

Test Data Referencing

Justification of Test Data Referencing, for EMC/RF and SAR

- Parent model: FCC ID: 2AH25T5F01
- Variant model: FCC ID: 2AH25T5F01N

- 1. Product Overview**
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1. Product Overview

Radio	FCC Rule Part	FCC ID: 2AH25T5F01	FCC ID: 2AH25T5F01N
GSM Band: 850,1900	Part 22, 24	Supported	Supported
WCDMA Band: 2,5	Part 22, 24, 27	Supported	Supported
LTE Band: 2,4,5,7,13,17,38,40, 41	Part 22, 24, 27	Supported	Supported
Wi-Fi, 2.4, 5GHz	Part 15	Supported	Supported
BT/BLE	Part 15	Supported	Supported
NFC	Part 15	Supported (chip-PN557A1EV/C101)	Supported (chip-SL6567P)

2. Comparison – Summary

2.1 Identical

FCC ID : 2AH25T5F01, FCC ID : 2AH25T5F01N are identical in the followings:

- The device form factor, the size of display area and the housing material is identical
- Enclosure and material
- PCB Layout

2.2 Difference:

FCC ID : (Variant model) is different from FCC ID : 2AH25T5F01 (Parent model), in the followings:

- Different NFC chips are used

3. NFC Chip

FCC ID: 2AH25T5F01 (Parent Model)	FCC ID: 2AH25T5F01N (Variant Model)
PN557A1EV/C101  A photograph of a square, light-colored NFC chip. The chip has yellow markings that read 'Q 55701', 'Z 03 03', and 'SSD414'.	SL6567P  A photograph of a square, dark-colored NFC chip. The chip has yellow markings that read '567', '2435M', and 'M014006'.

4. Test Strategy

- FCC ID 2AH25T5F01: parent model, full test for EMC/RF/SAR.
- FCC ID 2AH25T5F01N: variant model, data referencing from the reference model for EMC/RF and SAR.

■ Full test for different parts: NFC

■ Identical design parts: Spot check the worst cases in FCC ID 2AH25T5F01

➤ EMC/RF/SAR spot check justification:
Reference KDB484596 D01 Referencing Test Data v03

a) EMC Test Data Spot-Checks

These exhibits for the variant certification shall meet the following criteria:

- Spot-check measurements must correspond to the worst-case scenario reported in the parent device filing, i.e., for conditions closest to non-compliance.
- Spot-check measurements must always show compliance with the rule part(s) applicable to the test under consideration.
- Spot-check measurements may show deviations from the reference data, as specified in sub-sections 3.2.1 and 3.2.2. These specifications differ between EMC data and RF exposure test data.

For EMC compliance test data (e.g., spurious emissions limits), the deviation between the variant and the parent model, for both field and power quantities, is expressed as:

$$d_{dB} = |V_{dB} - R_{dB}| \quad (1) ,$$

where V_{dB} is the variant spot-check level in dB, and R_{dB} is the corresponding reference measurement level in dB for the parent model.

The spot-check will be deemed acceptable when:

$$d_{dB} \leq d_{dBmax} \quad (2) ,$$

where d_{dBmax} is the maximum deviation d_{dB} allowed for the EMC data for the spot-check to be considered acceptable. The definition of d_{dBmax} is based on “how far” the reference data R_{dB} is from the compliance threshold C_{dB} (also expressed in dB), for the test under consideration. More specifically, if M_{dB} is the margin in dB from the compliance limit, expressed as

$$M_{dB} = |C_{dB} - R_{dB}| \quad (3) ,$$

then d_{dBmax} is defined as a function of M_{dB} , which increases linearly from 3 dB to 6 dB (Fig. 2), according to:

$$d_{dBmax}(M_{dB}) = \begin{cases} (3 + M_{dB} / 20) \text{ dB} & , \text{ for } 0 \leq M_{dB} \leq 60 \text{ dB} \\ 6 \text{ dB} & , \text{ for } M_{dB} > 60 \text{ dB} \end{cases} \quad (4) .$$

b) The Spot-Check Plan for RF Exposure Test Data

By expressing all the quantities in linear units, an RF exposure spot-check must be accepted based on the maximum relative difference between the variant and the parent model test results.

The spot-check acceptance criterion is formulated in terms of the total exposure ratio (TER) to easily include RF exposure evaluations based on MPE and evaluations for simultaneous transmissions, (that may include a mix of MPE and SAR evaluations but not for incident power density related to frequencies above 6 GHz).

Accordingly, proceeding in a similar way to the previous section but operating in linear units, the relative difference (expressed as a percentage) between the TER of the variant (TER_V) and that of the parent model used as a reference (TER_R) is defined as

$$d_{TER} = | TER_V - TER_R | / TER_R \quad (5) ,$$

and the acceptance criterion for the spot-check on the variant will be:

$$d_{TER} \leq d_{TERmax} \quad (6) ,$$

where d_{TERmax} , to be defined further below, is the maximum acceptable d_{TER} , and all the quantities are expressed in linear units.

It is also important to note that if the MPE is considered to refer to a field quantity and not power, the corresponding TER is to be computed as the square of the field ratio, consistent with the other terms that refer to power levels.

The value of d_{TERmax} , the maximum d_{TER} allowed for the spot-check to be deemed acceptable, is established based on the compliance margin M corresponding to the worst-case test scenario (i.e., the most challenging from the compliance perspective) for the parent model.

The margin M is defined as

$$M = TER_T - TER_R = 1 - TER_R \quad (7) ,$$

where TER_T is the TER corresponding to the compliance threshold, which is always $TER_T = 1$.

For instance, for a general population evaluation, $SAR \leq 1.6$ W/kg, as required for any compliant measurement. Thus, since $TER = SAR/1.6$, and $0 \leq TER \leq 1$, then M in eq. (7) will always be a positive number because TER_R cannot be larger than 1 for the parent model to be compliant.

The threshold d_{TERmax} is defined as function of the margin M to provide values between 25% and 50%, linearly increasing between $M = 0.5$ (50% of the compliance limit) and $M = 0.75$ (75% of the compliance limit), in accordance with the following expression:

$$d_{TERmax}(M) = \begin{cases} 0.25 & , \text{ for } 0 \leq M < 0.5 \\ M - 0.25 & , \text{ for } 0.5 \leq M < 0.75 \\ 0.5 & , \text{ for } 0.75 \leq M \end{cases} \quad (8) .$$

- Compliance is determined by both the spot check data and the referenced test data.
- Test strategy is tabulated in next page

Band	Rule Part	Test item	Parent model FCC ID 2AH25T5F01		Variant model FCC ID 2AH25T5F01N	
			Data	Reference Report No.	Data Referencing	Remark
GSM850 WCDMA Band5 LTE Band 5	Part 22.913(a)(5)	Radiated Power Output Data	Full Test	GSM:KSEM210700112905 WCDMA:KSEM210700112906 LTE:KSEM210700112907	Y	Check Worse
	Part 22.913(d)	Peak-Average Ratio	Full Test		Y	reuse patrent data
	Part 2.1049	Bandwidth	Full Test		Y	reuse patrent data
	Part 22.917(a)	Band Edges Compliance	Full Test		Y	reuse patrent data
	Part 22.917(a)	Spurious Emission at Antenna Terminals	Full Test		Y	Check Worse
	Part 22.917(a)	Field Strength of Spurious Radiation	Full Test		Y	Check Worse
	Part 22.355	Frequency Stability	Full Test		Y	reuse patrent data
GSM1900 WCDMA Band2 LTE Band 2	Part 24.232(c)	Radiated Power Output Data	Full Test		Y	Check Worse
	Part 24.232(d)	Peak-Average Ratio	Full Test		Y	reuse patrent data
	Part 2.1049	Bandwidth	Full Test		Y	reuse patrent data
	Part 24.238(a)	Band Edges Compliance	Full Test		Y	reuse patrent data
	Part 24.238(a)	Spurious Emission at Antenna Terminals	Full Test		Y	Check Worse
	Part 24.238(a)	Field Strength of Spurious Radiation	Full Test		Y	Check Worse
	Part 24.235	Frequency Stability	Full Test		Y	reuse patrent data
LTE Band4	Part 27.50(d)(4)	Radiated Power Output Data	Full Test		Y	Check Worse
	Part 27.50(d)(5)	Peak-Average Ratio	Full Test		Y	reuse patrent data
	Part 2.1049	Bandwidth	Full Test		Y	reuse patrent data
	Part 27.53(h)	Band Edges Compliance	Full Test		Y	reuse patrent data
	Part 27.53(h)	Spurious Emission at Antenna Terminals	Full Test		Y	Check Worse
	Part 27.53(h)	Field Strength of Spurious Radiation	Full Test		Y	Check Worse
	Part 27.54	Frequency Stability	Full Test		Y	reuse patrent data
LTE Band 7/38/41	Part 27.50(h)(2)	Radiated Power Output Data	Full Test		Y	Check Worse
	N/A	Peak-Average Ratio	Full Test		Y	reuse patrent data
	Part 2.1049	Bandwidth	Full Test		Y	reuse patrent data
	Part 27.53(m)(4)	Band Edges Compliance	Full Test		Y	reuse patrent data
	Part 27.53(m)	Spurious Emission at Antenna Terminals	Full Test		Y	Check Worse
	Part 27.53(m)	Field Strength of Spurious Radiation	Full Test		Y	Check Worse
	Part 27.54	Frequency Stability	Full Test		Y	reuse patrent data
LTE Band 17	Part 27.50(c)(10)	Radiated Power Output Data	Full Test		Y	Check Worse
	N/A	Peak-Average Ratio	Full Test		Y	reuse patrent data
	Part 2.1049	Bandwidth	Full Test		Y	reuse patrent data
	Part 27.53(g)	Band Edges Compliance	Full Test		Y	reuse patrent data
	Part 27.53(g)	Spurious Emission at Antenna Terminals	Full Test		Y	Check Worse
	Part 27.53(g)	Field Strength of Spurious Radiation	Full Test		Y	Check Worse
	Part 27.54	Frequency Stability	Full Test		Y	reuse patrent data
LTE Band 13	Part 27.50(b)(10)	Radiated Power Output Data	Full Test		Y	Check Worse
	N/A	Peak-Average Ratio	Full Test		Y	reuse patrent data
	Part 2.1049	Bandwidth	Full Test		Y	reuse patrent data
	Part 27.53(c)	Band Edges Compliance	Full Test		Y	reuse patrent data
	Part 27.53(c)(f)	Spurious Emission at Antenna Terminals	Full Test		Y	Check Worse
	Part 27.53(c)(f)	Field Strength of Spurious Radiation	Full Test		Y	Check Worse
	Part 27.54	Frequency Stability	Full Test		Y	reuse patrent data
LTE Band 40	27.5	Radiated Power Output Data	Full Test		Y	Check Worse
	N/A	Peak-Average Ratio	Full Test		Y	reuse patrent data
	Part 2.1049	Bandwidth	Full Test		Y	reuse patrent data
	Part 27.53	Band Edges Compliance	Full Test		Y	reuse patrent data
	Part 27.53	Spurious Emission at Antenna Terminals	Full Test		Y	Check Worse
	Part 27.53	Field Strength of Spurious Radiation	Full Test		Y	Check Worse
	Part 27.54	Frequency Stability	Full Test		Y	reuse patrent data
BT	15.207	AC Power Line Conducted Emission	Full Test	KSEM210700112902	Y	reuse patrent data
	15.207	Conducted Peak Output Power	Full Test		Y	Check Worse
	15.247 (b)(1)	20dB Emission Bandwidth & 99% Occupied Bandwidth	Full Test		Y	reuse patrent data
	15.247 (a)(1)	Carrier Frequencies Separation	Full Test		Y	reuse patrent data
	15.247 (a)(1)	Hopping Channel Number	Full Test		Y	reuse patrent data
	15.247 (a)(1)	Dwell Time	Full Test		Y	reuse patrent

						data
	15.247 (a)(1)	Band-edge for RF Conducted Emissions	Full Test		Y	reuse patent data
	15.247(d)	RF Conducted Spurious Emissions	Full Test		Y	reuse patent data
	15.247(d); 15.205/15.209	Radiated Spurious emissions	Full Test		Y	Check Worse
	15.247(d); 15.205/15.209	Restricted bands around fundamental frequency (Radiated Emission)	Full Test		Y	Check Worse
BLE	15.207	AC Power Line Conducted Emission	Full Test	KSEM210700112903	Y	reuse patent data
	15.247 (b)(3)	Conducted Output Power	Full Test		Y	Check Worse
	15.247 (a)(2)	DTS (6 dB) Bandwidth & 99% Occupied Bandwidth	Full Test		Y	reuse patent data
	15.247 (e)	Power Spectral Density	Full Test		Y	reuse patent data
	15.247(d)	Band-edge for RF Conducted Emissions	Full Test		Y	reuse patent data
	15.247(d)	RF Conducted Spurious Emissions	Full Test		Y	reuse patent data
	15.205/15.209	Radiated Spurious Emissions	Full Test		Y	Check Worse
	15.205/15.209	Restricted bands around fundamental frequency (Radiated Emission)	Full Test		Y	Check Worse
2.4G WIFI	15.207	AC Power Line Conducted Emission	Full Test	KSEM210700112901	Y	reuse patent data
	15.247 (b)(3)	Conducted Output Power	Full Test		Y	Check Worse
	15.247 (a)(2)	DTS (6 dB) Bandwidth & 99% Occupied Bandwidth	Full Test		Y	reuse patent data
	15.247 (e)	Power Spectral Density	Full Test		Y	reuse patent data
	15.247(d)	Band-edge for RF Conducted Emissions	Full Test		Y	reuse patent data
	15.247(d)	RF Conducted Spurious Emissions	Full Test		Y	reuse patent data
	15.205/15.209	Radiated Spurious Emissions	Full Test		Y	Check Worse
	15.205/15.209	Restricted bands around fundamental frequency (Radiated Emission)	Full Test		Y	Check Worse
5G WIFI	Band I: 15.407(a)(1) Band II-A: 15.407(a)(2) Band II-C: 15.407(a)(2) Band III: 15.407(e)	26dB Emission Bandwidth 26dB Emission Bandwidth 26dB Emission Bandwidth 6dB Emission Bandwidth	Full Test	KSEM210700112904 KSEM210700112909	Y	reuse patent data
	Band I&Band II-A&Band II-C &Band III: KDB 789033 D02§ D	99% Occupied Bandwidth	Full Test		Y	reuse patent data
	Band I: 15.407(a)(iv) Band II-A: 15.407(a)(2) Band II-C: 15.407(a)(2) Band III: 15.407(a)(3)	Maximum Conducted Output Power	Full Test		Y	Check Worse
	Band I: 15.407(a)(iv) Band II-A: 15.407(a)(2) Band II-C: 15.407(a)(2) Band III: 15.407(a)(3)	Maximum Power Spectral Density	Full Test		Y	reuse patent data
	Band I&Band II-A&Band II-C &Band III: 15.407(b) 15.205/15.209	Radiated Spurious Emissions	Full Test		Y	Check Worse
	Band I&Band II-A&Band II-C &Band III: 15.407(b) 15.205/15.209	Restricted bands around fundamental frequency	Full Test		Y	Check Worse
	Band I&Band II-A&Band II-C &Band III: 15.207	AC Power Line Conducted Emissions	Full Test		Y	reuse patent data
	Band II-A &Band II-C: 15.407	Dynamic Frequency Selection	Full Test		Y	reuse patent data
	Band I&Band II-A&Band II-C &Band III: 15.407(g)	Frequency Stability	Full Test		Y	reuse patent data
NFC	15.207	AC Power Line Conducted Emission	Full Test	NA	N	Full Test
	15.21(c)	20dB Spectrum Bandwidth & 99% Occupied Bandwidth	Full Test		N	Full Test
	15.225(e)	Frequency Stability	Full Test		N	Full Test
	15.225(a)(b)(c)	Field Strength of Fundamental Emissions	Full Test		N	Full Test
	15.225(d)/15.209	Radiated Spurious Emissions	Full Test		N	Full Test
EMI	Part 15B (SDOC)	AC Conducted Emission	Full Test	SHEM210200121101	N	Check Worse
		Radiated Emission	Full Test		N	Check Worse
SAR	2.1093	SAR Testing	Full Test	KSEM210700112911	Y	Check Worse