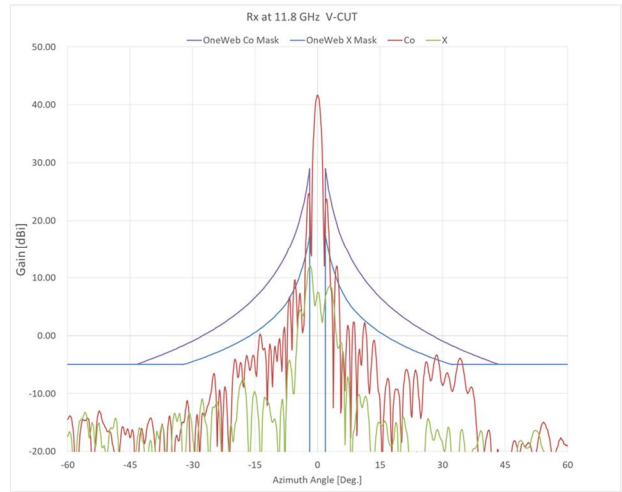
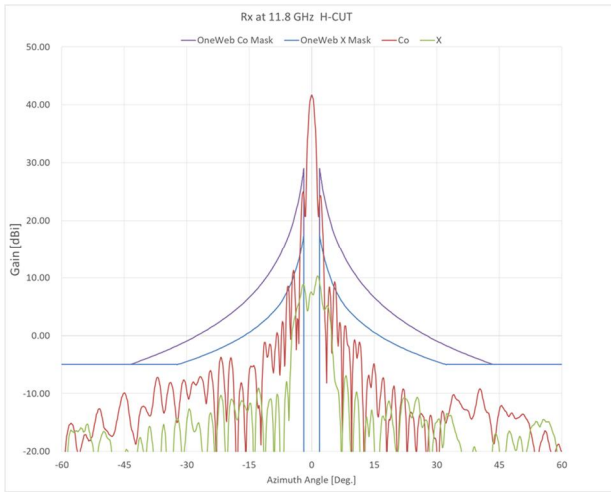


Figure 11 Result (Freq 11.8GHz)

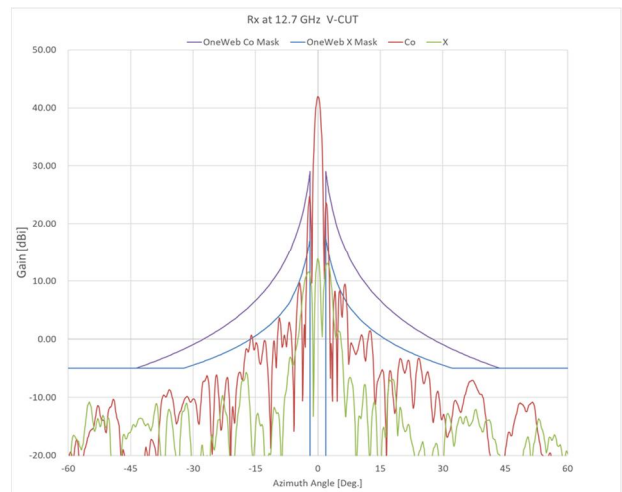
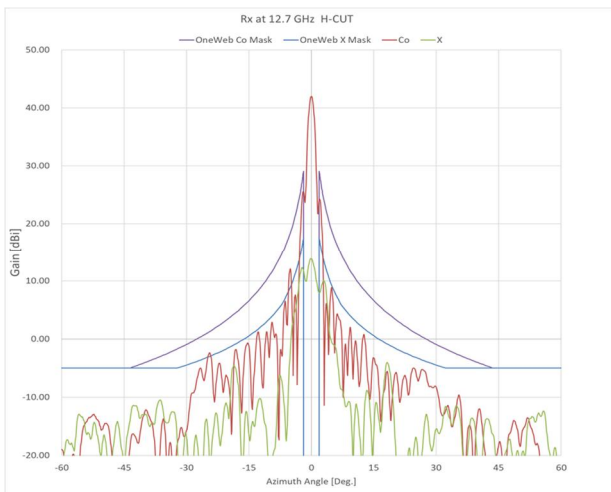


Figure 12 Result (Freq 12.7GHz)

*Use RF component specification values

Symbol	Parameters	Value	Unit
T_A	Sky Temperature	35	K
NF_rad	Radome NF	0.4	dB
NF_pol	FFeeder/Polarizer/Con NF	0.50	dB
NF_OMT	OMT NF	0.40	dB
To	RCM Reference Temp	290	K
NF_RCM	RCM NF(<11.7GHz)	1.1	dB
T_RCM	RCM Noise Temp(<11.7GHz)	83.59	K
G_RCM	RCM Gain	35.00	dB
NF_WTR	WTR NF	24.00	dB
NF_Rx	Total Receiver NF(<11.7GHz)	1.36	dB
T_Rx	T_Rx(<11.7GHz)	106.54	K
T_Rx	T_Rx(>11.7GHz)	106.54	K
L_A	Antenn Feed Loss factor	1.35	
T_Ant	Ant. Noise Temp (>11.7GHz)	207.50	K

	Radome	Aperture Feed/Polarizer	OMT
I.L. (dB)	0.4	0.5	0.4

Measure Directivity & Gain			
	10.7GHz	11.8GHz	12.7GHz
Directivity(dBi)	41.96	42.86	43.39
Gain(dBi)	40.66	41.56	42.09

OW130		
F (GHz)	SPEC	Measure G/T
10.7		17.49
11.8	18.20	18.39
12.7		18.92

Figure 13 Result (G/T)

8. RFP-04(Cross polarization_Rx)

8.1. Test Equipment and Facilities

- Range test facility
 - Chamber
 - Positioner Controller
 - Control PC
 - Network analyzer
 - Probe antenna
- RF cable
- ANTENNA(Radome + Reflector + Feedhorn+Polarizer+OMT)
- W/G to SMA adapter(WR62)
- W/G to SMA adapter(WR75)

8.2. Test Method

8.2.1. Test Setup

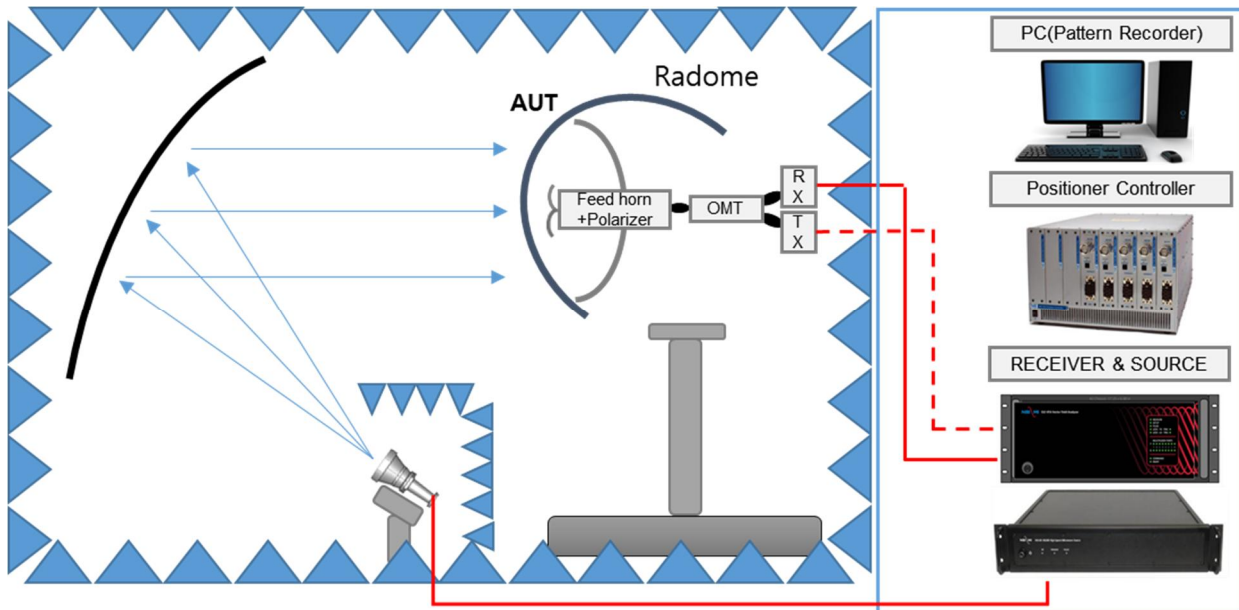


Figure 14 Range measurement Configuration

8.2.2. Test Steps

Test Procedure	
A	Set the test equipment as shown in Figure 14.
B	Connect the cable to Rx band port of AUT.
C	Set the measurement frequency of Pattern Recorder to Ku band 10.7GHz , 11.8GHz , 12.7GHz
D	The antenna is vertically and horizontally aligned so that the reception level of the antenna is maximized, and the horizontal pattern is measured.
E	Rotate the source horn 90 degrees and measure the horizontal pattern.
F	The antenna pattern measured in the above (A to E) is synthesized to confirm the Pattern, from the measuring equipment.
G	Check the amplitude difference between Co-pol and Cross-pol in the peak direction of the Co-pol pattern.
	The VCRM Requirement ID UT-PRD-GEN-075 / UT-ANTSS-RX-032

8.3. Test Result



Figure 15 Measurement Configuration

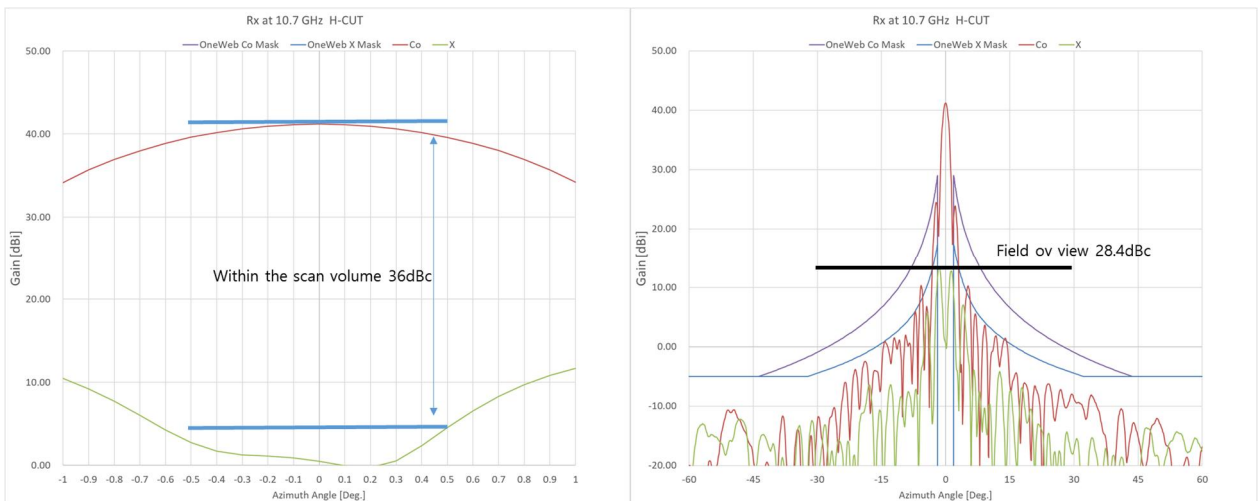


Figure 16 Cross Polarization(Within the scan volume & Field of view) @10.7GHz

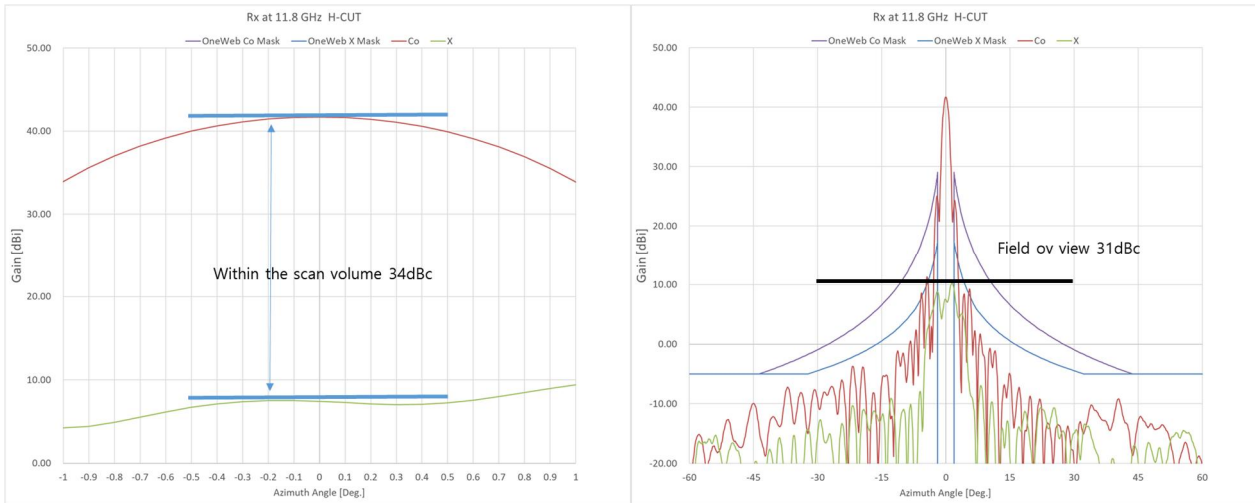


Figure 17 Cross Polarization(Within the scan volume & Field of view) @11.8GHz

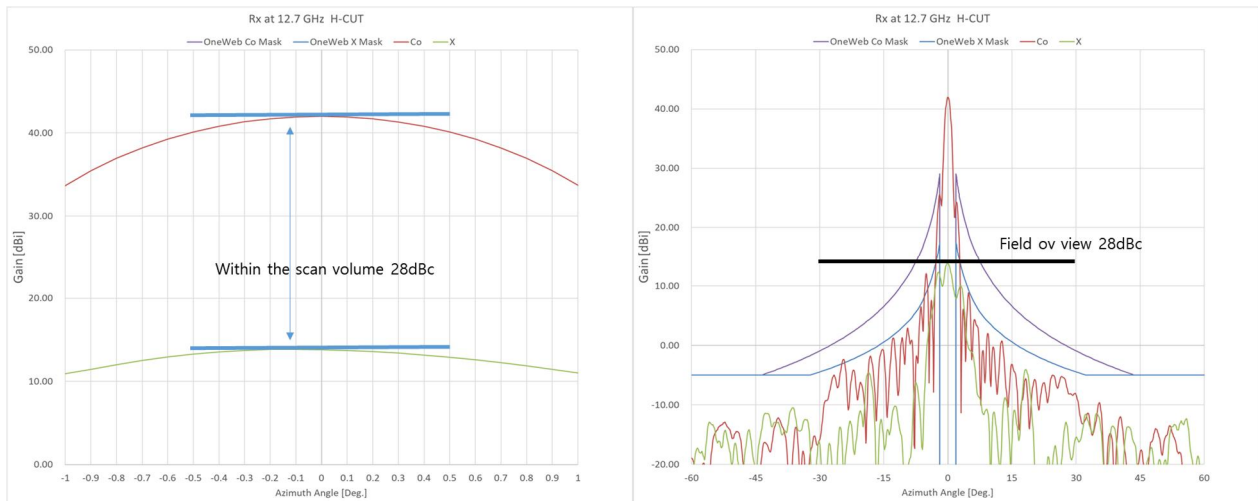


Figure 18 Cross Polarization(Within the scan volume & Field of view) @12.7GHz

Frequency(GHz)	Cross Polarization	
	Within the scan volume	Field of view
10.7	36dBc	28dBc
11.8	34dBc	31dBc
12.7	28dBc	28dBc

9. RFP-05(Transmit RF Frequency Range)

9.1. Test Equipment and Facilities

- Network analyzer
- Calibration KIT
- RF cable
- ANTENNA(Radome + Reflector + Feedhorn+Polarizer+OMT)
- W/G to SMA adapter(WR62)
- W/G to SMA adapter(WR75)

9.2. Test Method

9.2.1. Test Setup

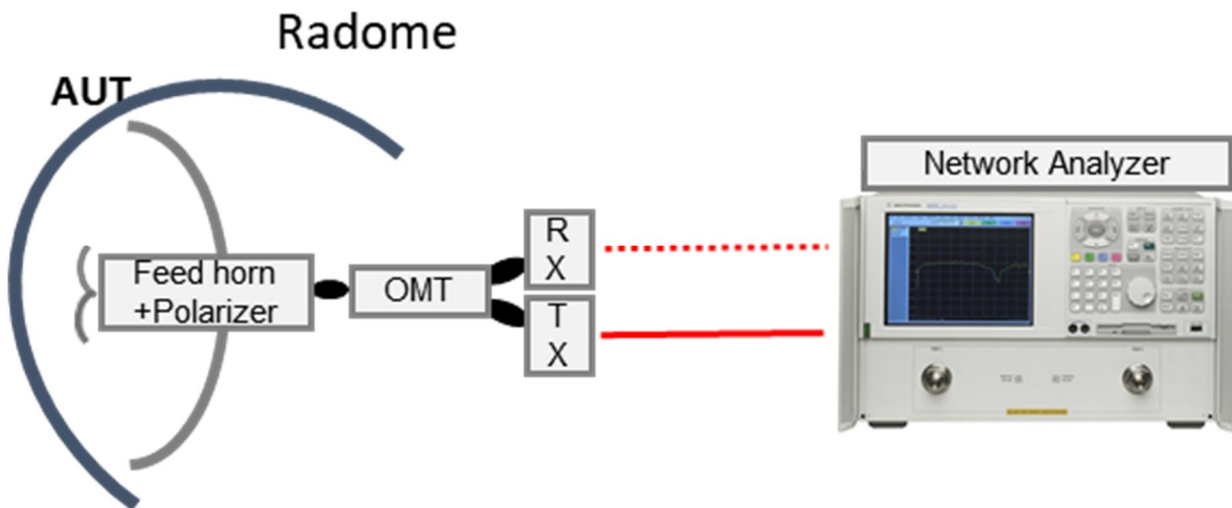


Figure 19 measurement Configuration

9.2.2. Test Steps

Test Procedure	
A	Set the test equipment as shown in Figure 19.
B	Set the measurement frequency (14.0GHz ~ 14.5GHz) by operating the Network Analyzer's Frequency menu.
C	Perform the calibration by operating the Calibration menu of Network Analyzer.
D	Connect the cable to the Tx port of the antenna and measure the VSWR.

E	Check the maximum value of the standing wave ratio in the Tx band to confirm that the requirement is satisfied.
F	satisfied, it is judged that the Transmit RF Frequency Range requirements are satisfied.
	The VCRM Requirement ID UT-PRD-GEN-044 / UT-ANTSS-TX-001

9.3. Test Result



Figure 20 Test Configuration

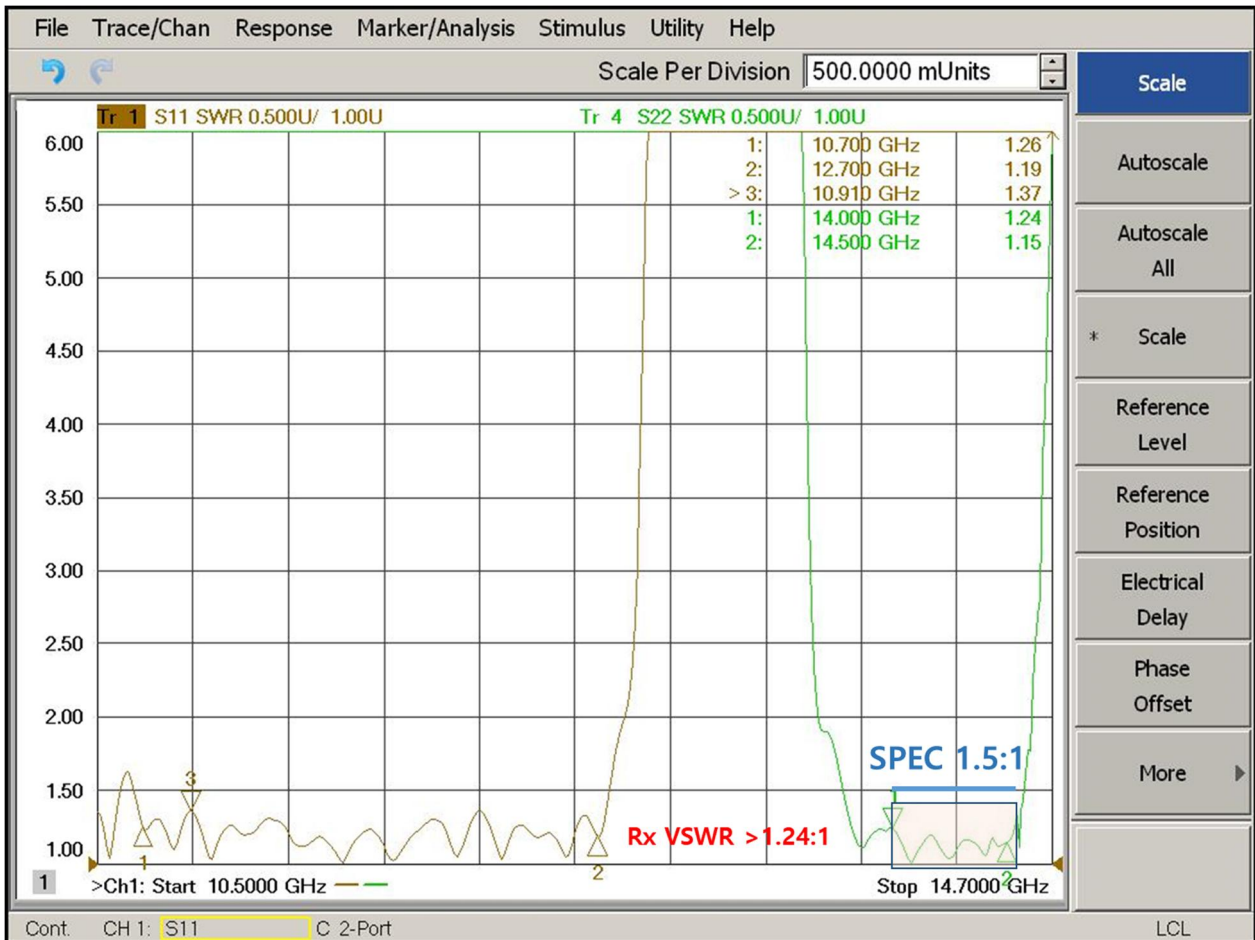


Figure 21 Result (VSWR)

	Requirement	Measure Result (Tx)
VSWR	<1.5: 1	<1.24 : 1

10. RFP-06(Polarization)

10.1. Test Equipment and Facilities

- Range test facility
 - Chamber
 - Positioner Controller
 - Control PC
 - Network analyzer
 - Probe antenna
- RF cable
- ANTENNA(Radome + Reflector + Feedhorn+Polarizer+OMT)
- W/G to SMA adapter(WR62)
- W/G to SMA adapter(WR75)

10.2. Test Method

10.2.1. Test Setup

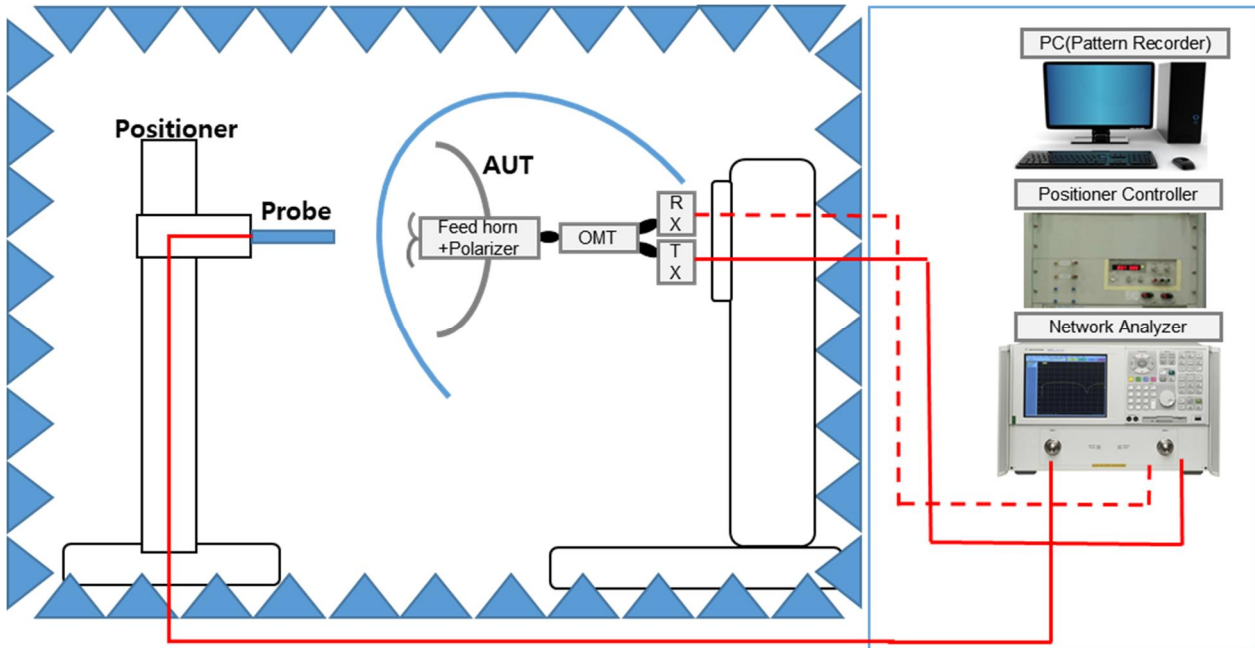


Figure 22 Range measurement Configuration

10.2.2. Test Steps

Test Procedure	
A	Set the test equipment as shown in Figure 22.
B	Connect the cable to Rx band port of AUT.
C	Set the measurement frequency of Pattern Recorder to Ku band 14.0GHz~ 14.5GHz.
D	The antenna is vertically and horizontally aligned so that the reception level of the antenna is maximized, and the horizontal pattern is measured.
E	Rotate the source horn 90 degrees and measure the horizontal pattern.
F	The antenna pattern measured in the above (A to E) is synthesized to confirm the polarization, from the measuring equipment.
G	Verify that the polarization of the antenna from the measurement meets the polarization requirements.

	The VCRM Requirement ID UT-PRD-GEN-048 / UT-ANTSS-TX-005
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10.3. Test Result



Figure 23 Measurement Configuration

Freq-sweep at peaked positions

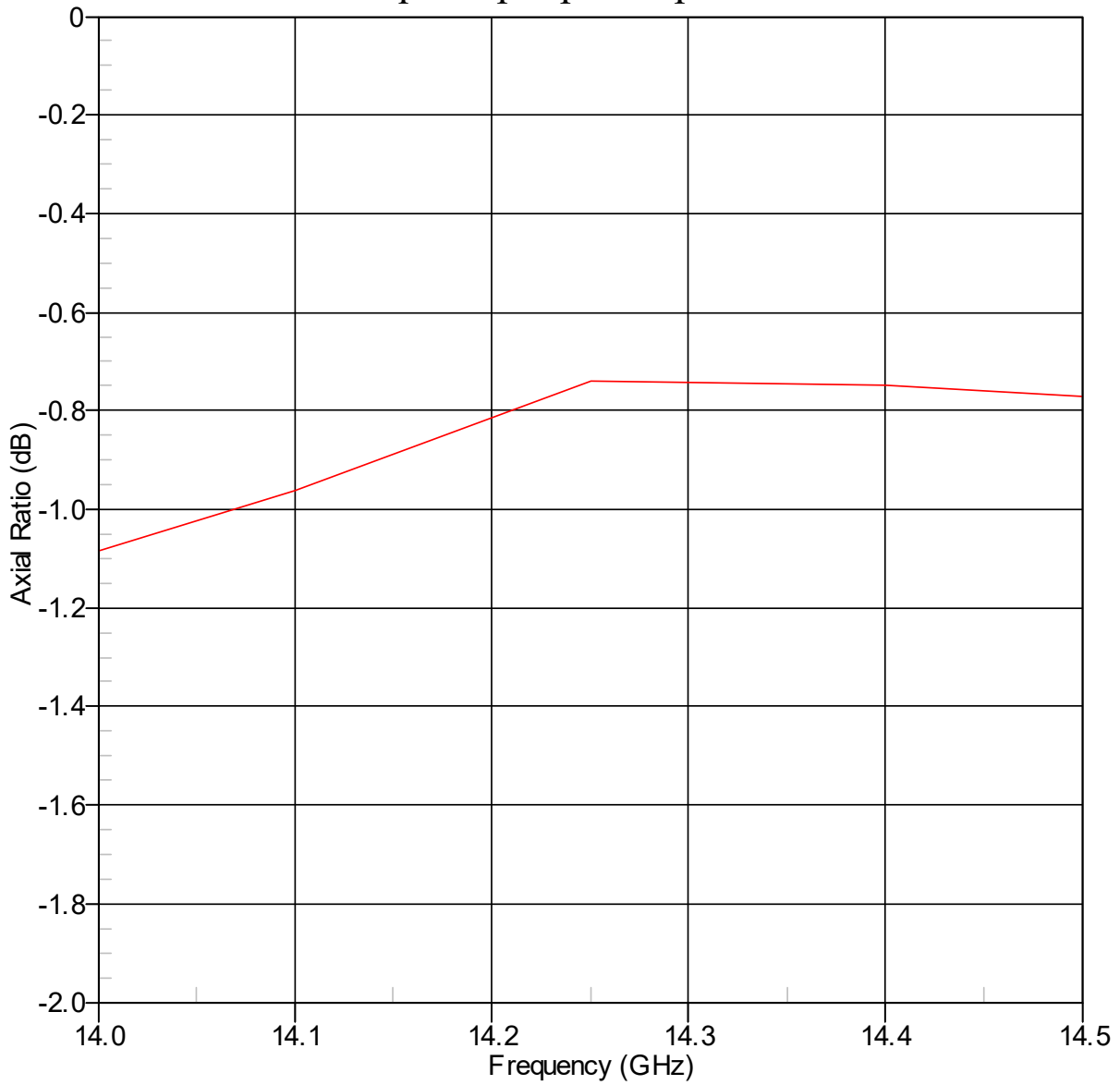


Figure 24 Result (Tx band)

	Requirement	Measure Result(Tx)
Axial ratio	<1.75dB(CPI 20dB)	< 1.1dB(CPI 24dB)

11. RFP-07(EIRP Density Mask 1503-3v3)

11.1. Test Equipment and Facilities

- Range test facility
 - Chamber
 - Positioner Controller
 - Control PC
 - Network analyzer
 - Source horn antenna
 - Standard horn antenna
- RF cable
- ANTENNA(Radome + Reflector + Feedhorn+Polarizer+OMT)
- W/G to SMA adapter(WR62)
- W/G to SMA adapter(WR75)

11.2. Test Method

11.2.1. Test Setup

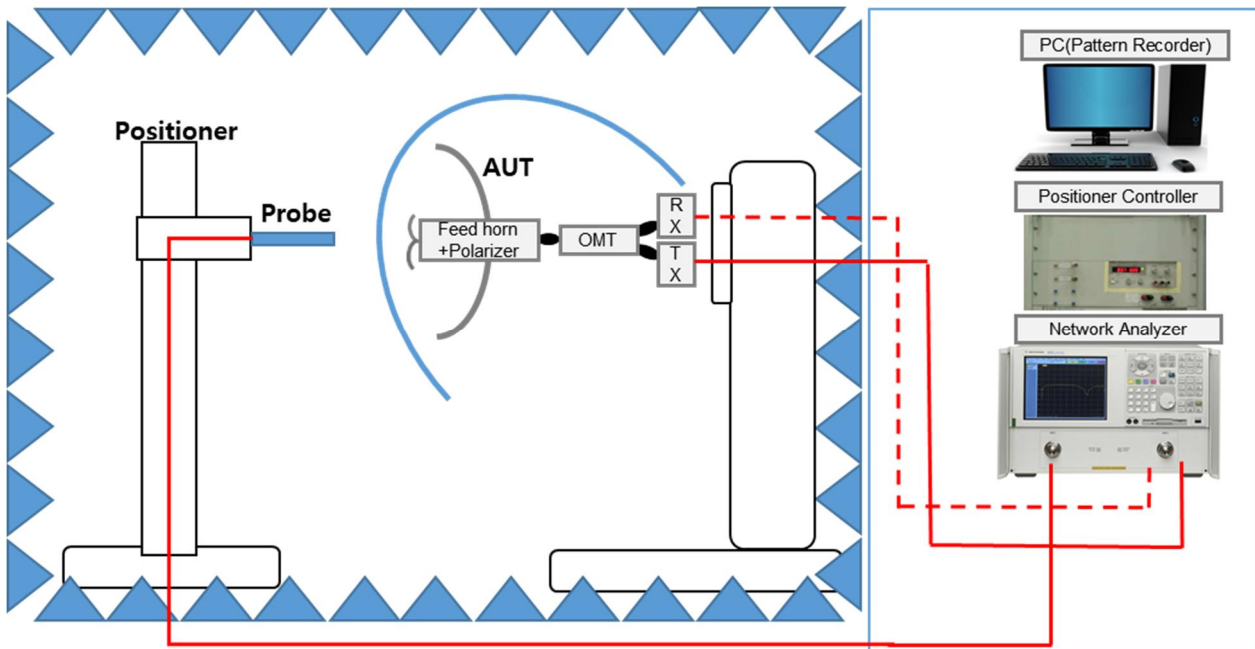


Figure 25 Range measurement Configuration

11.2.2. Test Steps

Test Procedure	
A	Set the test equipment as shown in Figure 25.
B	Connect the cable to Tx band port of AUT.
C	Set the measurement frequency of Pattern Recorder to Ku band 14.0GHz, 14.25GHz, and 14.5GHz.

D	The antenna is vertically and horizontally aligned so that the reception level of the antenna is maximized, and the horizontal pattern is measured.
E	Rotate the source horn 90 degrees and measure the horizontal pattern.
F	The antenna pattern measured in the above (A to E) is synthesized to confirm H pattern from the measuring equipment.
G	Rotate the AUT 90deg and measure the horizontal pattern and measure the horizontal pattern by rotating the source horn by 90 deg
H	The antenna pattern measured at (G) is synthesized to confirm the V pattern from the measurement equipment.
I	The measured antenna sidelobe and antenna gain is used as a value to check whether the EIRPsd Pattern(Extreme case) requirements are satisfied.
	The VCRM Requirement ID UT-PRD-GEN-081 / UT-ANTSS-TX-029

11.3. Test Result



Figure 26 Measurement Configuration

OW70 Extream case 33.6dBW/2.16MHz (16.27dBW/40KHz)
[Assumption] OW130 Extream case is same OW70
6.3dB Up → 22.57dBW/40KHz

After normalizing the measured antenna gain to the Extream case (22.57dB), verify the measured antenna pattern against the EIRPsd MASK.

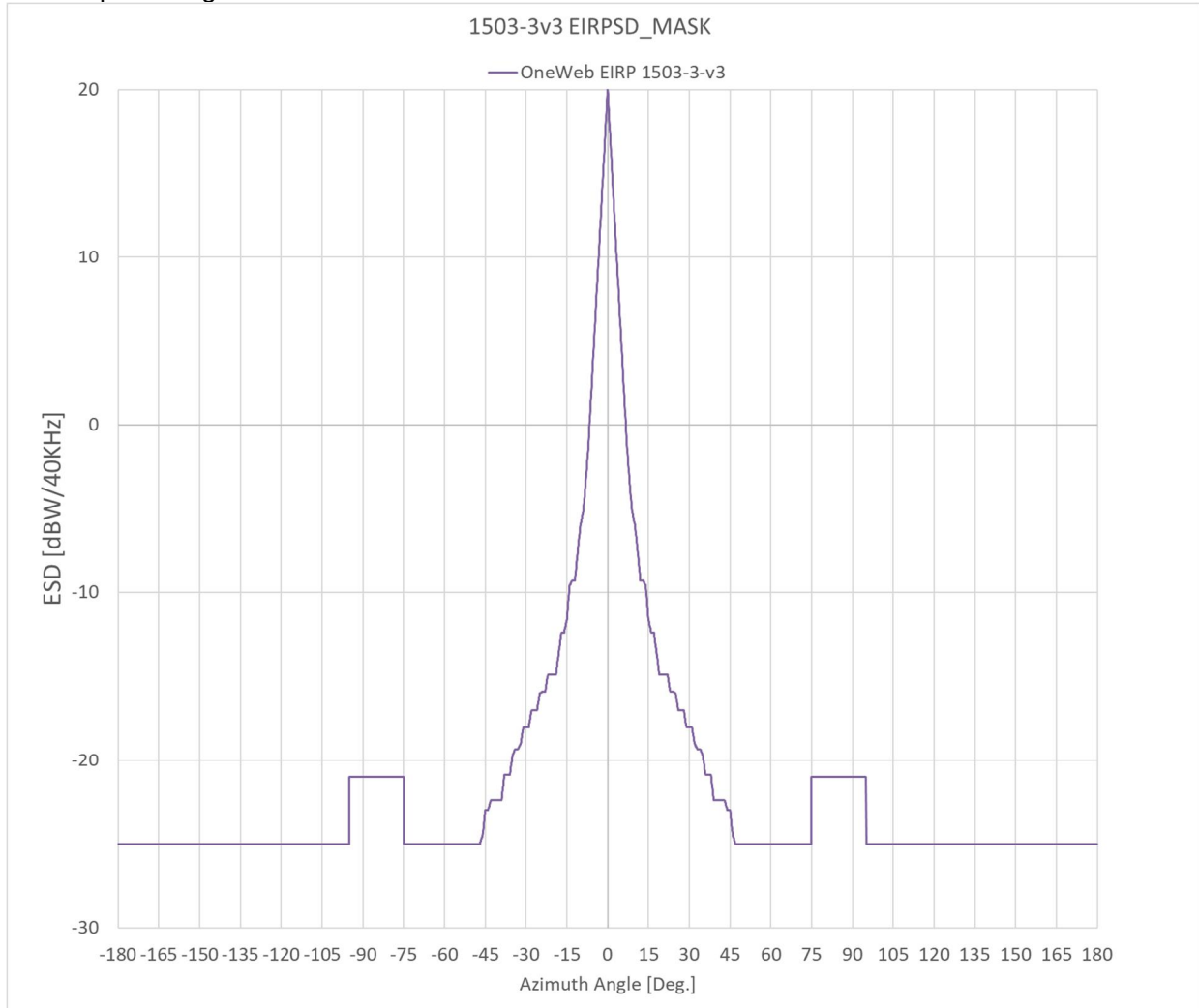


Figure 27 1503-3v3 EIRPSD_MASK



Factory Acceptance Test

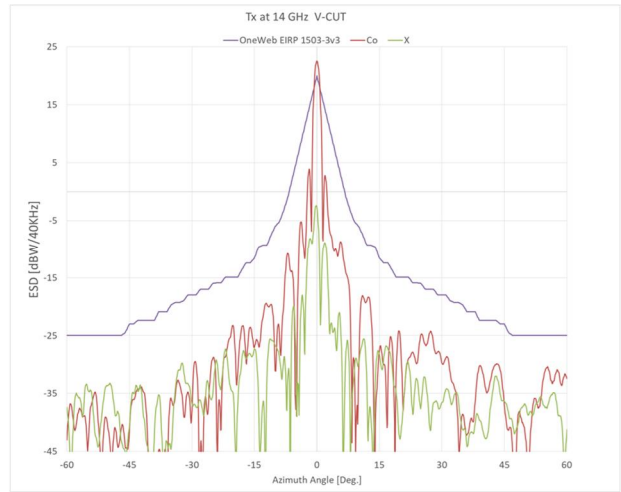
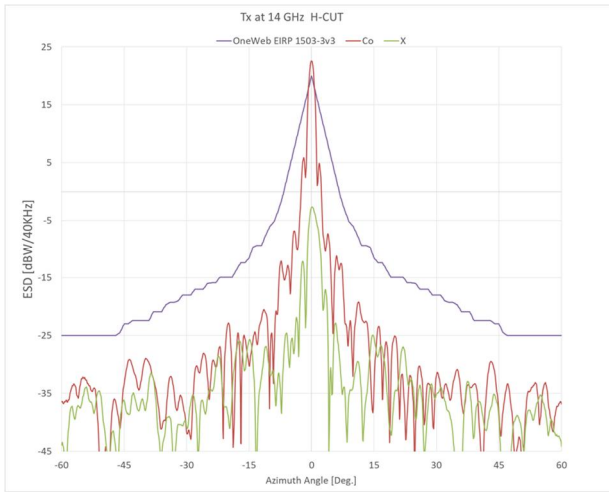


Figure 28 Result (Nearfield)

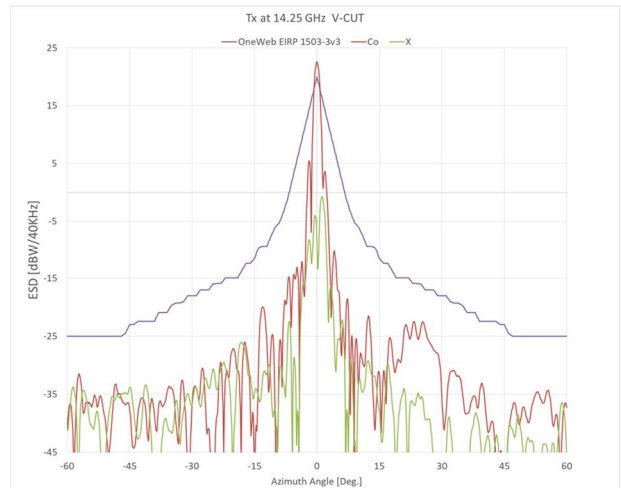
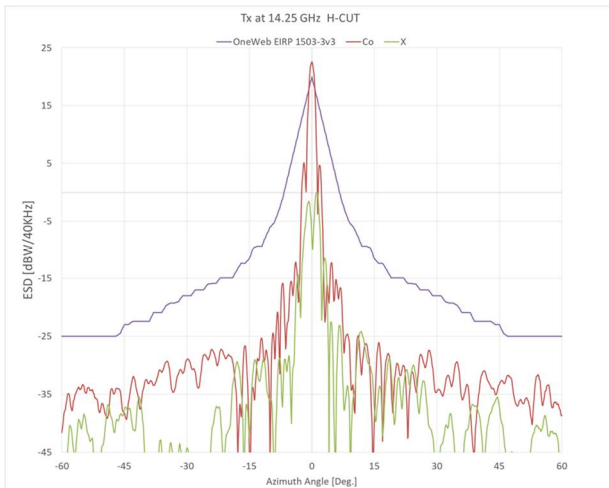


Figure 29 Result (Nearfield)

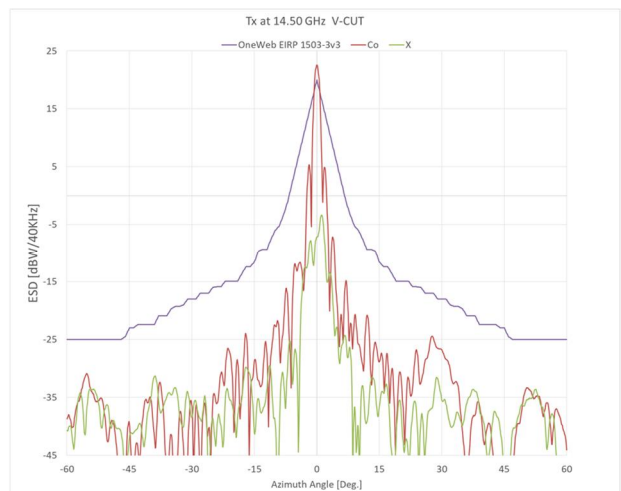
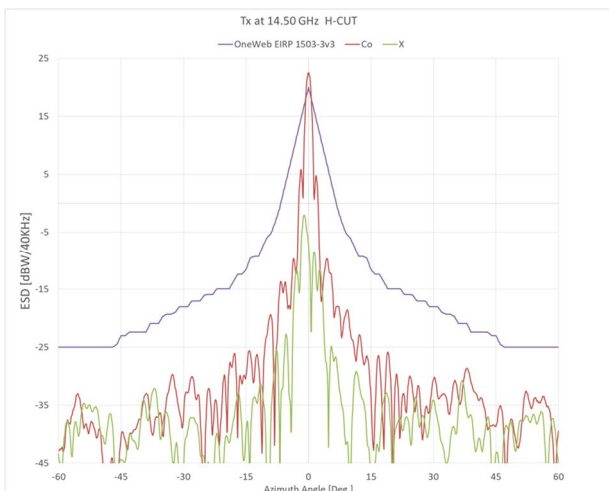


Figure 30 Result (Nearfield)

12. RFP-08(Cross polarization_Tx)

12.1. Test Equipment and Facilities

- Range test facility
 - Chamber
 - Positioner Controller
 - Control PC
 - Network analyzer
 - Probe antenna
- RF cable
- ANTENNA(Radome + Reflector + Feedhorn+Polarizer+OMT)
- W/G to SMA adapter(WR62)
- W/G to SMA adapter(WR75)

12.2. Test Method

12.2.1. Test Setup

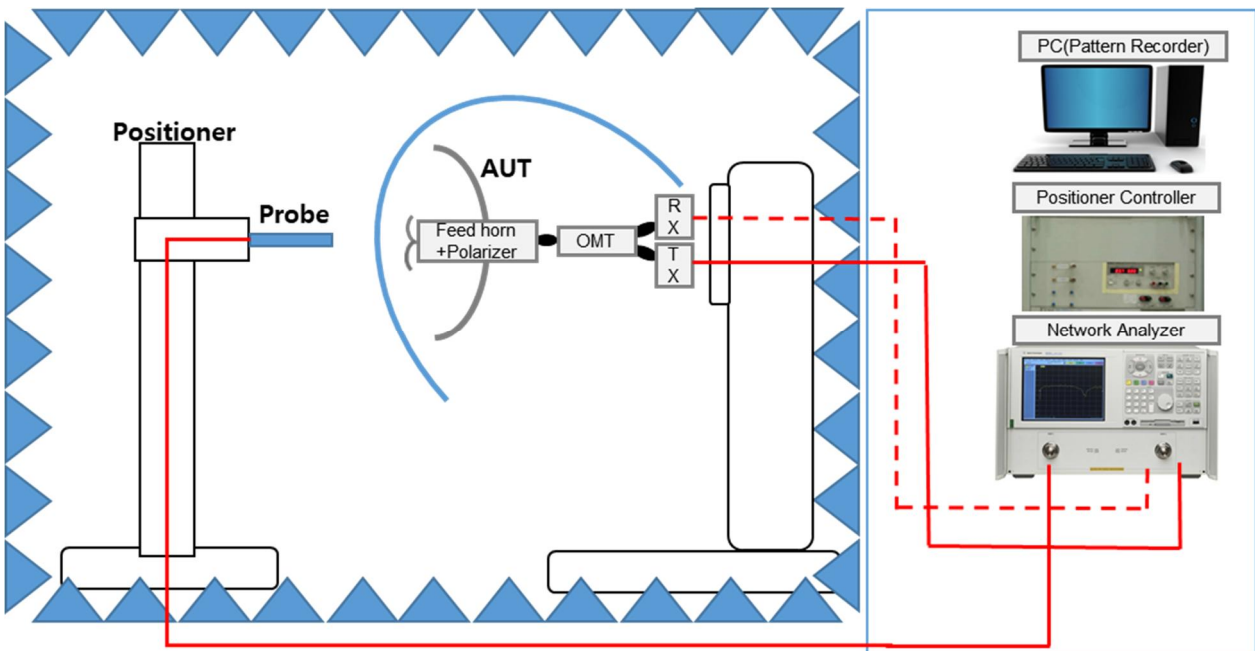


Figure 31 Range measurement Configuration

12.2.2. Test Steps

Test Procedure	
A	Set the test equipment as shown in Figure 34.
B	Connect the cable to Tx band port of AUT.

C	Set the measurement frequency of Pattern Recorder to Ku band 14.0GHz , 14.25GHz , 14.5GHz
D	The antenna is vertically and horizontally aligned so that the reception level of the antenna is maximized, and the horizontal pattern is measured.
E	Rotate the source horn 90 degrees and measure the horizontal pattern.
F	The antenna pattern measured in the above (A to E) is synthesized to confirm the Pattern, from the measuring equipment.
G	Check the amplitude difference between Co-pol and Cross-pol in the peak direction of the Co-pol pattern.
G	The VCRM Requirement ID UT-PRD-GEN-075 / UT-ANTSS-TX-037

12.3. Test Result



Figure 32 Measurement Configuration

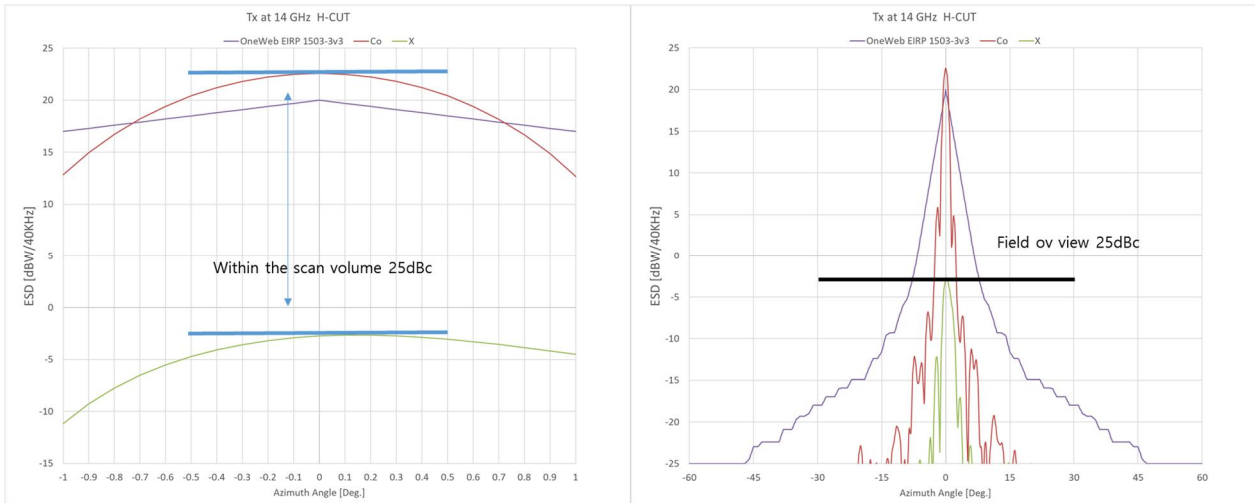


Figure 33 Cross Polarization(Within the scan volume & Field of view) @14.0GHz

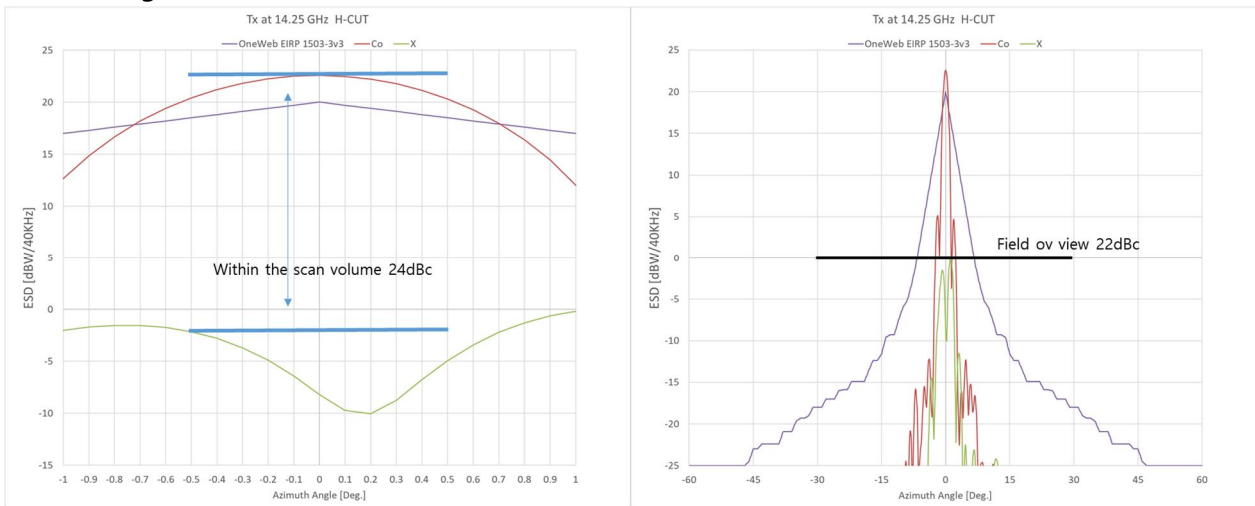


Figure 34 Cross Polarization(Within the scan volume & Field of view) @14.25GHz

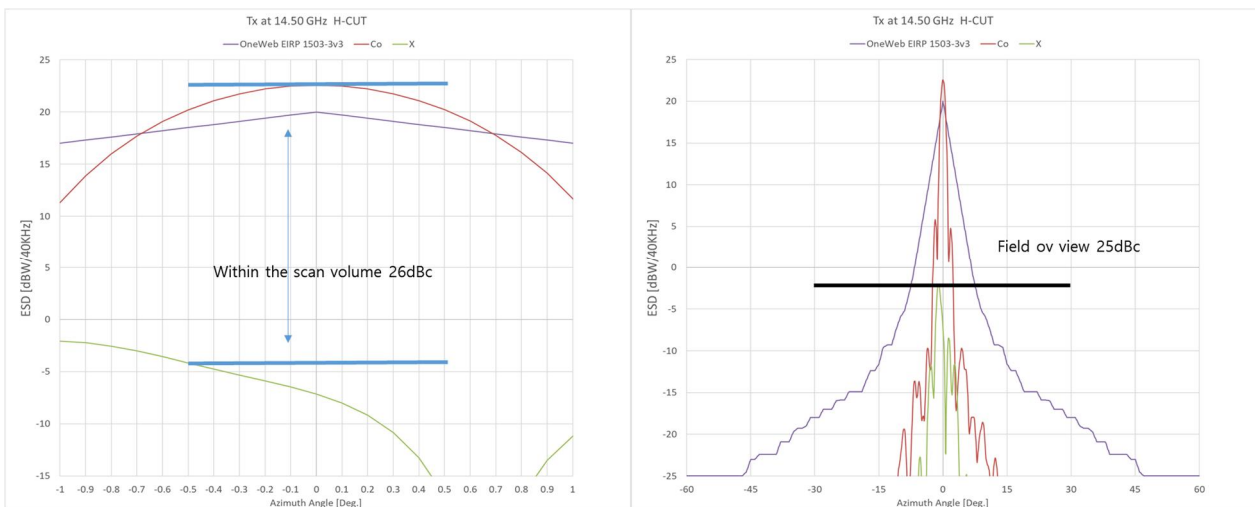


Figure 35 Cross Polarization(Within the scan volume & Field of view) @14.5GHz

Frequency(GHz)	Cross Polarization	
	Within the scan volume	Field of view
14.0	25dBc	25dBc
14.25	24dBc	22dBc
14.5	26dBc	25dBc

13. RFP-09(Beam Squint Angle relative to Rx beam over Rx and Tx frequencies)

13.1. Test Equipment and Facilities

- Range test facility
 - Chamber
 - Positioner Controller
 - Control PC
 - Network analyzer
 - Probe antenna
- RF cable
- ANTENNA(Radome + Reflector + Feedhorn+Polarizer+OMT)+Radome
- W/G to SMA adapter(WR62)
- W/G to SMA adapter(WR75)

13.2. Test Method

13.2.1. Test Setup

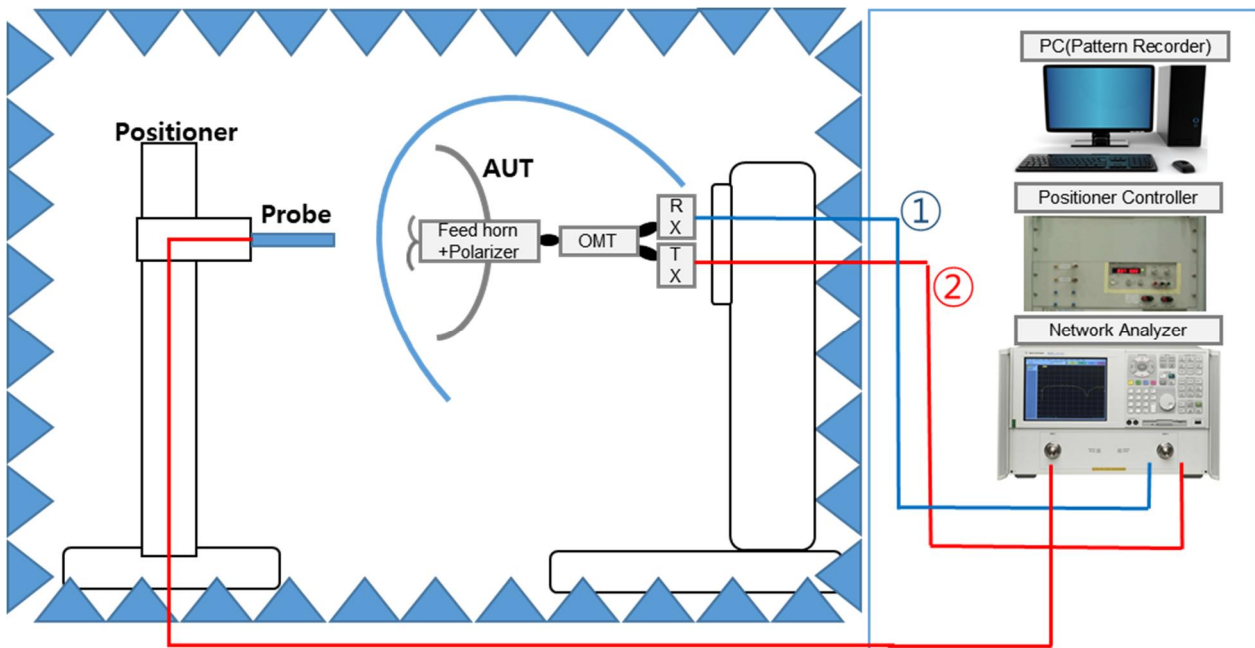


Figure 36 Range measurement Configuration

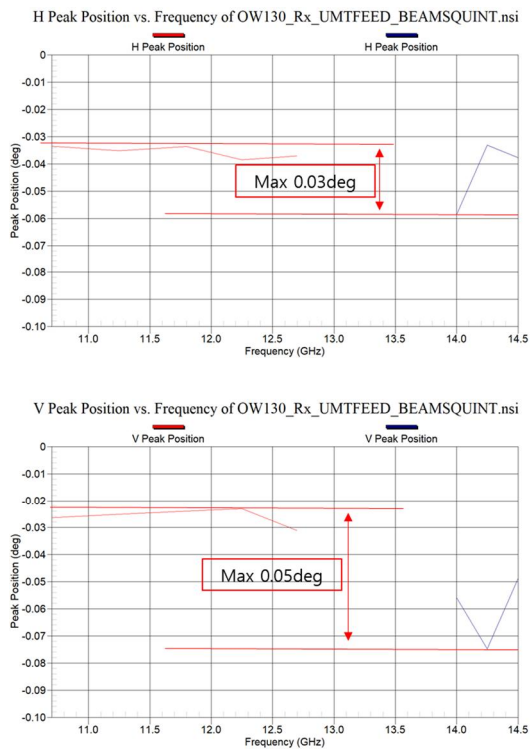
13.2.2. Test Steps

	Test Procedure
A	Set the test equipment as shown in Figure 39.
B	Connect the cable to Rx band port of AUT.
C	Set the measurement frequency of Pattern Recoder to Ku band 10.7GHz~12.7GHz
D	The antenna is vertically and horizontally aligned so that the reception level of the antenna is maximized, and the horizontal pattern is measured.
E	Rotate the source horn 90 degrees and measure the horizontal pattern.
F	The antenna pattern measured in the above (A to E) is synthesized to confirm H pattern from the measuring equipment.
G	Connect the cable to Tx band port of AUT.
H	Set the measurement frequency of Pattern Recoder to Ku band 14.0GHz~14.5GHz
I	Measure the pattern without alignment.
J	Rotate the probe 90 degrees and measure the pattern.
K	The antenna pattern measured in the above is synthesized to confirm the Peak level angle from the measuring equipment. Rotate the probe 90 degrees and measure the pattern.
L	Compare the difference between the results of F and K to ensure that the Beam squint angle meets the requirements
	The VCRM Requirement ID UT-ANT-RF-TX-008

13.3. Test Result



Figure 37 Measurement Configuration



Frequency [GHz]	H-Cut Peak Pos Normalized @ 10.7GHz	V-Cut Peak Pos Normalized @ 10.7GHz
10.7	0.00	0.00
11.0	0.00	0.00
11.25	0.00	0.00
11.5	0.00	0.00
11.8	0.00	0.00
12.0	0.00	0.00
12.25	-0.01	0.00
12.5	0.00	0.00
12.7	0.00	-0.01
14	-0.03	-0.03
14.1	-0.01	-0.04
14.25	0.00	-0.05
14.4	0.00	-0.04
14.5	0.00	-0.03

Figure 38 Result (Beam Squint)

14. RFP-10(UT EIRP)

14.1. Test Equipment and Facilities

- Range test facility
 - Chamber
 - Positioner Controller
 - Control PC
 - Network analyzer
 - Probe antenna
- RF cable
- ANTENNA(Radome + Reflector + Feedhorn+Polarizer+OMT)
- W/G to SMA adapter(WR62)
- W/G to SMA adapter(WR75)

14.2. Test Method

14.2.1. Test Setup

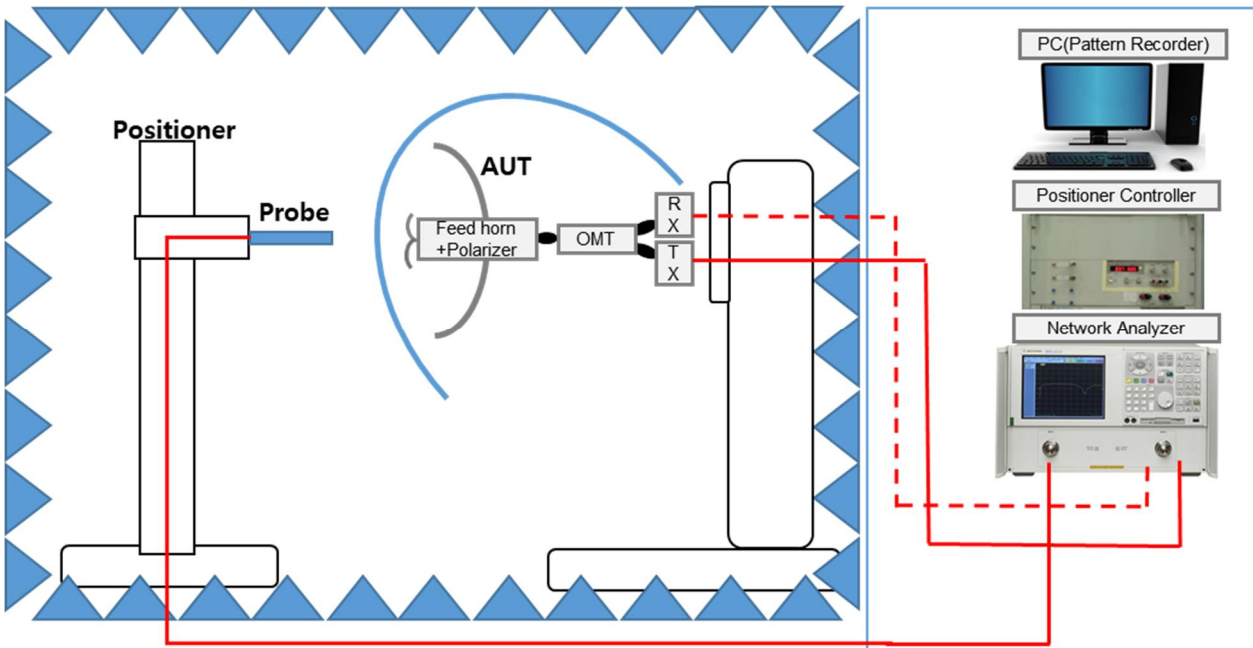


Figure 39 Range measurement Configuration

14.2.2. Test Steps

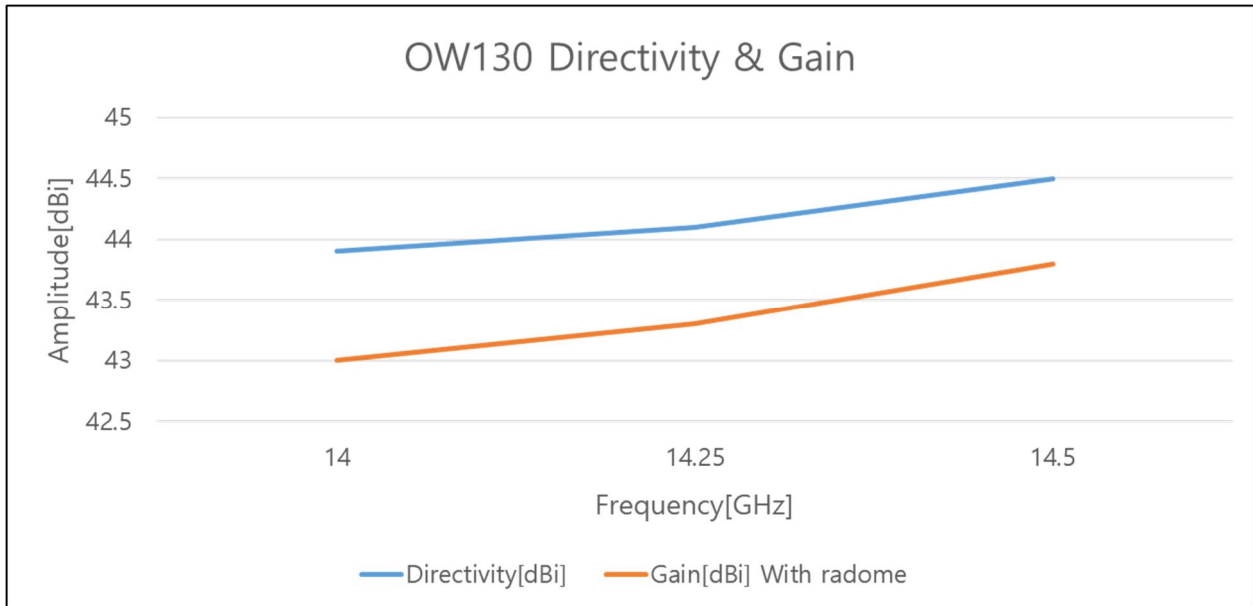
Test Procedure	
A	Set the test equipment as shown in Figure 42.

B	Connect the cable to Rx band port of AUT.
C	Set the measurement frequency of Pattern Recorder to Ku band 14.0GHz, 14.25GHz, and 14.5GHz.
D	The antenna is vertically and horizontally aligned so that the reception level of the antenna is maximized, and the horizontal pattern is measured.
E	Rotate the source horn 90 degrees and measure the horizontal pattern.
F	The antenna pattern measured in the above (A to E) is synthesized to confirm the Gain, from the measuring equipment.
G	Analyze the EIRP carrier using the measured gain and RCM output.
H	The VCRM Requirement ID UT-PRD-GEN-233 / UT-ANTSS-TX-009.001

14.3. Test Result



Figure 40 Measurement Configuration



Target Gain	Frequency	Directivity[dBi]	Gain		Total Loss
			Without	With	
42.4@14GHz	14	43.9	43.4	43.0	0.9
	14.25	44.1	43.6	43.3	1.0
	14.5	44.5	44.0	43.8	0.8

Figure 41 Result (Tx band Gain)

The EIRP calculation includes RCM, OMT, Antenna Gain, and Radome loss

**Use RF component specification values*

dual carrier mode

Measured Gain (Antenna with Radome, OMT, Feedloss) + RCM(0.5dBW) >42.9dBW EIRP/40MHz

single carrier mode

Measured Gain (Antenna with Radome, OMT, Feedloss) + RCM(-2.5dBW) >39.9dBW EIRP/20MHz

EIRP			
Spec EIRP 39.9dBW single-carrier, 42.9dBW dual-carrier			
Frequency	14.00	14.25	14.50
Diameter[m]	1.25	1.25	1.25
Directivity[dBi]	43.92	44.11	44.49
RCM(Psat[W])	3.00	3.00	3.00
RCM(MOP[W])	1.12	1.12	1.12
single carrier[dBW]	-2.50	-2.50	-2.50
Dual carrier[dBW]	0.50	0.50	0.50
FEED/Polarizer loss[dB]	0.50	0.50	0.50
OMT(TRF/RRF) loss[dB]	0.50	0.50	0.50
Radome loss[dB]	0.40	0.40	0.40
EIRP single (dBW/20MHz)	40.02	40.20	40.58
EIRP dual (dBW/40MHz)	43.02	43.20	43.58
EIRP Margin	0.22	0.40	0.78

Tx			
	Radome	Aperture Feed/Polarizer	OMT
I.L. (dB)	0.4	0.5	0.5

Measure Directivity & Gain			
	14.0GHz	14.25GHz	14.5GHz
Directivity(dBi)	43.92	44.11	44.49
Gain(dBi)	42.52	42.71	43.09

OW130		
F (GHz)	SPEC	EIRP
10.7		43.02
11.8	42.9	43.2
12.7		43.58

※ Antenna Maximum Gain

- Tx: 43.1 dBi
- Rx: 42.1 dBi