



TEST REPORT Total Radiated Power (TRP) Test Measured in Antenna Full-anechoic Room (A-FAR)	
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Date of receipt of test item :	28-Jun-2022
Date(s) of performance of tests... :	30-Jun-2022
General remarks: A cross ☒ in a rectangular shape means that this option is applied.	

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Description of DUT

Model / Type reference	SNS212 Esr4 module for verification of the total radiated power and total isotropic sensitivity in Zigbee channels 11, 18 and 25. Also pre-compliance conducted spurious emissions in Zigbee channel 18.
Supplementary information	---

Summary of test configuration**Test configuration**

Testing is performed in a fully-anechoic (antenna) room. TRP is calculated based on 3D radiation pattern measurement on a grid with 15° increments in both azimuth and elevation angles. Measured EIRP data are processed towards TRP in line with the procedure outlines in [1].

DUT specific configurations

Test distance.....	☐	3 m
	☒	4.56 m
	☐	Other:
Supplementary information.....	The test distance should be larger than 2.5×maximum luminaire dimension as described.	
Transmitted power	+4 dBm	
Communication type	☐	GPRS 2G
	☐	Other:
Communication channels	☒	Zigbee Channels 11, 18, 25 (2.405, 2.44, 2.475 GHz)
	☐	Wi-Fi
	☐	Other:
Operating modes	No.	Operating mode of test item
	1	SNS212 Esr4: TRP measurements with module in constant transmit, carrier only mode at fixed power level of +4 dBm in Zigbee channel 11. The bare sensor was measured without any luminaire.
	2	SNS212 Esr4: Spot TIS measurement in Zigbee channel 11. The bare sensor was measured without any luminaire.
	3	SNS212 Esr4: TRP measurement with module in constant transmit, carrier only mode at fixed power level of +4 dBm in Zigbee channel 18. The bare sensor was measured without any luminaire.
	4	SNS212 Esr4: Spot TIS measurement in Zigbee channel 18. The bare sensor was measured without any luminaire.
	5	SNS212 Esr4: TRP measurement with module in constant transmit, carrier only mode at fixed power level of +4 dBm in Zigbee channel 25. The bare sensor was measured without any luminaire.
	6	SNS212 Esr4: Spot TIS measurement in Zigbee channel 25. The bare sensor was measured without any luminaire.

	7	Conducted spurious emissions on modified SNS212 Esr4 module in Zigbee channel 18.
Supplementary information.....:		

Results**TRP & TIS from A-FAR measurement system**

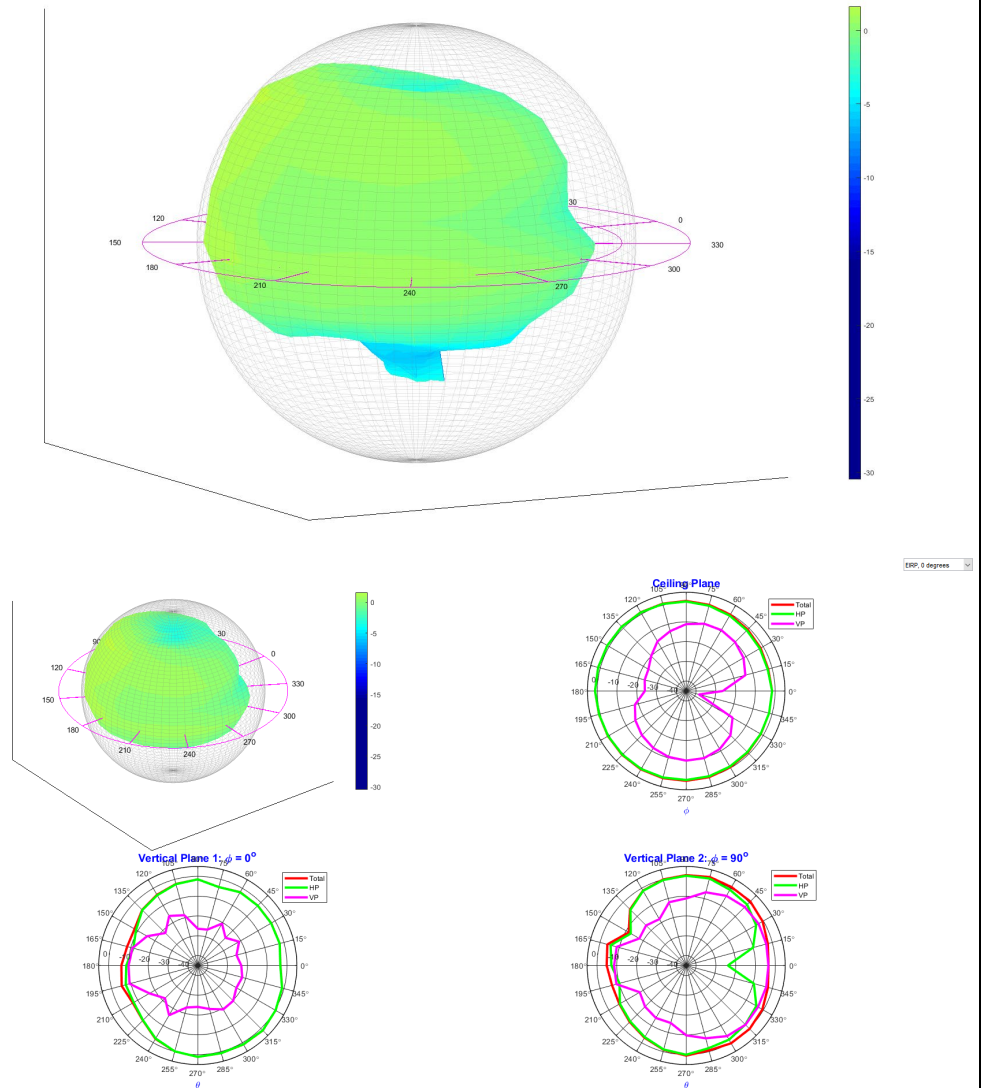
Measurement # / Configuration	Channel	Frequency (MHz)	TRP/TIS (dBm)	EIRP _{max} (dBm)	Realized Gain (dBi)
1 SNS212 TRP	11	2405	-1.1	1.6	-2.4
2 SNS212 TIS	11	2405	-108.1		
3 SNS212 TRP	18	2440	-0.6	2.0	-2.0
4 SNS212 TIS	18	2440	-105.6		
5 SNS212 TRP	25	2475	-0.5 dBm	2.5	-1.5
6 SNS212 TIS	25	2475	-103.2 dBm		
7 SNS212 Fundamental and Spurious Emissions	18	2440	2.44 GHz 4.88 GHz 7.32 GHz 7.76 GHz 12.20 GHz 14.64 GHz	+5.33 dBm -60.60 dBm -57.35 dBm -78.79 dBm -79.67 dBm -87.59 dBm	

Realized Gain = maximum total EIRP – input power (+4 dBm)

Antenna pattern results

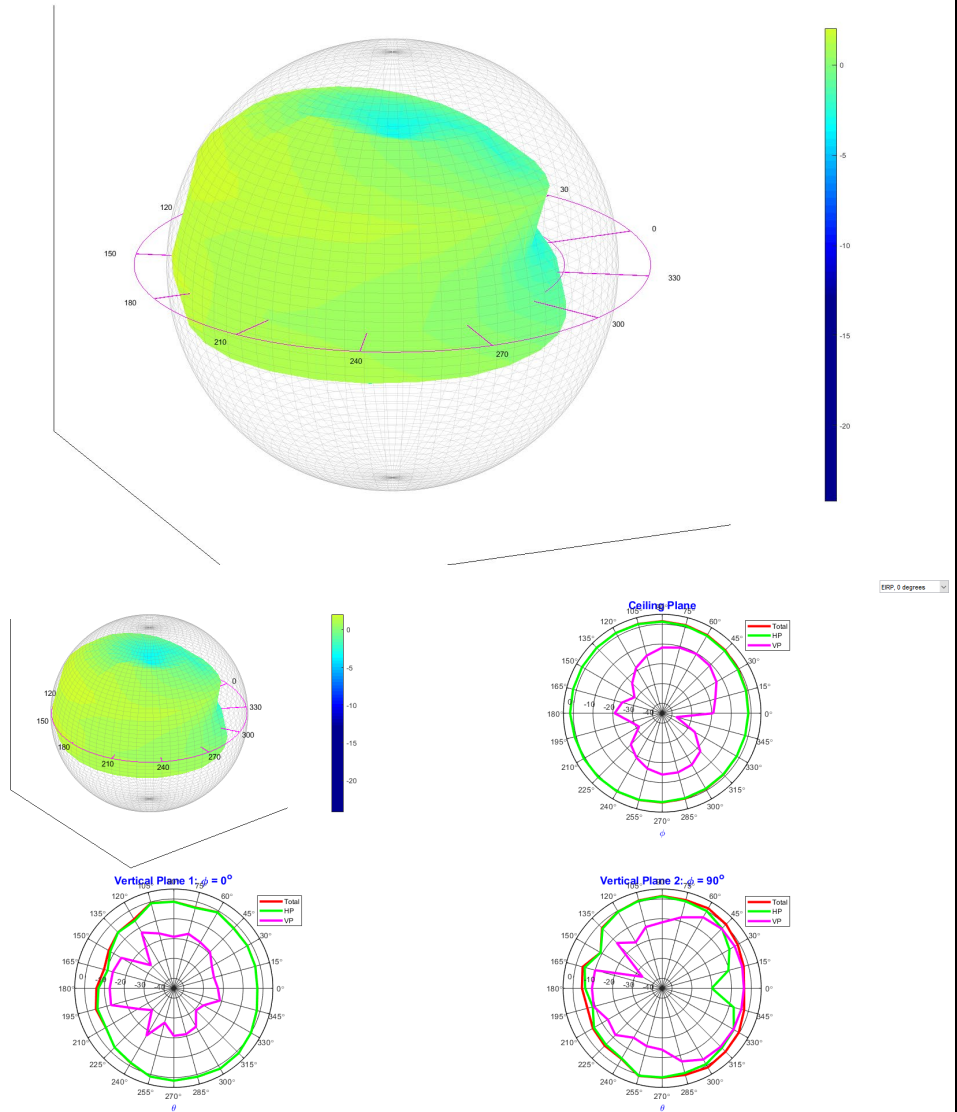
EIRP Measurement 1:

SNS212 EIRP

Channel 11,
 $P_{TX} = +4$ dBm

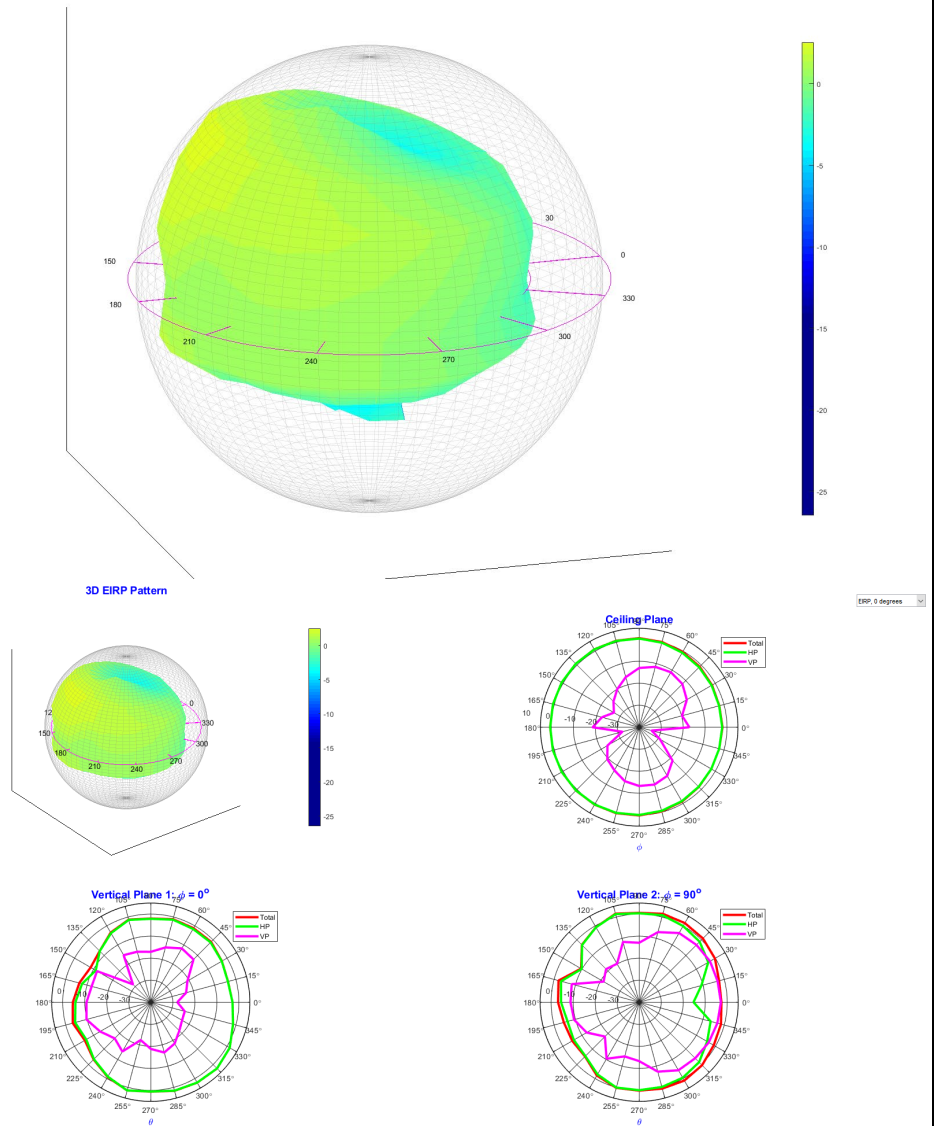
EIRP Measurement 3:

SNS212 EIRP

Channel 18,
 $P_{TX} = +4 \text{ dBm}$ 

EIRP Measurement 5:

SNS212 EIRP

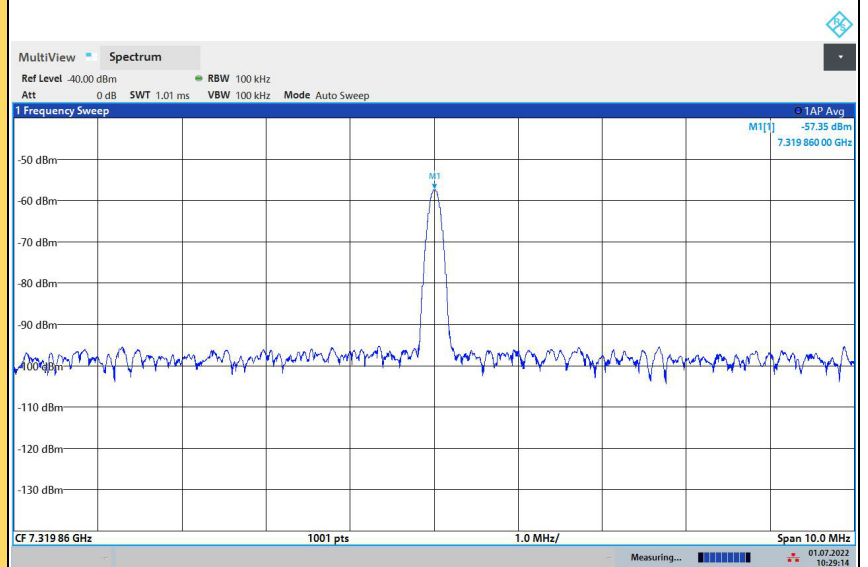
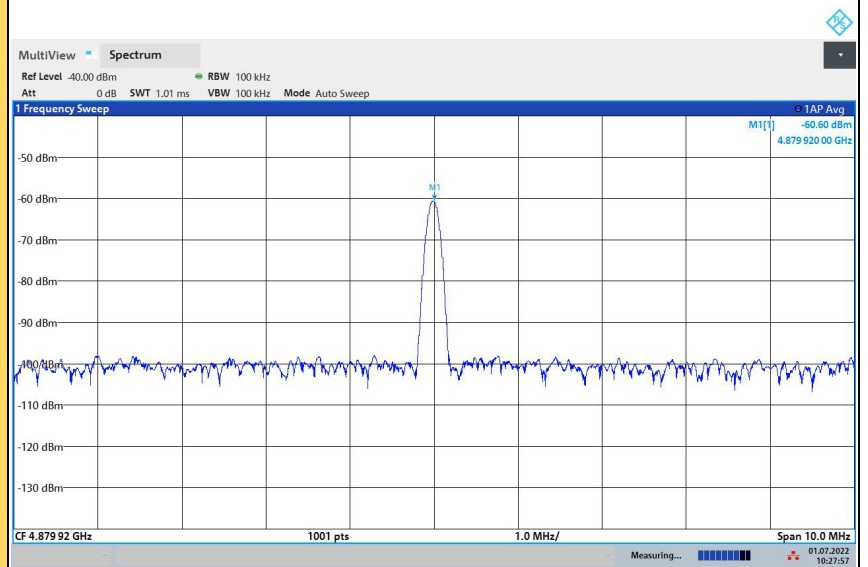
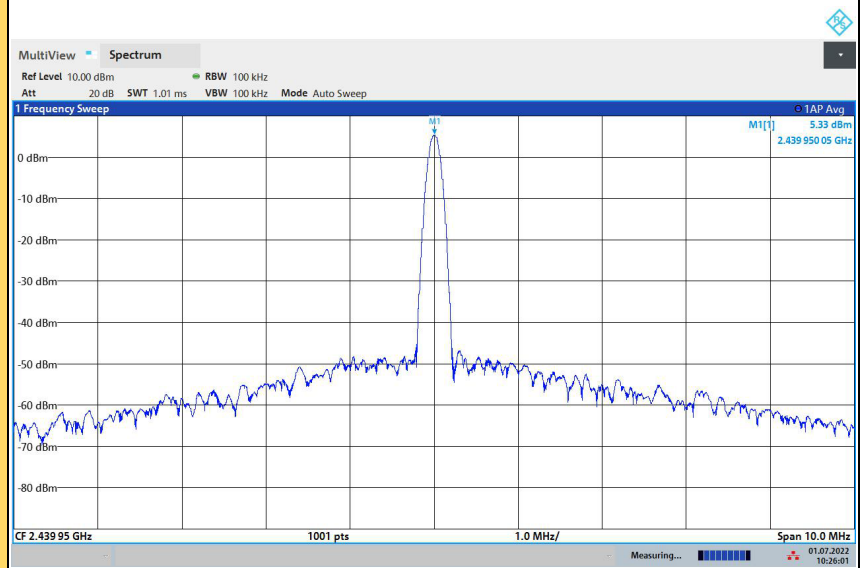
Channel 25,
 $P_{TX} = +4 \text{ dBm}$ 

Spurious emissions results

Emissions Measurement 7:

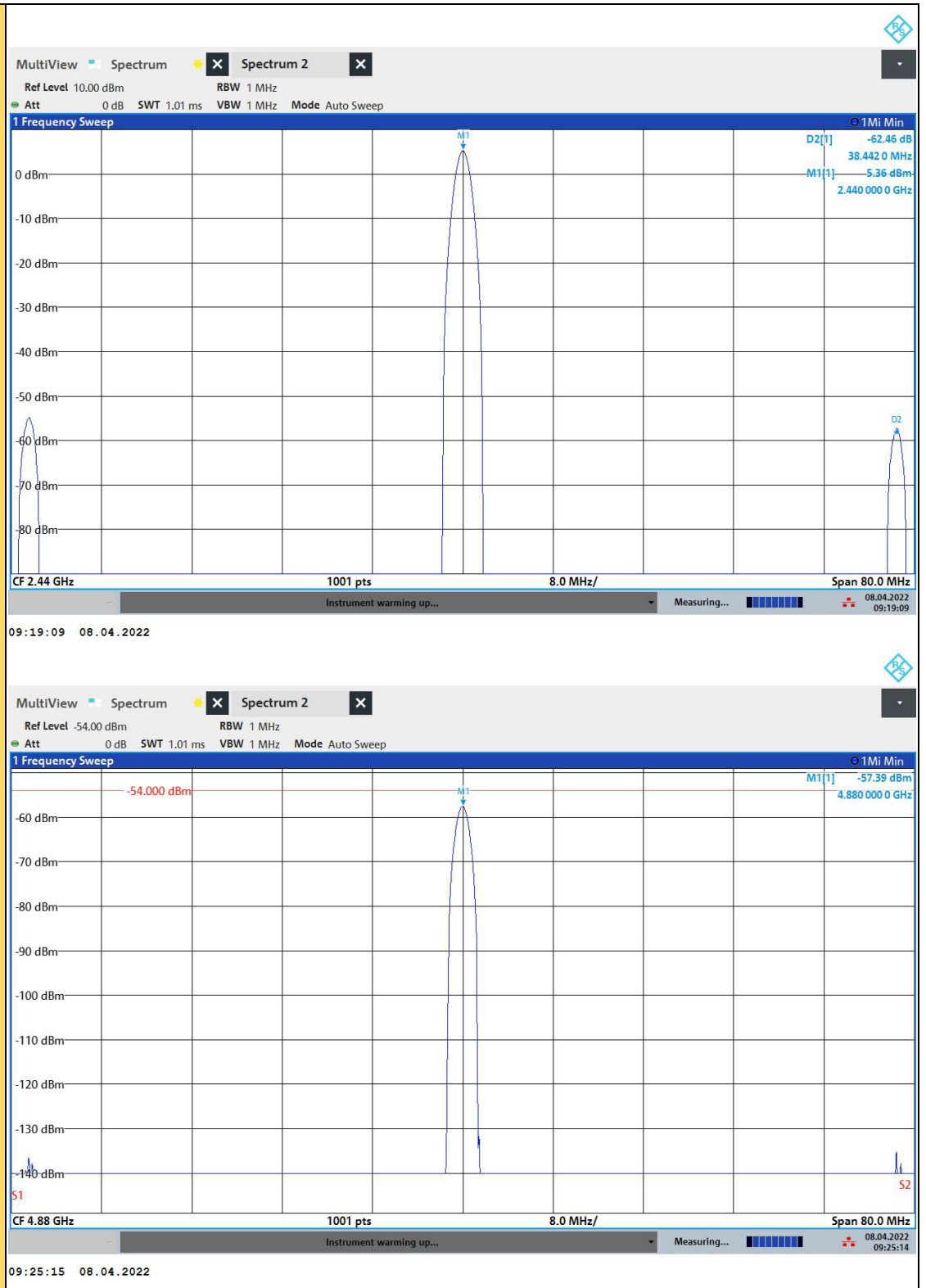
Channel 25, $P_{TX} = +4$ dBm

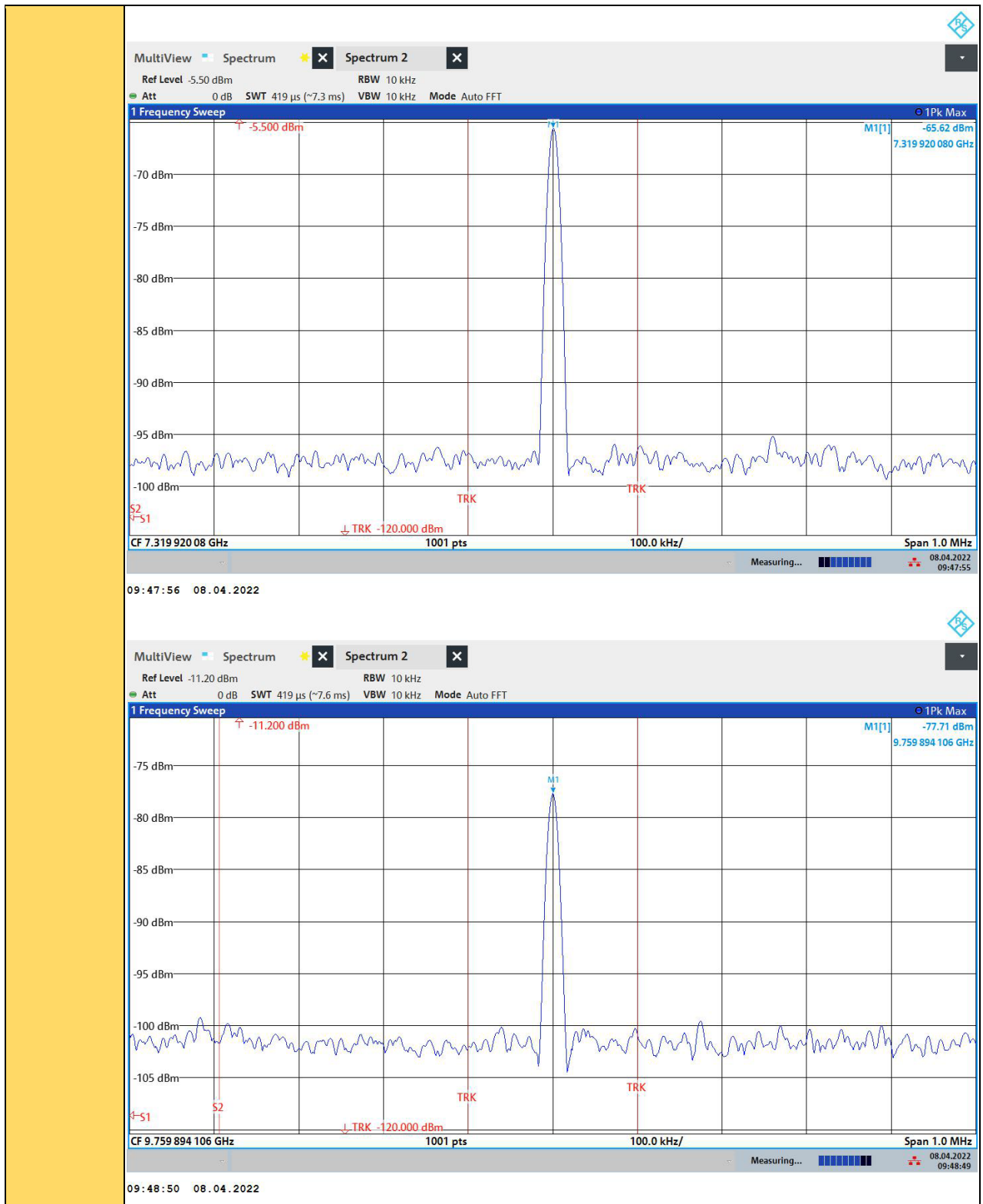
SNS212 Fundamental and Spurious





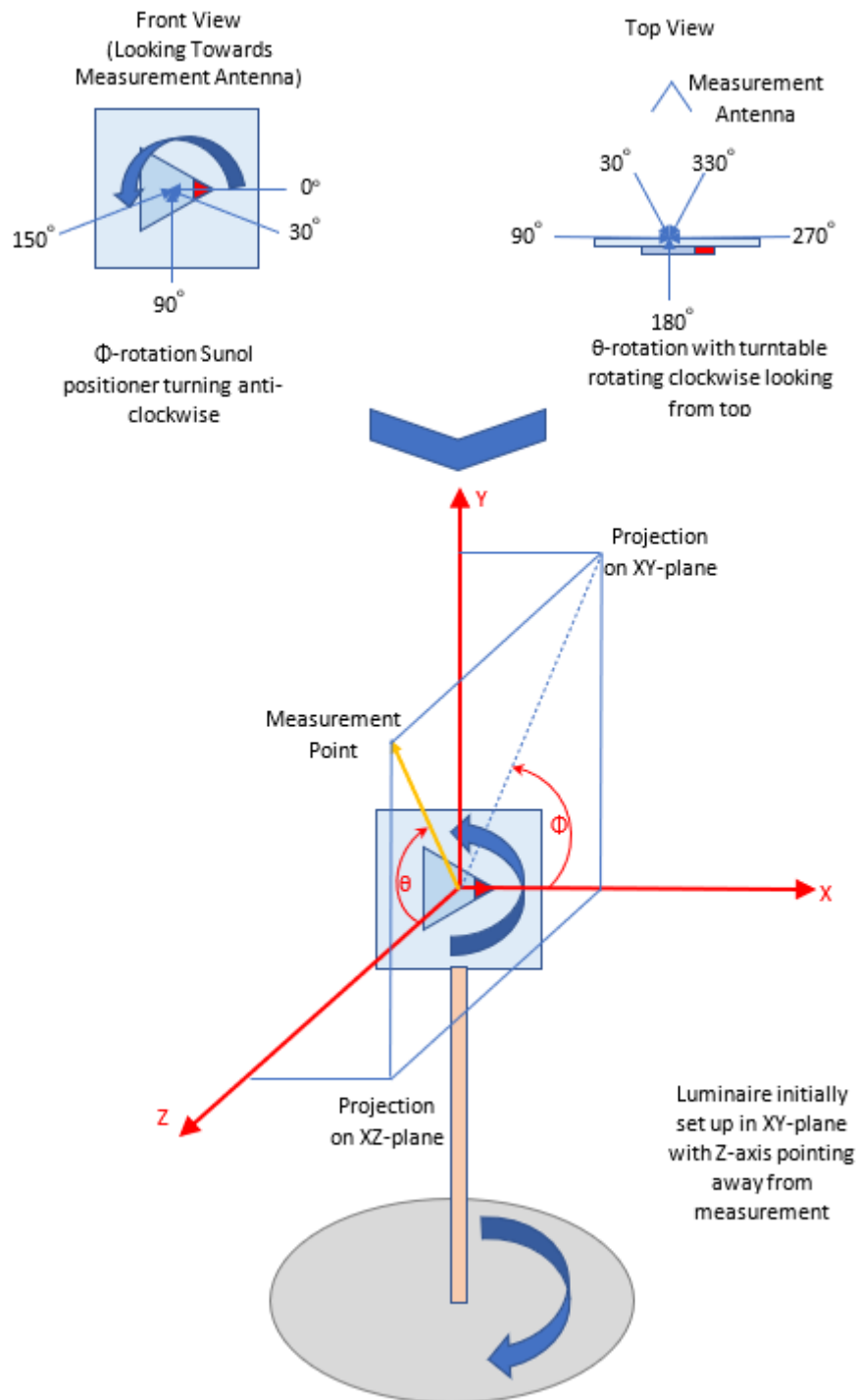
Channel 18







Reference System

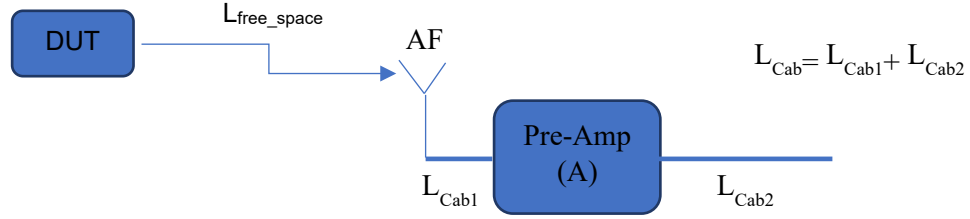


Equipment list

No.	Type	Instrument	Manufacturer	Calibration date
9400-0063	FSP	Spectrum Analyzer	Rohde & Schwarz	No calibration required
9400-3034	LNA-40-00101800-25-10P	Amplifier	Miteq	No calibration required
9400-3031	BBHX 9120E	Horn antenna	Schwarzbeck	No calibration required
6400-3063	FSV3044	Signal & Spectrum Analyzer	Rohde & Schwarz	22 August 2023
9400 0373	RFDS-F/A-100	Anechoic chamber	ETS Lindgren	No calibration required
Test software		Matlab Ver 9.5.0.1586782 (R2018b) Instrument Control Toolbox Ver.3.14 (R2018b)		

Appendix 1: TRP Measurement Procedure

First measure the effective isotropic radiated power (EIRP):



$$EIRP_{dBm} = P_{meas,dBm} + L_{free-space,dB} - G_{dB} - (A_{dB} - L_{Cab,dB})$$

with

- $P_{meas,dBm}$ are the measurement power values.
- G_{dB} is the antenna gain obtained for the appropriate polarization using.
- $A_{dB} - L_{Cab,dB}$ is the fixed loss/gain factor of all cables, preamplifier, and switches connected between the antenna connector and the connector of the spectrum analyser.
- $L_{free-space,dB}$ is the free-space path loss at the measurement distance d_{meas}

$$L_{free-space,dB} = 20 \cdot \log_{10} \left(\frac{4\pi d_{meas}}{\lambda} \right)$$

The TRP is then calculated from the EIRP measured for the two polarizations as follows:

References

[1]	Test Plan for Wireless Device Over-the-Air Performance: Method of Measurement for Radiated RF Power and Receiver Performance. Revision 3.3.2, September 2014, http://www.ctia.org/certification .
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