

OTA Test Report

Date of Report	16/09/2019	Client's Contact person:	Olle Johansson
Number of pages:	12	Responsible Test engineer:	Ilari Kinnunen
Testing laboratory:	Verkotan Oy Elektroniikkatie 17 90590 Oulu Finland	Client:	Aluminium Radiation Protection AB
Tested devices	Samsung Galaxy S9+ with and with out radiation protection shield		
Testing has been carried out in accordance with:	3GPP TS 34.114 Technical Specification Group Radio Access Network; User Equipment (UE) / Mobile Station (MS) Over The Air (OTA) antenna performance; Conformance testing 3GPP TR 37.902 Measurements of User Equipment (UE) radio performances for LTE/UMTS terminals; Total Radiated Power (TRP) and Total Radiated Sensitivity (TRS) test methodology		
Documentation:	The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory		
Test Results:	The test results relate only to devices specified in this document		

Date and signatures: 16.09.2019
For the contents: **Laboratory Manager**

1. SUMMARY

1.1 TEST DETAILS

Devices under Test (DUT):

Product:	Samsung Galaxy S9+
Manufacturer:	Samsung
Model:	SM-G965F
IMEI:	352419095817389

Testing information:

Testing performed:	28.8.2019
Notes:	
Document name:	Trp Report Arp Id3749 30082019
Temperature °C / Humidity RH%	22±1 / 30%±10%
Measurement performed by:	Miia Nurkkala

1.2 MEASUREMENT UNCERTAINTY

Expanded Uncertainty (dB)	
Test Configuration	TRP
Free Space	1.08

1.3 RESULTS SUMMARY

1.3.1 LTE TRP BAND AVERAGES

Band	With Out Shield		With OLD Shield		With A Shield		With B Shield		With C Shield		With D Shield	
	Test Result		Test Result		Test Result		Test Result		Test Result		Test Result	
	(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)	(dBm)	(mW)
LTE 3	18.6	72.2	4.5	2.8	2.6	1.8	2.3	1.7	5.1	3.2	4.1	2.6
LTE 8	16.5	44.4	3.2	2.1	0.6	1.1	0.1	1.0	5.4	3.4	3.7	2.3



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2. TEST EQUIPMENT

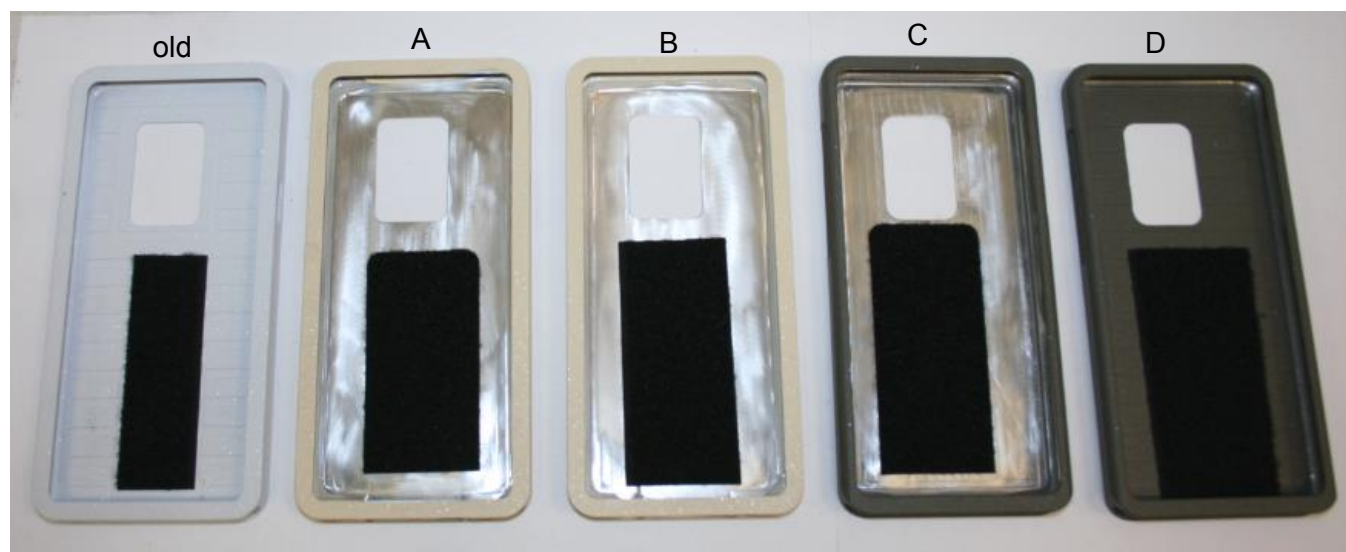
Main used test equipment is listed below. For full equipment list and calibration intervals, please contact the testing laboratory.

Type of Equipment	Type	Manufacturer
Power Meter	NRP-Z21	Rohde&Schwarz
Radio Communication Tester	MT8820C	Anritsu
Diagonal Dual Polarized Horn Measurement Antenna	3161-03	ETS
Positioning Controller	2090	EMCO
3D Positioner	Custom made	ETS-Lindgren
Switching System	1256	Racal
Switching System	MSN-6TD-06-DEC-SP	American Microwave
Anechoic Chamber	2	ETS-Lindgren

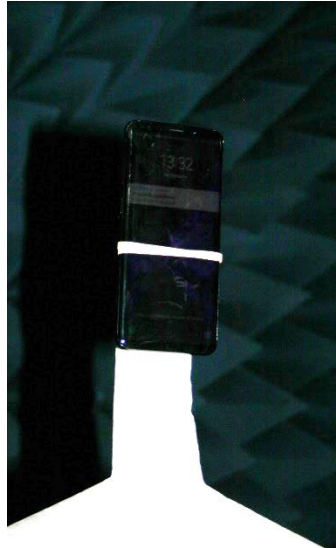
3. MEASUREMENTS

Testing was performed per 3GPP TS 34.114 and TR 37.902 as far as they were applicable. Bandwidth of 10 MHz was used for all testing.

Testing was performed with 5 aluminium shield shown in a picture below on the DUT and with out any.



3.1.1 Test setup with out shield



3.1.2 Test setup for shields



3.2 TRP RESULTS

LTE 3

DUT	UL Channel	UL RB Allocation	TX Frequency (MHz) [Center of UL RB allocation]	with out shield	with old shield	with A shield	with B shield	with C shield	with D shield
				Test Result (dBm)	Test Result (dBm)	Test Result (dBm)	Test Result (dBm)	Test Result (dBm)	Test Result (dBm)
S9+	19250	12 RBs with RB start 0	1711.58	18.51	3.67	1.83	1.65	3.05	2.55
	19575	12 RBs with RB start 19	1747.5	18.66	4.76	3.01	2.81	4.4	3.62
	19900	12 RBs with RB start 38	1783.42	18.58	4.83	2.87	2.46	6.9	5.62

LTE 8

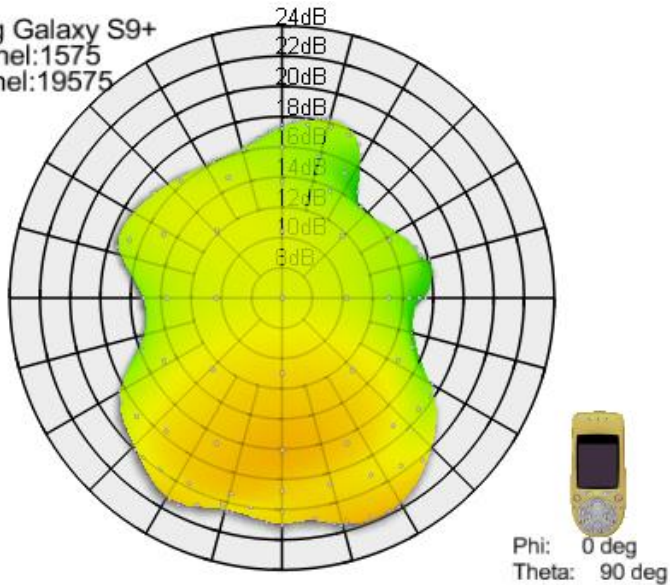
DUT	UL Channel	UL RB Allocation	TX Frequency (MHz) [Center of UL RB allocation]	with out shield	with old shield	with A shield	with B shield	with C shield	with D shield
				Test Result (dBm)	Test Result (dBm)	Test Result (dBm)	Test Result (dBm)	Test Result (dBm)	Test Result (dBm)
S9+	21500	12 RBs with RB start 0	881.58	15.94	2.61	0.13	0.54	3.35	2.58
	21625	12 RBs with RB start 19	897.5	16.68	3.91	0.9	0.43	5.9	3.97
	21750	12 RBs with RB start 38	913.42	16.76	3.12	0.62	-0.87	6.29	4.31

3.3 3D PATTERNS

3.3.1 LTE BAND 3 TRP PATTERN

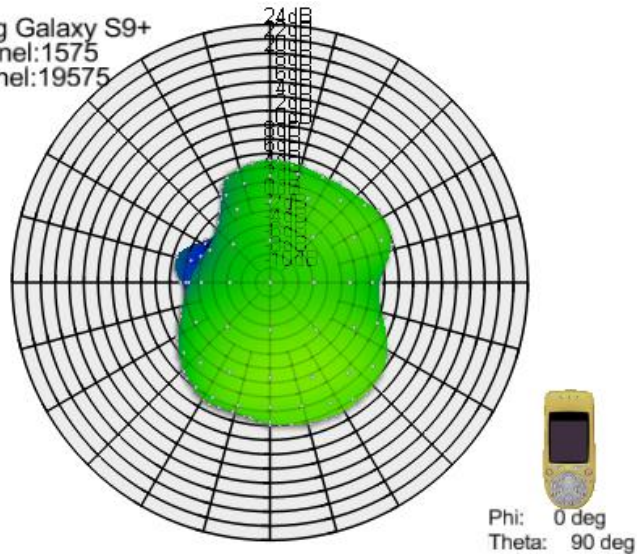
With out shield, scale maximum 24dB

Samsung Galaxy S9+
RX channel:1575
TX channel:19575



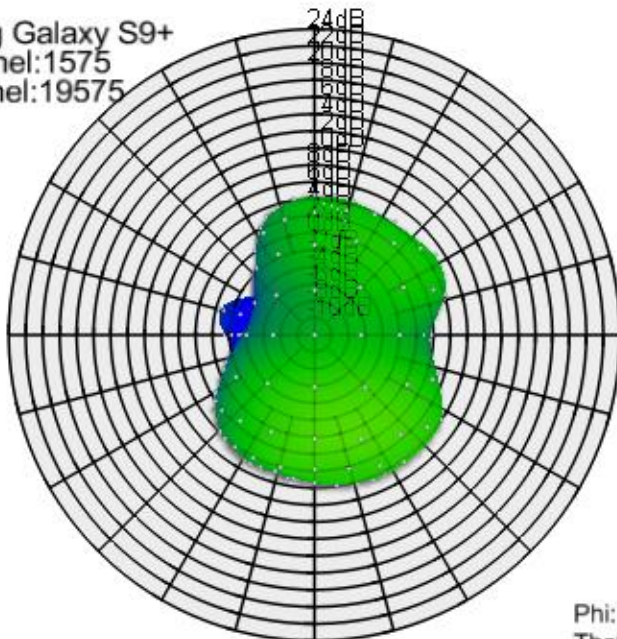
With old shield, scale maximum 24dB

Samsung Galaxy S9+
RX channel:1575
TX channel:19575



With shield A, scale maximum 24dB

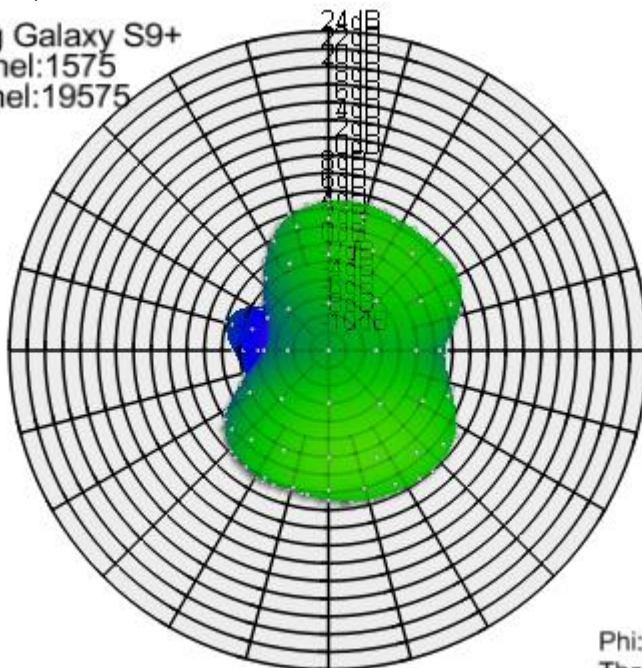
Samsung Galaxy S9+
RX channel:1575
TX channel:19575



Phi: 0 deg
Theta: 90 deg

With shield B, scale maximum 24dB

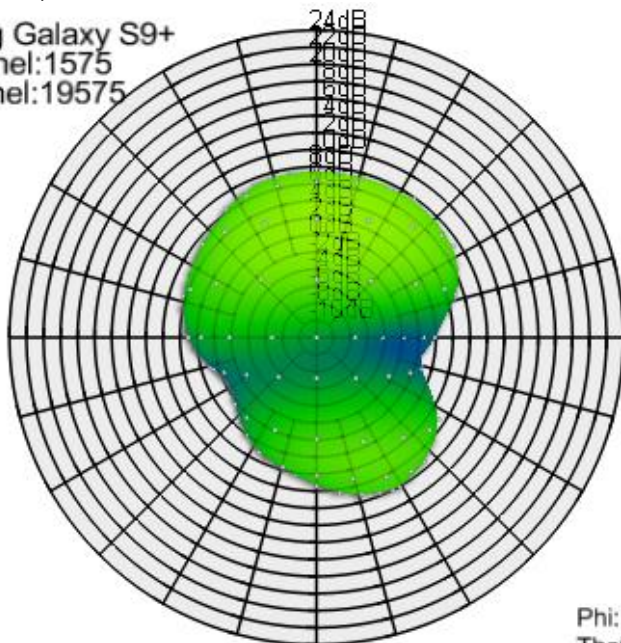
Samsung Galaxy S9+
RX channel:1575
TX channel:19575



Phi: 0 deg
Theta: 90 deg

With shield C, scale maximum 24dB

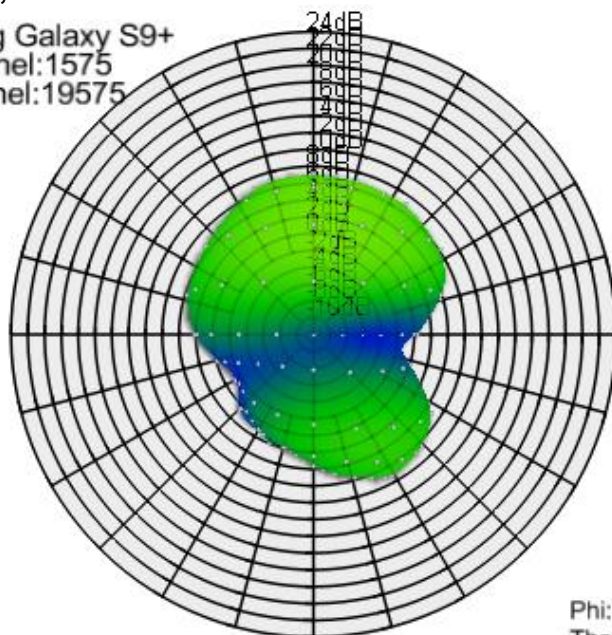
Samsung Galaxy S9+
RX channel:1575
TX channel:19575



Phi: 0 deg
Theta: 90 deg

With shield D, scale maximum 24dB

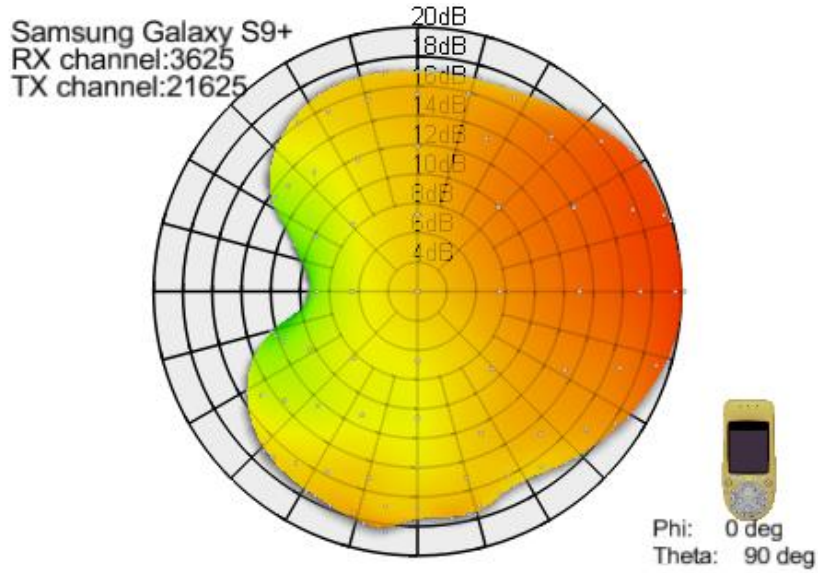
Samsung Galaxy S9+
RX channel:1575
TX channel:19575



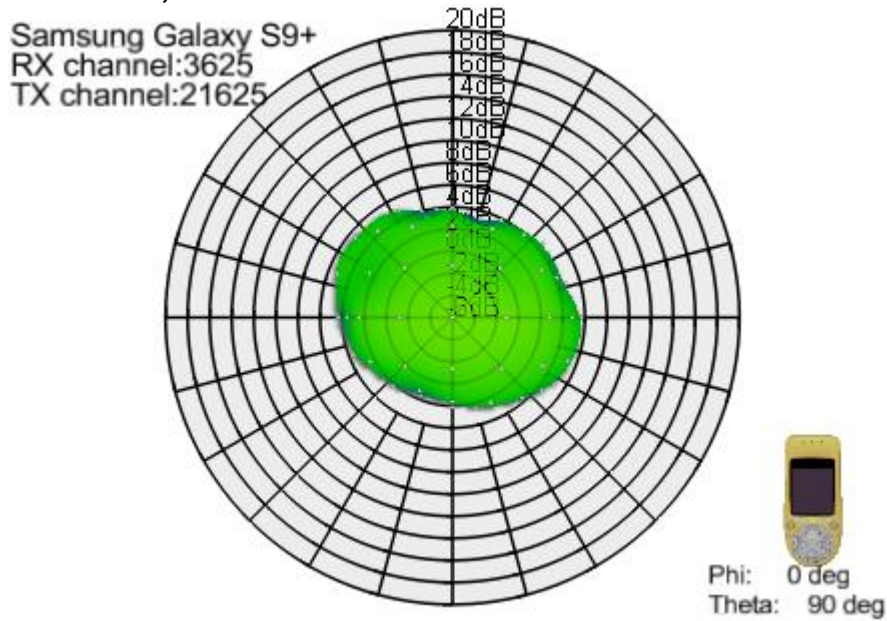
Phi: 0 deg
Theta: 90 deg

3.3.2 LTE BAND 8 TRP PATTERN

With out shield, scale maximum 20 dB

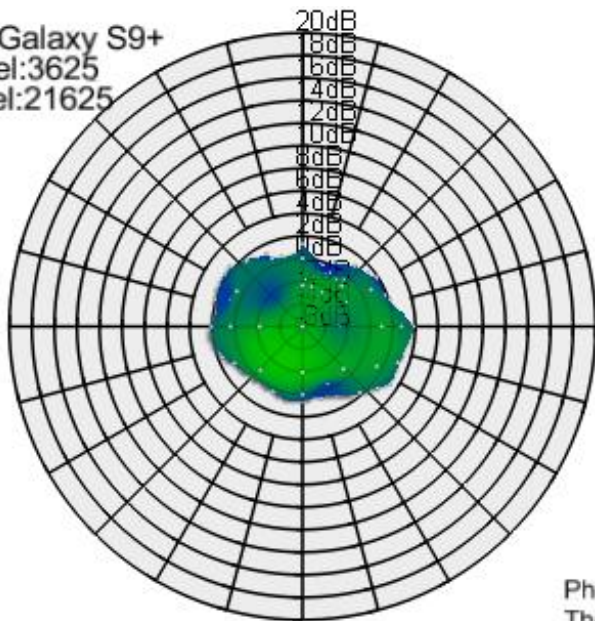


With old shield, scale maximum 20 dB



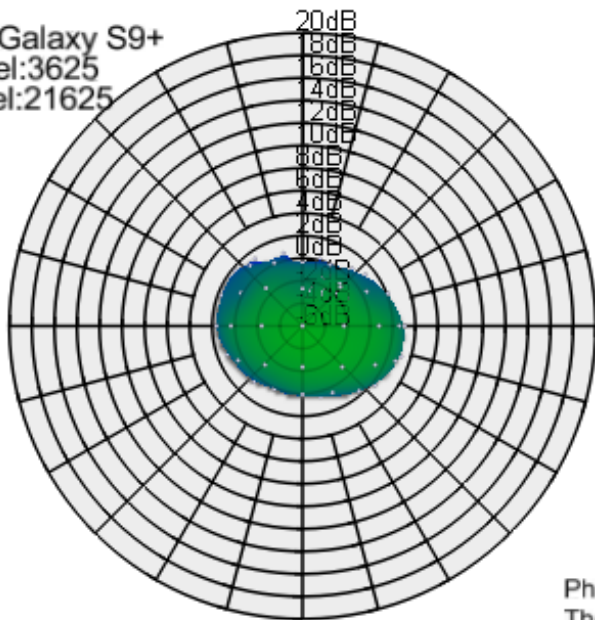
With shield A, scale maximum 20 dB

Samsung Galaxy S9+
RX channel:3625
TX channel:21625



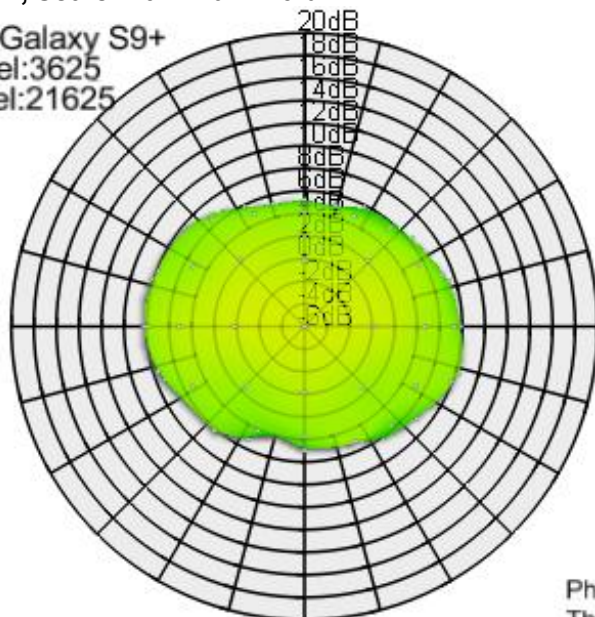
With shield B, scale maximum 20 dB

Samsung Galaxy S9+
RX channel:3625
TX channel:21625



With shield C, scale maximum 20 dB

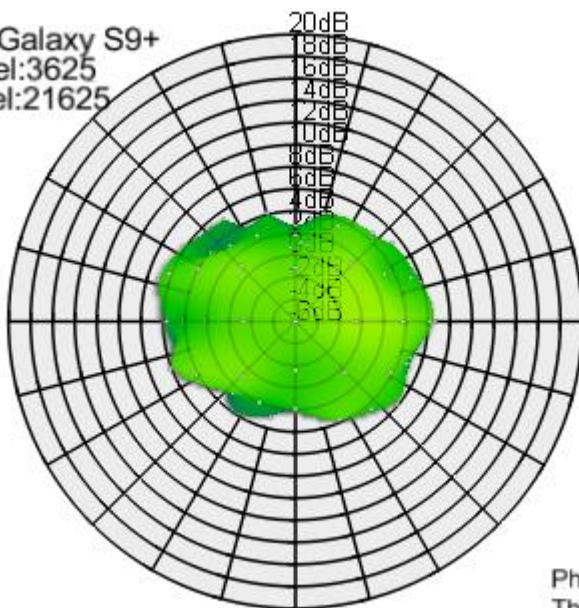
Samsung Galaxy S9+
RX channel:3625
TX channel:21625



Phi: 0 deg
Theta: 90 deg

With shield D, scale maximum 20 dB

Samsung Galaxy S9+
RX channel:3625
TX channel:21625



Phi: 0 deg
Theta: 90 deg